UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM S-1
REGISTRATION STATEMENT
Under
The Securities Act of 1933

MODERNA, INC.
(Exact name of registrant as specified in its charter)

200 Technology Square
Cambridge, MA 02139
(617) 714-6500

(address, including zip code, and telephone number, including area code, of registrant’s principal executive offices)

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(617) 714-6500

(Name, address, including zip code, and telephone number, including area code, of agent for service)

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Approximate date of commencement of proposed sale to the public: As soon as practicable after the effective date of this registration statement.

If any of the securities being registered on this Form are to be offered on a delayed or continuous basis pursuant to Rule 415 under the Securities Act of 1933, as amended, check the following box.

☐

If this Form is filed to register additional securities for an offering pursuant to Rule 462(b) under the Securities Act, please check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering.

☐

If this Form is a post-effective amendment filed pursuant to Rule 462(c) under the Securities Act, check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering.

☐

If this Form is a post-effective amendment filed pursuant to Rule 462(d) under the Securities Act, please check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering.

☐

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company or an emerging growth company. See the definitions of “large accelerated filer,” “accelerated filer,” “smaller reporting company” and “emerging growth company” in Rule 12b-2 of the Exchange Act.

☐ Large Accelerated Filer
☐ Accelerated Filer
☐ Non-Accelerated Filer
☒ Smaller Reporting Company
☐ Emerging Growth Company

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided in Section 7(a)(2)(B) of the Securities Act.

☐

CALCULATION OF REGISTRATION FEE

<table>
<thead>
<tr>
<th>Title of each Class of Securities to be Registered</th>
<th>Proposed Maximum Aggregate Offering Price(1)(2)</th>
<th>Amount of Registration Fee</th>
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<tr>
<td>Common Stock, par value $0.0001 per share</td>
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<td>$60,600</td>
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(1) Estimated solely for the purpose of calculating the registration fee pursuant to Rule 457(o) under the Securities Act of 1933, as amended.

(2) Includes the offering price of shares that the underwriters may purchase pursuant to an option to purchase additional shares.

The registrant hereby amends this registration statement on such date or dates as may be necessary to delay its effective date until the registrant shall file a further amendment that specifically states that this registration statement shall thereafter become effective in accordance with Section 8(a) of the Securities Act of 1933, as amended, or until this registration statement shall become effective on such date as the Commission, acting pursuant to said Section 8(a), may determine.
The information in this preliminary prospectus is not complete and may be changed. These securities may not be sold until the registration statement filed with the Securities and Exchange Commission is effective. This preliminary prospectus is not an offer to sell nor does it seek an offer to buy these securities in any jurisdiction where the offer or sale is not permitted.

SUBJECT TO COMPLETION, DATED NOVEMBER 9, 2018

Shares

Common Stock

This is the initial public offering of shares of our common stock. Prior to this offering, there has been no public market for our common stock. We are selling shares of our common stock. The initial public offering price of our common stock is expected to be between $ and $ per share.

We have applied to list our common stock on the Nasdaq Global Select Market under the symbol “MRNA.”

We are an “emerging growth company” as that term is used in the Jumpstart Our Business Startups Act of 2012, or the JOBS Act, and, as such, we have elected to comply with certain reduced public company reporting requirements for this prospectus and future filings.

Investing in our common stock involves risks. See “Risk Factors” on page 16.

<table>
<thead>
<tr>
<th>Price to Public</th>
<th>Underwriting Discounts and Commissions</th>
<th>Proceeds to Company</th>
</tr>
</thead>
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<tr>
<td>$</td>
<td>$</td>
<td>$</td>
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<tr>
<td>Total</td>
<td>$</td>
<td>$</td>
</tr>
</tbody>
</table>

(1) See “Underwriting” beginning on page 338 of this prospectus for additional information regarding underwriting compensation.

Delivery of the shares of common stock will be made on or about .

Neither the Securities and Exchange Commission nor any state securities commission has approved or disapproved of these securities or determined if this prospectus is truthful or complete. Any representation to the contrary is a criminal offense.

The underwriters have an option to purchase up to additional shares of common stock from us.

Morgan Stanley Goldman Sachs & Co. LLC J.P. Morgan
Oddo BHF Oppenheimer & Co. Needham & Company Chardan

The date of this prospectus is , .
mRNA, THE SOFTWARE OF LIFE

STORAGE
DNA stores instructions for proteins in the nucleus

SOFTWARE
mRNA is a temporary set of instructions for cells to make a protein; mRNA is made using DNA

APPLICATIONS
Proteins form the basis of life by performing the functions required by every cell; proteins are made using mRNA

OUR MISSION

Deliver on the promise of mRNA science to create a new generation of transformative medicines for patients.
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Through and including [ ], (25 days after the commencement of this offering), all dealers effecting transactions in these securities, whether or not participating in this offering, may be required to deliver a prospectus. This delivery requirement is in addition to the obligation of dealers to deliver a prospectus when acting as underwriters and with respect to their unsold allotments or subscriptions.

You should rely only on the information contained in this prospectus or in any free writing prospectus we file with the Securities and Exchange Commission, or the SEC. Neither we nor the underwriters have authorized anyone to provide you with information other than that contained in this prospectus or any free writing prospectus prepared by or on behalf of us or to which we have referred you. We take no responsibility for, and can provide no assurance as to the reliability of, any other information that others may give you. We and the underwriters are offering to sell, and seeking offers to buy, common stock only in jurisdictions where offers and sales are permitted. The information contained in this prospectus is accurate only as of the date on the front cover page of this prospectus, or other earlier date stated in this prospectus, regardless of the time of delivery of this prospectus or of any sale of our common stock.

The market data and certain other statistical information used throughout this prospectus are based on independent industry publications, governmental publications, reports by market research firms, or other independent sources that we believe to be reliable sources. Industry publications and third-party research, surveys, and studies generally indicate that their information has been obtained from sources believed to be reliable, although they do not guarantee the accuracy or completeness of such information. We are responsible for all of the disclosure contained in this prospectus, and we believe that these sources are reliable; however, we have not independently verified the information contained in such publications. While we are not aware of any misstatements regarding any third-party information presented in this prospectus, their estimates, in particular, as they relate to projections, involve numerous assumptions, are subject to risks and uncertainties, and are subject to change based on various factors, including those discussed under the section entitled “Risk Factors” and elsewhere in this prospectus. Some data are also based on our good faith estimates.
Overview

We are creating a new category of transformative medicines based on messenger RNA, or mRNA, to improve the lives of patients. From the beginning, we designed our strategy and operations to realize the full potential value and impact of mRNA over a long time horizon across a broad array of human diseases. We built and continue to invest in a platform to advance the technological frontier of mRNA medicines. We made and continue to make forward investments in scalable infrastructure and capabilities to pursue a pipeline of potential medicines that reflect the breadth of the mRNA opportunity. Since we nominated our first program in late 2014, we and our strategic collaborators have advanced in parallel a diverse development pipeline of 21 programs, of which 10 have entered clinical studies and another 3 have open INDs. Our therapeutic and vaccine development programs span infectious diseases, oncology, cardiovascular diseases, and rare genetic diseases. We have assembled an exceptional team of approximately 680 employees and have established strategic alliances with leading biopharmaceutical companies, including AstraZeneca, Merck & Co., and Vertex Pharmaceuticals, as well as government-sponsored and private organizations focused on global health initiatives, including Biomedical Advanced Research and Development Authority, or BARDA, Defense Advanced Research Projects Agency, or DARPA, and the Bill & Melinda Gates Foundation. As of September 30, 2018, we have raised over $2.6 billion in total funding from our strategic collaborators and investors, and have cash, cash equivalents, and investments of $1.2 billion. As we unlock the inherent advantages of mRNA, we aim to address as many diseases and impact as many patients as our technology, talent, and capital permit.

mRNA, the software of life

mRNA transfers the instructions stored in DNA to make the proteins required in every living cell. Our approach is to use mRNA medicines to instruct a patient’s own cells to produce proteins that could prevent, treat, or cure disease. A schematic of the central role of mRNA in making proteins is shown in the figure below.
We believe mRNA’s intrinsic properties could serve as a foundation for a new category of medicines for patients. Every cell in the human body utilizes mRNA in existing natural processes to produce all types of proteins, including secreted, membrane, and intracellular proteins, in varying quantities, in different locations, and in various combinations. mRNA has a pharmacological profile that we believe is consistent with the target profile of traditional therapeutics and has a simple molecular structure that comprises a sequence of four chemically similar nucleotides. To change a protein encoded by an mRNA molecule, only a change to the sequence within the mRNA is required. As a result, each mRNA molecule is highly chemically similar, yet mRNAs can encode proteins with divergent chemical properties and functions.

mRNA medicines, we believe, represent an opportunity that could meaningfully exceed that of other classes of biopharmaceuticals. One such class, recombinant protein therapeutics, which focuses on secreted proteins, today generates over $200 billion in annual worldwide sales. Two other types of proteins, intracellular and membrane proteins, represent as much as two-thirds of all human proteins and are critical to human biology; however, delivery of these proteins is currently beyond the reach of recombinant protein technology. We believe that mRNA medicines could address all three protein types, including these areas untapped by recombinant protein therapeutics.

The breadth of biology addressable using mRNA technology is reflected in our current development pipeline of 21 programs. These span 24 different proteins: ten different antigens (including complexes and virus-like particles, or VLPs) for infectious disease vaccines; two different types of neoantigen cancer vaccines, of which one is combined with an endoplasmic reticulum membrane protein; four different immuno-modulator targets (including membrane and systemically secreted proteins) for immuno-oncology programs; one secreted, local regenerative factor for a heart failure program; three secreted proteins of diverse biology (an antibody, an engineered protein hormone, and a lysosomal enzyme); and three intracellular enzymes for rare disease programs. The diversity of proteins made from mRNA within our development pipeline is shown in the figure below.
Our pipeline and progress

We dosed our first subject in a clinical trial in December 2015, five years after our inception. Since then, we or our strategic collaborators have achieved first-in-human dosing for a total of ten different mRNA investigational medicines. Phase 1 studies were conducted to assess safety and tolerability of these investigational medicines, which provided sufficient data for all ten clinical stage programs to warrant continued advancement within a trial or for further development. We have also observed activity in Phase 1 trials for six out of seven clinical programs, with an additional three programs yet to read out. The clinical activity readouts include:

- dose-dependent protein production in patients for VEGF-A (AZD8601), a secreted protein, along with pharmacologic activity in the form of changes in local blood flow, directly quantified after intradermal administration of AZD8601;
- protein production in tumor tissue from patients for OX40L (mRNA-2416), an immune co-stimulator, after intratumoral administration of mRNA-2416; and
- neutralizing antibody responses to pathogenic viral antigens in healthy volunteers for four viral vaccine programs: influenza H10N8 vaccine (mRNA-1440), influenza H7N9 vaccine (mRNA-1851), Chikungunya vaccine (mRNA-1388), and RSV vaccine (mRNA-1777).

The one vaccine program that has not shown sufficient antibody response in a Phase 1 trial is mRNA-1325, a Zika virus vaccine. Although the Phase 1 safety and tolerability data generated would permit additional dose escalation of mRNA-1325, we have focused our development efforts on a follow-on candidate, mRNA-1893, that in preclinical studies has been observed to have significantly greater potency than mRNA-1325.

Of the ten clinical programs, the Phase 1 trials for H10N8 vaccine and VEGF-A were conducted in Germany; the Phase 1 trial for RSV vaccine is being conducted in Australia; the Phase 1 trials for the remaining seven vaccines and oncology programs are being conducted in the United States; and the Phase 2a trial for VEGF-A is being conducted in Finland.

We have several programs that are in, or will start, Phase 1 clinical trials in which we expect to measure pharmacology in patients or healthy volunteers following administration of our mRNA investigational medicines, as well as direct or indirect evidence of protein production. In these trials, we aim to show: the induction of specific T cells to encoded neoantigens in our cancer vaccines; observable levels of proteins produced in our intratumoral and systematically administered therapeutics; and serum changes in metabolites resulting from restoration of active enzymes in metabolic pathways in our systemic secreted and systemic intracellular therapeutics.

More than 755 subjects have been dosed with our mRNA vaccines or therapeutics in clinical trials.

The following chart shows our current pipeline of 21 development candidates, grouped into modalities. A modality is a group of potential mRNA medicines with shared product features, and the associated combination of mRNA technologies, delivery technologies, and manufacturing processes.
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#### Prophylactic Vaccines

<table>
<thead>
<tr>
<th>Name of Vaccine</th>
<th>Program #</th>
<th>Program Indication</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3 and beyond</th>
<th>Moderna Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>mRNA-1273</td>
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#### Cancer Vaccines

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<th>Phase 2</th>
<th>Phase 3 and beyond</th>
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</thead>
<tbody>
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<td>VGX-1301</td>
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<td>MECP2 191</td>
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<td>IL12 Solid tumors</td>
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#### Intramuscular Immunotherapy

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#### Localised Immunotherapeutic Monoclonals

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<th>Phase 1</th>
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<th>Phase 3 and beyond</th>
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<td>α-GAL Fabry disease</td>
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#### Systemic Immunotherapeutic Monoclonals

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<th>Phase 2</th>
<th>Phase 3 and beyond</th>
<th>Moderna Status</th>
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<td>FH 4</td>
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*Life cycle to mRNA-1893

**Abbreviations:** AZ, AstraZeneca; α-GAL, alpha galactosidase; CMV, cytomegalovirus; CRC, colorectal cancer; hMPV, human metapneumovirus; IL12, interleukin 12; IL23, interleukin 23; IL36γ, interleukin 36 gamma; MUT, methylmalonyl-CoA mutase; NSCLC, non-small cell lung cancer; PAH, phenylalanine hydroxylase; PCCA/PCCB, propionyl-CoA carboxylase subunits A/B; PCV, personalized cancer vaccine; PIV3, human parainfluenza 3; RSV, respiratory syncytial virus; VEGF-A, vascular endothelial growth factor A; VZV, varicella zoster virus.
Our strategic principles and approach to managing risk

To guide our business, we established a set of strategic principles: discover and develop a large pipeline in parallel; undertake sustained and long-term investment in technology creation; accelerate learning; integrate across critical parts of the value chain; and forward invest in capabilities and infrastructure. We apply these principles to critical capital allocation decisions such as: how much capital we devote to technology, drug discovery, development, and infrastructure; which development candidates to advance and how; whether to advance development candidates alone or in collaboration with pharmaceutical partners or other sources of funding; and which capabilities to build internally versus outsource. In addition, we see four key risks inherent to our business—technology risk, biology risk, execution risk, and financing risk. We seek to actively manage these risks as we apply our strategic principles in our decision making. There is no single strategic principle nor single category of risk that dominates our decision making.

We aim to compartmentalize risk in part by using modalities, each of which is a group of programs that share a combination of technologies to create a common set of product features. Each modality is designed to overcome the challenges of delivering the right amount of mRNA to the right tissue at the right times across a portfolio of applications. We currently have six modalities: prophylactic vaccines; cancer vaccines; intratumoral immuno-oncology; localized regenerative therapeutics; systemic secreted therapeutics; and systemic intracellular therapeutics.

Our platform

We have created a platform to improve the underlying pharmaceutical properties of our mRNA medicines. Our platform consists of three core areas: mRNA technologies, delivery technologies, and manufacturing processes. We pursue mRNA science to minimize the undesirable activation of the immune system by mRNA and to maximize the potency of mRNA once in the target cells. We pursue delivery science to protect mRNA from extracellular enzymes that would degrade it, to deliver mRNA to desired tissues, and to facilitate the transport of mRNA across cell membranes to the translational machinery inside the cell. Finally, we pursue manufacturing process science to optimize these features for our potential mRNA medicines and to develop the technical capability to scale our mRNA for clinical development. We believe that our science provides the foundation for technology advancement, with the ultimate goal of identifying new modalities and expanding the utility of our existing modalities.

Through September 30, 2018, we have incurred approximately $480 million of expenses to advance our platform technology and our intellectual property. This investment has underpinned the creation of our six existing modalities and 21 programs, and has helped us to establish fundamental intellectual property protecting our platform and programs. We have filed over 1,500 patent applications since 2010 (including pending and expired applications), and have over 100 issued or allowed U.S. and foreign patents.

Executing at scale on a broad pipeline

Executing rapidly on many pipeline programs in parallel requires investment in scalable capabilities across the entire drug development value chain. mRNA has common chemical features, design rules, and synthetic processes that permit us to invest in scalable infrastructure, built on a digital backbone and enabled by automation, that is designed to generate and advance a broad pipeline. We stage our scale efforts into three infrastructure groupings, or engines, to: (1) advance new product ideas to development candidates, (2) move development candidates into early clinical trials for human proof of concept, and (3) advance these candidates through late-stage development, approval, and eventual commercialization. These engines are supported and enabled by our integrated digital investments, our highly talented and motivated team members, and our deep capital base, which in total allow us to execute effectively. Manufacturing is a strategically critical component of
our infrastructure, and in July 2018, we opened our 200,000 square foot current good manufacturing practices, or cGMP, manufacturing facility in Norwood, MA. This facility provides us with significant supply chain integration, while also providing flexible capacity that can produce up to 100 cGMP lots per year to support our current and future pipeline.

Our strategic collaborators and investors
We have established a wide range of strategic alliances with leading biopharmaceutical companies, including AstraZeneca, Merck & Co., and Vertex Pharmaceuticals, as well as government-sponsored and private organizations focused on global health initiatives, including BARDA, DARPA, and the Bill & Melinda Gates Foundation. Our strategic collaborators contribute their therapeutic expertise, provide significant capital, and over time have helped to validate our platform. Each of AstraZeneca, Merck & Co., and DARPA has entered into multiple strategic alliances with us. We have also raised funding from a diverse group of investors, including well-established global institutional investors. As of September 30, 2018, we have raised over $2.6 billion in total funding from our strategic collaborators and investors. This funding has enabled us to create our mRNA platform, establish cGMP manufacturing, including the build-out of our Norwood, MA facility, progress our pipeline of 21 programs, and provide operational enterprise support. As of September 30, 2018, we had cash, cash equivalents, and investments of $1.2 billion.

Our team
We have assembled a team with deep scientific, clinical, manufacturing, business, and leadership expertise in biotechnology, platform research, drug discovery, and development. Our founding Chief Executive Officer, Stéphane Bancel, was previously the CEO of bioMérieux and managing director of Eli Lilly & Company, Belgium, before joining Moderna in 2011. Our board of directors is chaired by our co-founder Noubar Afeyan, Ph.D., Founder and CEO of Flagship Pioneering, who has co-founded and successfully launched over 30 life science startups. Our leadership team and board of directors contribute a diverse range of experiences from leading companies and academic institutions including Bain Capital, bioMérieux, Brigham Health, Eli Lilly & Company, Flagship Pioneering, GlaxoSmithKline, Goldman Sachs, Massachusetts Institute of Technology, McKinsey & Company, Motorola, Novartis, Sanofi, and Vertex Pharmaceuticals. The Chief Scientific Officer of our research platform was elected to the National Academy of Sciences in 2017 for her work on RNA. Our research efforts are also guided by world-class scientists and physicians on our Scientific Advisory Board, including Dr. Jack Szostak, the 2009 Nobel Laureate in Physiology or Medicine, and five members of the National Academies of Sciences, Engineering, and Medicine. We have assembled an exceptional team of approximately 680 employees, more than 55% of whom hold Ph.D., M.D., J.D., or Master’s degrees.

Our beginnings—Moderna and Flagship Pioneering
Moderna was founded in 2010 by Flagship Pioneering to develop and commercialize a new category of medicines to treat human diseases. Our early platform technology was conceived and launched by Flagship Pioneering’s VentureLabs (VL) innovation team, led by Dr. Noubar Afeyan (Moderna’s founding and current Chairman) working together with academic co-founders Dr. Derrick Rossi (Harvard Medical School), Dr. Robert Langer (MIT), and Dr. Kenneth Chien (Harvard Medical School). Inspired by chemically-modified mRNA used in cell culture experiments, the VL innovation team, working with a team of scientists assembled to launch Moderna, identified chemical modifications of mRNA, engineered mRNA sequences for greater in vivo potency, and demonstrated our first instances of in vivo protein expression. Stéphane Bancel joined Moderna’s Board of Directors in March 2011. Upon resigning as CEO of bioMérieux (BIM:FP), Mr. Bancel became Executive Chairman of Moderna and a Senior Partner at Flagship Pioneering in July 2011. He was then named Moderna’s founding CEO in October 2011.
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<th><strong>Table of Contents</strong></th>
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<td><strong>Our mission</strong></td>
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<tr>
<td>To deliver on the promise of mRNA science to create a new generation of transformative medicines for patients.</td>
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<tr>
<td><strong>Our values</strong></td>
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</tbody>
</table>
| We execute against our strategy while being guided by our values:
| • Quality, Integrity, and Respect: We believe these serve as the foundation upon which everything else is built. |
| • Bold: We are wholly committed to realizing the enormous potential of mRNA technology to transform the lives of patients. |
| • Collaborative: We know that the way to accomplish our goals is by working together, supporting each other, and respecting one another’s viewpoints. We act as one team. |
| • Curious: We are intensely curious and are always seeking to challenge and improve upon the status quo. We believe curiosity is the heart of innovation. |
| • Relentless: We are tenacious in the pursuit of our mission to bring medicines to patients. We learn from challenges and build on successes. |
Risks associated with our business

We have identified four categories of risks that are inherent to our business—technology risk, biology risk, execution risk, and financing risk. No single category of risk dominates our decision making. Our choices are complex and our risk profile changes as we learn. However, our strategic principles, combined with the way we manage risk, are critical to our decision making. These risks are discussed more fully in the Business section of this prospectus. Our business is also subject to a number of other risks of which you should be aware before making an investment decision. These risks are discussed more fully in the section entitled “Risk Factors” appearing immediately following this prospectus summary, and include the following:

• Even if this offering is completed, we will need to seek and secure significant additional funding through financings or from other sources. Clinical data or trial execution that creates delays, setbacks, or failures in one or more of our programs or modalities or the entire pipeline could result in an impaired ability or inability to finance or fund the Company in the future.

• No mRNA drug has been approved in this new potential category of medicines, and may never be approved as a result of efforts by others or us. mRNA drug development has substantial clinical development and regulatory risks due to the novel and unprecedented nature of this new category of medicines.

• Our business is highly dependent on the clinical advancement of our programs and modalities. Delay or failure to advance programs or modalities could adversely impact our business.

• We have incurred significant losses since our inception and anticipate that we will continue to incur significant losses for the foreseeable future.

• While we attempt to diversify our risks by developing one or more programs in each modality, there are risks that are unique to each modality and risks that are applicable across modalities. These risks may impair our ability to advance one or more of our programs in clinical development, obtain regulatory approval or ultimately commercialize our programs, or cause us to experience significant delays in doing so, any of which may materially harm our business.

• Preclinical development is lengthy and uncertain, especially for a new category of medicines such as mRNA, and therefore our preclinical programs or development candidates may be delayed, terminated, or may never advance to the clinic, any of which may affect our ability to obtain funding and may have a material adverse impact on our platform or our business.

• Clinical development is lengthy and uncertain, especially with a new category of medicines such as mRNA medicines. Clinical trials of our investigational medicines may be delayed, and certain programs may never advance in the clinic, or may be more costly to conduct than we anticipate, any of which may affect our ability to fund the Company and would have a material adverse impact on our platform or our business.

• mRNA medicines are a novel approach, and negative perception of the efficacy, safety, or tolerability of any investigational medicines that we develop could adversely affect our ability to conduct our business, advance our investigational medicines, or obtain regulatory approvals.

• Our mRNA development candidates and investigational medicines are based on novel technologies and any development candidates and investigational medicines we develop may be complex and difficult to manufacture. We may encounter difficulties in manufacturing, product release, shelf life, testing, storage, and supply chain management or shipping. If we or any of our third-party manufacturers encounter such difficulties, our ability to supply material for clinical trials or any approved product to patients could be delayed or stopped.

• We have in the past entered into, and in the future may enter into, strategic alliances with third parties to develop investigational medicines. If these strategic alliances are not successful, our business could be adversely affected.
We will need to develop and expand our Company, and we may encounter difficulties in managing this development and expansion, which could disrupt our operations.

**Implications of being an emerging growth company**

We qualify as an “emerging growth company” as defined in the Jumpstart Our Business Startups Act of 2012, as amended, or the JOBS Act. As an emerging growth company, we may take advantage of specified reduced disclosure and other requirements that are otherwise applicable generally to public companies. These provisions include:

- only two years of audited financial statements in addition to any required unaudited interim financial statements with correspondingly reduced “Management’s Discussion and Analysis of Financial Condition and Results of Operations” disclosure;
- reduced disclosure about our executive compensation arrangements;
- no non-binding advisory votes on executive compensation or golden parachute arrangements; and
- exemption from the auditor attestation requirement in the assessment of our internal control over financial reporting.

We may take advantage of these exemptions for up to five years or such earlier time that we are no longer an emerging growth company. We would cease to be an emerging growth company on the date that is the earliest of (i) the last day of the fiscal year in which we have total annual gross revenues of $1.07 billion or more; (ii) the last day of our fiscal year following the fifth anniversary of the date of the completion of this offering; (iii) the date on which we have issued more than $1 billion in nonconvertible debt during the previous three years; or (iv) the date on which we are deemed to be a large accelerated filer under the rules of the SEC. We may choose to take advantage of some but not all of these exemptions. We have taken advantage of reduced reporting requirements in this prospectus. Accordingly, the information contained herein may be different from the information you receive from other public companies in which you hold stock. Additionally, the JOBS Act provides that an emerging growth company can take advantage of an extended transition period for complying with new or revised accounting standards. This allows an emerging growth company to delay the adoption of certain accounting standards until those standards would otherwise apply to private companies. We have elected to avail ourselves of this exemption and, therefore, while we are an emerging growth company we will not be subject to new or revised accounting standards at the same time that they become applicable to other public companies that are not emerging growth companies.

**Corporate history**

We were incorporated under the laws of the State of Delaware on July 22, 2016. We are the successor in interest to Moderna LLC, a limited liability company formed under the laws of the State of Delaware in 2013. Moderna LLC was the successor in interest to Moderna Therapeutics, Inc., a Delaware corporation incorporated in 2009 as Newco LS18, Inc. by Flagship Pioneering. In August 2018, we changed our name from Moderna Therapeutics, Inc. to Moderna, Inc. Our principal corporate office is located at 200 Technology Square, Cambridge, MA 02139, and our telephone number is (617) 714-6500. Our website address is www.modernatx.com. We do not incorporate the information on or accessible through our website into this prospectus, and you should not consider any information on, or that can be accessed through, our website as part of this prospectus.

We own various U.S. federal trademark applications and unregistered trademarks, including our company name. All other trademarks or trade names referred to in this prospectus are the property of their respective owners. Solely for convenience, the trademarks and trade names in this prospectus are referred to without the symbols ® and ™, but such references should not be construed as any indicator that their respective owners will not assert, to the fullest extent under applicable law, their rights thereto.
As more fully described in the section entitled “Reorganization” appearing elsewhere in this prospectus, on August 10, 2016, we completed a series of transactions pursuant to which Moderna LLC became a wholly-owned subsidiary of Moderna Therapeutics, Inc., or the 2016 Reorganization. In connection with the 2016 Reorganization, all of the outstanding common and preferred unitholders of Moderna LLC received shares of common and preferred stock of Moderna Therapeutics, Inc., respectively, holders of incentive units in Moderna LLC received shares of restricted common stock in Moderna Therapeutics, Inc., and holders of unit options in Moderna LLC received options to purchase shares of common stock in Moderna Therapeutics, Inc.
THE OFFERING

Common stock offered shares.

Common stock to be outstanding immediately after this offering shares (shares if the underwriters exercise their option to purchase additional shares in full).

Underwriters’ option to purchase additional shares We have granted a 30-day option to the underwriters to purchase up to an aggregate of additional shares of common stock from us at the public offering price, less underwriting discounts and commissions on the same terms as set forth in this prospectus.

Use of proceeds We estimate that our net proceeds from the sale of shares of our common stock in this offering will be approximately $ million, or $ million if the underwriters exercise in full their option to purchase additional shares, assuming an initial public offering price of $ per share, the midpoint of the price range set forth on the cover page of this prospectus, and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us. The principal purposes of this offering are to create a public market for our common stock and thereby facilitate future access to the public equity markets, increase our visibility in the marketplace and obtain additional capital. We currently intend to use the net proceeds from this offering for the following: (i) to fund drug discovery and clinical development, further expansion of our manufacturing platform and capabilities, and infrastructure to support our pipeline; (ii) to fund further development of our mRNA technology platform and the creation of new modalities; and (iii) the remainder to fund working capital and other general corporate purposes.

Risk factors You should carefully read the “Risk Factors” section of this prospectus for a discussion of factors that you should consider before deciding to invest in our common stock.

Proposed Nasdaq Global Select Market symbol “MRNA”

The number of shares of our common stock to be outstanding after this offering is based on shares of our common stock outstanding as of September 30, 2018, including shares of our common stock issuable upon the automatic conversion of all outstanding shares of our preferred stock upon the closing of this offering, and excludes:

• 96,086,048 shares of common stock issuable upon the exercise of stock options outstanding as of September 30, 2018, at a weighted average exercise price of $4.84 per share;

• 1,000,000 shares of common stock issuable upon the vesting and settlement of restricted stock units that were outstanding as of September 30, 2018;

• shares of our common stock that will become available for future issuance under our 2018 Stock Option and Incentive Plan, or 2018 Stock Plan, which will become effective in connection with the completion of this offering, inclusive of 10,000,000 shares of common stock issuable upon the exercise of a common stock
option subject to service-based vesting to be granted to our Chief Executive Officer immediately following the effectiveness of the
registration statement of which this prospectus is a part; and

- shares of our common stock that will become available for future issuance under our 2018 Employee Stock Purchase Plan, or ESPP,
  which will become effective in connection with the completion of this offering.

Unless otherwise indicated, all information in this prospectus reflects or assumes the following:

- the filing of our amended and restated certificate of incorporation upon the closing of this offering and the effectiveness of our amended and
  restated by-laws upon the effectiveness of the registration statement of which this prospectus is a part;

- the conversion of all outstanding shares of our preferred stock (except for our Series A preferred stock, Series B preferred stock, and Series H
  preferred stock) into an aggregate of approximately shares of common stock upon the closing of this offering;

- the conversion of all outstanding shares of our Series A preferred stock into an aggregate of shares of common stock upon the
  closing of this offering, based on the assumed initial public offering price of $ per share, which is the midpoint of the estimated offering
  range set forth on the cover page of this prospectus. The number of shares of common stock into which the Series A preferred stock is
  converted will be adjusted in respect of cash distributions made to the holders of Series A preferred stock through the date of conversion by
  decreasing the number of shares of common stock into which the Series A preferred stock will convert by a number of shares equal to such
  cash distributions divided by the price to the public per share of common stock sold pursuant to this prospectus. A $1.00 decrease in the
  initial offering price would increase the number of shares of our common stock issuable upon conversion of our Series A preferred stock
  by shares, and a $1.00 increase in the initial public offering price would decrease the number of shares of our common stock
  issuable upon conversion of our Series A preferred stock by shares;

- the conversion of all outstanding shares of our Series B preferred stock into an aggregate of shares of common stock upon the
  closing of this offering, based on the assumed initial public offering price of $ per share, which is the midpoint of the estimated offering range set
  forth on the cover page of this prospectus. The number of shares of common stock into which the Series B preferred stock is converted will be
  adjusted in respect of cash distributions made to the holders of Series B preferred stock through the date of conversion by decreasing the
  number of shares of common stock into which the Series B preferred stock will convert by a number of shares equal to such cash distributions
  divided by the price to the public per share of common stock sold pursuant to this prospectus. A $1.00 decrease in the initial offering price
  would increase the number of shares of our common stock issuable upon conversion of our Series B preferred stock by shares, and a
  $1.00 increase in the initial public offering price would decrease the number of shares of our common stock issuable upon conversion of our
  Series B preferred stock by shares;

- the conversion of all outstanding shares of our Series H preferred stock into an aggregate of shares of common stock upon the
  closing of this offering, based on the assumed initial public offering price of $ per share, which is the midpoint of the estimated offering
  range set forth on the cover page of this prospectus. The Series H preferred stock will convert into common stock at a conversion ratio equal
  to the quotient obtained by dividing the original issue price of $25.00 per preferred share by the greater of (i) the product of 0.9 multiplied
  by the initial public offering price per share of common stock sold pursuant to this prospectus and (ii) $10.06. A $1.00 decrease in the initial
  offering price would increase the number of shares of our common stock issuable upon conversion of our Series H preferred stock
  by shares, and a $1.00 increase in the initial public offering price would decrease the number of shares of our common stock issuable
  upon conversion of our Series H preferred stock by shares; and

- no exercise by the underwriters of their option to purchase up to additional shares of common stock in this offering.
The summary consolidated financial data set forth below should be read together with our consolidated financial statements and the related notes to those statements, as well as the sections of this prospectus titled “Selected Consolidated Financial Data” and “Management’s Discussion and Analysis of Financial Condition and Results of Operations.” The statements of operations data for the years ended December 31, 2016 and 2017 have been derived from our audited consolidated financial statements included elsewhere in this prospectus. The statements of operations data for the nine months ended September 30, 2017 and 2018 and the balance sheet data as of September 30, 2018 have been derived from our unaudited condensed consolidated financial statements included elsewhere in this prospectus. In the opinion of management, the unaudited data reflects all adjustments, consisting only of normal recurring adjustments, necessary for a fair presentation of the financial information in those statements. Our historical results are not necessarily indicative of results that may be expected in the future.

<table>
<thead>
<tr>
<th>Statement of Operations Data:</th>
<th>Year Ended December 31</th>
<th>Nine Months Ended September 30</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016 (in thousands, except share and per share data)</td>
<td>2017</td>
</tr>
<tr>
<td><strong>Revenue:</strong></td>
<td></td>
<td>2016</td>
</tr>
<tr>
<td>Collaboration revenue</td>
<td>$101,536</td>
<td>$176,974</td>
</tr>
<tr>
<td>Grant revenue</td>
<td>$6,860</td>
<td>$28,851</td>
</tr>
<tr>
<td><strong>Total revenue</strong></td>
<td>$108,396</td>
<td>$205,825</td>
</tr>
<tr>
<td><strong>Operating expenses:</strong></td>
<td></td>
<td>2016</td>
</tr>
<tr>
<td>Research and development</td>
<td>$274,717</td>
<td>$410,459</td>
</tr>
<tr>
<td>General and administrative</td>
<td>$57,450</td>
<td>$64,722</td>
</tr>
<tr>
<td><strong>Total operating expenses</strong></td>
<td>$332,167</td>
<td>$475,181</td>
</tr>
<tr>
<td>Loss from operations</td>
<td>$(223,771)</td>
<td>$(269,356)</td>
</tr>
<tr>
<td>Interest income</td>
<td>$11,312</td>
<td>$15,235</td>
</tr>
<tr>
<td>Other expense, net</td>
<td>$(2,709)</td>
<td>$(1,875)</td>
</tr>
<tr>
<td><strong>Loss before provision for (benefit from) income taxes</strong></td>
<td>$(215,168)</td>
<td>$(255,996)</td>
</tr>
<tr>
<td>Provision for (benefit from) income taxes</td>
<td>$1,043</td>
<td>$(80)</td>
</tr>
<tr>
<td><strong>Net loss</strong></td>
<td>$(216,211)</td>
<td>$(255,916)</td>
</tr>
</tbody>
</table>

Reconciliation of net loss to net loss attributable to common stockholders:

- **Premium paid on repurchase of redeemable stock**
  - $(4,127)
- **Accretion of redeemable convertible preferred units to redemption value**
  - $8,663
- **Cumulative preferred stock dividends**
  - $5,440
- **Net loss attributable to common stockholders**
  - $(230,314) $269,841 $228,415 $257,758
- **Net loss per share attributable to common stockholders, basic and diluted**
  - $(1.74) $1.92 $(1.63) $(1.79)
- **Weighted average common shares used in net loss per share attributable to common stockholders, basic and diluted**
  - 132,429,389 140,604,647 140,176,261 143,634,775
- **Pro forma net loss per share attributable to common stockholders, basic and diluted (unaudited)**
  - $(5,440)
- **Pro forma weighted average common shares used in pro forma net loss per share attributable to common stockholders, basic and diluted (unaudited)**
  - 132,429,389 140,604,647 140,176,261 143,634,775
### Table of Contents

As of September 30, 2018

<table>
<thead>
<tr>
<th>Balance Sheet Data:</th>
<th>Actual</th>
<th>Pro Forma (2)</th>
<th>Pro Forma As Adjusted (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash, cash equivalents, restricted cash, and investments</td>
<td>$1,234,921</td>
<td>$1,234,921</td>
<td></td>
</tr>
<tr>
<td>Total assets</td>
<td>1,489,160</td>
<td>1,489,160</td>
<td></td>
</tr>
<tr>
<td>Total deferred revenue</td>
<td>302,565</td>
<td>302,565</td>
<td></td>
</tr>
<tr>
<td>Redeemable convertible preferred stock</td>
<td>1,833,561</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Total stockholders’ (deficit) equity</td>
<td>(757,129)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Basic and diluted net loss per share attributable to common stockholders give effect to the conversion of all preferred units to preferred stock and give effect to the ten-for-one forward stock split that occurred in connection with the 2016 Reorganization. Additionally, basic and diluted pro forma net loss per share attributable to common stockholders give effect to the conversion of all shares of preferred stock into shares of common stock and the vesting of certain of our performance-based restricted stock units which will vest upon the closing of this offering, assuming such conversion or vesting occurred on the later of the first day in the period or the issuance date of the corresponding equity instruments and assuming an initial public offering price equal to the midpoint of the estimated offering price range set forth on the cover page of this prospectus.

(2) Pro forma amounts give effect to the automatic conversion of all of our outstanding shares of preferred stock into an aggregate of shares of common stock upon the completion of this offering and certain of our performance-based restricted stock units which will vest upon the closing of this offering. If the initial public offering price is equal to the midpoint of the estimated offering price range set forth on the cover page of this prospectus, the shares of our Series A preferred stock would convert into shares of our common stock. The number of shares of common stock into which the Series A preferred stock is converted will be adjusted in respect of cash distributions made to the holders of Series A preferred stock through the date of conversion by decreasing the number of shares of common stock into which the Series A preferred stock will convert by a number of shares equal to such cash distributions divided by the price to the public per share of common stock sold pursuant to this prospectus. A $1.00 decrease in the initial public offering price would increase the number of shares of our common stock issuable upon conversion of our Series A preferred stock by shares, and a $1.00 increase in the initial public offering price would decrease the number of shares of our common stock issuable upon conversion of our Series A preferred stock by shares.

If the initial public offering price is equal to the midpoint of the estimated offering price range set forth on the cover page of this prospectus, the shares of our Series B preferred stock would convert into shares of our common stock. The number of shares of common stock into which the Series B preferred stock is converted will be adjusted in respect of cash distributions made to the holders of Series B preferred stock through the date of conversion by decreasing the number of shares of common stock into which the Series B preferred stock will convert by a number of shares equal to such cash distributions divided by the price to the public per share of common stock sold pursuant to this prospectus. A $1.00 decrease in the initial public offering price would increase the number of shares of our common stock issuable upon conversion of our Series B preferred stock by shares, and a $1.00 increase in the initial public offering price would decrease the number of shares of our common stock issuable upon conversion of our Series B preferred stock by shares.

If the initial public offering price is equal to the midpoint of the estimated offering price range set forth on the cover page of this prospectus, the shares of our Series H preferred stock would convert into shares of our common stock. The Series H preferred stock will convert into common stock at a conversion ratio equal to the quotient obtained by dividing the original issue price of $25.00 per preferred share by the

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greater of (i) the product of 0.9 multiplied by the initial public offering price per share of common stock sold pursuant to this prospectus and (ii) $10.06. A $1.00 decrease in the initial public offering price would increase the number of shares of our common stock issuable upon conversion of our Series H preferred stock by shares, and a $1.00 increase in the initial public offering price would decrease the number of shares of our common stock issuable upon conversion of our Series H preferred stock by shares.

(3) Pro forma as adjusted amounts reflect pro forma adjustments described in footnote (2) as well as the sale of shares of our common stock in this offering at the assumed initial public offering price of $ per share, the midpoint of the price range set forth on the cover page of this prospectus, and after deducting the estimated underwriting discounts and commissions and estimated offering expenses payable by us. A $1.00 increase (decrease) in the assumed initial public offering price of $ per share, the midpoint of the price range set forth on the cover of this prospectus, would increase (decrease) the pro forma as adjusted amount of each of cash, working capital, total assets and total stockholders’ equity by approximately $ million, assuming that the number of shares offered by us, as set forth on the cover of this prospectus, remains the same and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us. Similarly, each increase (decrease) of 1.0 million shares offered by us would increase (decrease) the net proceeds to us from this offering by approximately $ million, assuming the assumed initial public offering price remains the same and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us.

(4) We define working capital as current assets less current liabilities.
RISK FACTORS

Investing in our common stock involves a high degree of risk. You should carefully consider the following risks and uncertainties, together with all other information in this prospectus, including our consolidated financial statements and related notes and “Management’s Discussion and Analysis of Financial Condition and Results of Operations,” before investing in our common stock. Any of the risk factors we describe below could adversely affect our business, financial condition or results of operations. The market price of our common stock could decline if one or more of these risks or uncertainties actually occur, causing you to lose all or part of the money you paid to buy our common stock. Additional risks that we currently do not know about or that we currently believe to be immaterial may also impair our business. Certain statements below are forward-looking statements. See the section titled “Special Note Regarding Forward-Looking Statements” appearing elsewhere in this prospectus.

Risks related to our business and creating a new category of medicines

Even if this offering is completed, we will need to seek and secure significant additional funding through financings or from other sources. Clinical data or trial execution that creates delays, setbacks, or failures in one or more of our programs or modalities or the entire pipeline could result in an impaired ability or inability to finance or fund the Company in the future.

We are currently advancing our pipeline of 21 programs in development, 10 of which are in clinical studies. Discovering development candidates and developing investigational medicines is expensive, and we expect to continue to spend substantial amounts to (i) perform basic research, perform preclinical studies, and conduct clinical trials of our current and future programs, (ii) continue to develop and expand our platform and infrastructure and supply preclinical studies and clinical trials with appropriate grade materials (including current good manufacturing practices, or cGMP, materials), (iii) seek regulatory approvals for our investigational medicines, and (iv) launch and commercialize any products for which we receive regulatory approval, including building our own commercial sales, marketing, and distribution organization.

As of September 30, 2018, we had approximately $1.2 billion in cash, cash equivalents, and investments. We estimate that the net proceeds from this offering will be approximately $4 million, assuming an initial public offering price of $ per share, the midpoint of the price range set forth on the cover of this prospectus, after deducting estimated underwriting discounts and commissions and offering expenses payable by us. We expect that the net proceeds from this offering and our existing cash, cash equivalents, and investments will be sufficient to fund our current operations through at least the next twelve months. However, our operating plan may change as a result of many factors currently unknown to us, and we may need to seek additional funds sooner than planned, through public or private equity or debt financings, government or other third-party funding, sales of assets, marketing and distribution arrangements, other collaborations and licensing arrangements, or a combination of these approaches. In any event, we will require additional capital to obtain regulatory approval for, and to commercialize, our investigational medicines. Even if we believe we have sufficient funds for our current or future operating plans, we may seek additional capital if market conditions are favorable or if we have specific strategic considerations. Our spending will vary based on new and ongoing development and corporate activities. Because the length of time and activities associated with discovery of development candidates and development of our investigational medicines are highly uncertain, we are unable to estimate the actual funds we will require for development, marketing, and commercialization activities. Our future funding requirements, both near and long term, will depend on many factors, including, but not limited to:

• the initiation, progress, timing, costs, and results of preclinical or nonclinical studies and clinical trials for our development candidates and investigational medicines;
• results of research and our other platform activities;
• the clinical development plans we establish for these investigational medicines;
• the terms of any agreements with our current or future strategic collaborators;

As of September 30, 2018, we had approximately $1.2 billion in cash, cash equivalents, and investments. We estimate that the net proceeds from this offering will be approximately $4 million, assuming an initial public offering price of $ per share, the midpoint of the price range set forth on the cover of this prospectus, after deducting estimated underwriting discounts and commissions and offering expenses payable by us. We expect that the net proceeds from this offering and our existing cash, cash equivalents, and investments will be sufficient to fund our current operations through at least the next twelve months. However, our operating plan may change as a result of many factors currently unknown to us, and we may need to seek additional funds sooner than planned, through public or private equity or debt financings, government or other third-party funding, sales of assets, marketing and distribution arrangements, other collaborations and licensing arrangements, or a combination of these approaches. In any event, we will require additional capital to obtain regulatory approval for, and to commercialize, our investigational medicines. Even if we believe we have sufficient funds for our current or future operating plans, we may seek additional capital if market conditions are favorable or if we have specific strategic considerations. Our spending will vary based on new and ongoing development and corporate activities. Because the length of time and activities associated with discovery of development candidates and development of our investigational medicines are highly uncertain, we are unable to estimate the actual funds we will require for development, marketing, and commercialization activities. Our future funding requirements, both near and long term, will depend on many factors, including, but not limited to:

• the initiation, progress, timing, costs, and results of preclinical or nonclinical studies and clinical trials for our development candidates and investigational medicines;
• results of research and our other platform activities;
• the clinical development plans we establish for these investigational medicines;
• the terms of any agreements with our current or future strategic collaborators;
the number and characteristics of development candidates and investigational medicines that we develop or may in-license;

the outcome, timing, and cost of meeting regulatory requirements established by the U.S. Food and Drug Administration, or FDA, the European Medicines Agency, or EMA, and other comparable foreign regulatory authorities;

the cost of filing, prosecuting, defending, and enforcing our patent claims and other intellectual property rights, including patent infringement actions brought by third parties against us regarding our investigational medicines or actions by us challenging the patent or intellectual property rights of others;

the effect of competing technological and market developments, including other products that may compete with one or more of our development candidates or investigational medicines;

the cost and timing of completion and further expansion of clinical and commercial scale manufacturing activities sufficient to support all of our current and future programs, whether in-house or outsourced; and

the cost of establishing sales, marketing, and distribution capabilities for any investigational medicines for which we may receive marketing approval and reimbursement in regions where we choose to commercialize our medicines on our own.

To date, we have financed our operations primarily through the sale of equity securities and revenue from strategic alliances and we cannot be certain that additional funding will be available on favorable terms, or at all. Until we can generate sufficient product or royalty revenue to finance our operations, which we may never do, we expect to finance our future cash needs through a combination of public or private equity offerings, debt financings, collaborations, strategic alliances, sales of assets, licensing arrangements, and other marketing or distribution arrangements. Any fundraising efforts may divert our management from their day-to-day activities, which may adversely affect our ability to develop and commercialize our investigational medicines. In addition, we cannot guarantee that future financing will be available in sufficient amounts, at the right time, on favorable terms, or at all. Negative clinical trial data or setbacks, or perceived setbacks, in our programs or with respect to our technology could impair our ability to raise additional financing on favorable terms, or at all. Moreover, the terms of any financing may adversely affect the holdings or the rights of our stockholders and the issuance of additional securities, whether equity or debt, by us, or the possibility of such issuance, may cause the market price of our shares to decline. If we raise additional funds through public or private equity offerings, the terms of these securities may include liquidation or other preferences that may adversely affect our stockholders' rights.

Further, to the extent that we raise additional capital through the sale of common stock or securities convertible or exchangeable into common stock, your ownership interest will be diluted. If we raise additional capital through debt financing, we would be subject to fixed payment obligations and may be subject to covenants limiting or restricting our ability to take specific actions, such as incurring additional debt, making capital expenditures or declaring dividends. If we raise additional capital through marketing and distribution arrangements, sales of assets or other collaborations, strategic alliances, or licensing arrangements with third parties, we may have to relinquish certain valuable rights to our development candidates and investigational medicines, technologies, future revenue streams, or research programs. We also could be required to seek strategic collaborators for one or more of our current or future investigational medicines at an earlier stage than otherwise would be desirable or relinquish our rights to development candidates, investigational medicines, or intellectual property that we otherwise would seek to develop or commercialize ourselves. If we are unable to raise additional capital in sufficient amounts, at the right time, on favorable terms, or at all, we may have to significantly delay, scale back, or discontinue the development or commercialization of one or more of our products or investigational medicines, or one or more of our other research and development initiatives. Any of the above events could significantly harm our business, prospects, financial condition, and results of operations, cause the price of our common stock to decline, and negatively impact our ability to fund operations.
We attempt to distribute our technology, biology, execution and financing risks across a wide variety of therapeutic areas, disease states, programs, and technologies. However, our assessment of, and approach to, risk may not be comprehensive or effectively avoid delays or failures in one or more of our programs or modalities. Failures in one or more of our programs or modalities could adversely impact other programs or modalities in our pipeline and have a material adverse impact on our business, results of operations and ability to fund our business.

We are creating a new category of medicines based on mRNA, to improve the lives of patients. From the beginning, we designed our strategy and operations to realize the full potential value and impact of mRNA over a long time horizon across a broad array of human diseases. We have made investments in our platform, infrastructure, and clinical capabilities that have enabled us to establish a pipeline of 21 programs in development, 10 of which are in clinical studies. As our development candidates and investigational medicines progress, we or others may determine: that certain of our risk allocation decisions were incorrect or insufficient; that we made platform level technology mistakes; that individual programs or our mRNA science in general has technology or biology risks that were unknown or underappreciated; that our choices on how to develop our infrastructure to support our scale will result in an inability to manufacture our products for clinical trials or otherwise impair our manufacturing; or that we have allocated resources in such a way that large investments are not recovered and capital allocation is not subject to rapid re-direction.

All of these risks may relate to our current and future programs sharing similar science (including mRNA science) and infrastructure, and in the event material decisions in any of these areas turn out to have been incorrect or under-optimized, we may experience a material adverse impact on our business and ability to fund our operations and we may never realize what we believe is the potential of mRNA.

No mRNA drug has been approved in this new potential category of medicines, and may never be approved as a result of efforts by others or us. mRNA drug development has substantial clinical development and regulatory risks due to the novel and unprecedented nature of this new category of medicines.

As a potential new category of medicines, no mRNA medicines have been approved to date by the FDA or other regulatory agency. Successful discovery and development of mRNA medicines by either us or our strategic collaborators is highly uncertain and depends on numerous factors, many of which are beyond our or their control. We have made and will continue to make a series of business decisions and take calculated risks to advance our development efforts and pipeline, including those related to mRNA technology, delivery technology, and manufacturing processes which may be shown to be incorrect based on further work by us, our strategic collaborators, or others. To date, there has never been a Phase 3 trial or a commercialized product in which mRNA is the primary active ingredient. Our mRNA medicines that appear promising in the early phases of development may fail to advance, experience delays in the clinic, experience clinical holds, or fail to reach the market for many reasons, including:

- discovery efforts at identifying potential mRNA medicines may not be successful;
- nonclinical or preclinical study results may show potential mRNA medicines to be less effective than desired or to have harmful or problematic side effects;
- clinical trial results may show the mRNA medicines to be less effective than expected (e.g., a clinical trial could fail to meet one or more endpoint(s)) or to have unacceptable side effects or toxicities;
- adverse effects in any one of our clinical programs or adverse effects relating to our mRNA, or lipid nanoparticles, or LNPs, may lead to delays in or termination of one or more of our programs;
- the insufficient ability of our translational models to reduce risk or predict outcomes in humans, particularly given that each component of our investigational medicines and development candidates, may have a dependent or independent effect on safety, tolerability, and efficacy, which may, among other things, be species-dependent;
- manufacturing failures or insufficient supply of cGMP materials for clinical trials, or higher than expected cost could delay or set back clinical trials, or make mRNA based medicines commercially unattractive;
our improvements in the manufacturing processes for this new class of potential medicines may not be sufficient to satisfy the clinical or commercial demand of our mRNA investigational medicines or regulatory requirements for clinical trials;

changes that we make to optimize our manufacturing, testing or formulating of cGMP materials could impact the safety, tolerability, and efficacy of our investigational medicines and development candidates;

pricing or reimbursement issues or other factors that delay clinical trials or make any mRNA medicine uneconomical or noncompetitive with other therapies;

failure to timely advance our programs or receive the necessary regulatory approvals or a delay in receiving such approvals, due to, among other reasons, slow or failure to complete enrollment in clinical trials, withdrawal by trial participants from trials, failure to achieve trial endpoints, additional time requirements for data analysis, data integrity issues, biologics license application, or BLA, or the equivalent application, discussions with the FDA or EMA, a regulatory request for additional nonclinical or clinical data, or safety formulation or manufacturing issues may lead to our inability to obtain sufficient funding; and

the proprietary rights of others and their competing products and technologies that may prevent our mRNA medicines from being commercialized.

Currently, mRNA is considered a gene therapy product by the FDA. Unlike certain gene therapies that irreversibly alter cell DNA and could act as a source of side effects, mRNA based medicines are designed to not irreversibly change cell DNA; however, side effects observed in gene therapy could negatively impact the perception of mRNA medicines despite the differences in mechanism. In addition, because no product in which mRNA is the primary active ingredient has been approved, the regulatory pathway for approval is uncertain. The number and design of the clinical and preclinical studies required for the approval of these types of medicines have not been established, may be different from those required for gene therapy products or may require safety testing like gene therapy products. Moreover, the length of time necessary to complete clinical trials and to submit an application for marketing approval for a final decision by a regulatory authority varies significantly from one pharmaceutical product to the next, and may be difficult to predict.

We have incurred significant losses since our inception and anticipate that we will continue to incur significant losses for the foreseeable future.

We have incurred net losses in each year since our inception in 2009, including net losses of $216.2 million and $255.9 million for the years ended December 31, 2016 and 2017, respectively. As of December 31, 2017, we had an accumulated deficit of $621.9 million. As of September 30, 2018, we had an accumulated deficit of $865.2 million.

We have devoted most of our financial resources to research and development, including our clinical and preclinical development activities and the development of our platform. To date, we have financed our operations primarily through the sale of equity securities and proceeds from strategic alliances and, to a lesser extent, through grants from governmental and private organizations. The amount of our future net losses will depend, in part, on the rate of our future expenditures and our ability to obtain funding through equity or debt financings, sales of assets, strategic alliances, or additional grants. We have not commenced or completed pivotal clinical studies for any of our programs in clinical trials, or investigational medicines, and it will be several years, if ever, before we or our strategic collaborators have an investigational medicine ready for commercialization. Even if we obtain regulatory approval to market an investigational medicine, our future revenues will depend upon the size of any markets in which our investigational medicines have received approval, and our ability to achieve sufficient market acceptance, reimbursement from third-party payors, and adequate market share in those markets. We may never achieve profitability.

We expect to continue to incur significant expenses and increasing operating losses for the foreseeable future. We anticipate that our expenses will increase substantially if and as we:

- continue or expand our research or development of our programs in preclinical development;
• continue or expand the scope of our mRNA clinical studies for our investigational medicines;
• initiate additional preclinical, clinical, or other studies for our development candidates and investigational medicines, including under our strategic alliance agreements;
• continue to invest in our platform to conduct research to identify novel mRNA technology improvements, including identifying novel methods of mRNA delivery, such as LNPs that improve distribution and uptake of mRNA to specific tissues;
• change or add to internal manufacturing capacity or capability;
• change or add additional manufacturers or suppliers;
• add additional infrastructure to our quality control and quality assurance groups to support our operations as we progress our investigational medicines toward commercialization;
• attract and retain skilled personnel, particularly in Cambridge and Norwood, MA;
• create additional infrastructure to support our operations as a public company and our product development and planned future commercialization efforts, including new sites in the United States and abroad;
• seek marketing approvals and reimbursement for our investigational medicines;
• establish a sales, marketing, and distribution infrastructure to commercialize any products for which we may obtain marketing approval;
• seek to identify and validate additional development candidates and investigational medicines;
• acquire or in-license other development candidates, investigational medicines, and technologies;
• make milestone or other payments under any in-license agreements;
• maintain, protect, and expand our intellectual property portfolio; and
• experience any delays or encounter issues with any of the above.

Our quarterly and annual operating results may fluctuate in the future. As a result, we may fail to meet or exceed the expectations of research analysts or investors, which could cause our stock price to decline and negatively impact our financing or funding ability as well as negatively impact our ability to exist as a standalone company.

Our financial condition and operating results have varied in the past and will continue to fluctuate from quarter-to-quarter and year-to-year in the future due to a variety of factors, many of which are beyond our control. Factors relating to our business that may contribute to these fluctuations include the following, as well as other factors described elsewhere in this prospectus:

• delays or failures in advancement of existing or future development candidates into the clinic or in clinical trials;
• the feasibility of developing, manufacturing, and commercializing our programs;
• our ability to manage our growth;
• the outcomes of research programs, clinical trials, or other product development or approval processes conducted by us and our strategic collaborators;
• our ability to develop or successfully commercialize mRNA medicines;
• the ability of our strategic collaborators to develop and successfully commercialize mRNA medicines or other products developed from our intellectual property;
• our relationships, and any associated exclusivity terms, with strategic collaborators;
• our contractual or other obligations to provide resources to fund our development candidates and investigational medicines, and to provide resources to our strategic collaborators or to the strategic alliances themselves;
• our operation in a net loss position for the foreseeable future;
• risks associated with the international aspects of our business including the conduct of clinical trials in multiple locations and potential commercialization in such locations;
• our ability to consistently manufacture our development candidates and investigational medicines;
• our ability to accurately report our financial results in a timely manner;
• our dependence on, and the need to attract and retain, key management and other personnel;
• our ability to obtain, protect, and enforce our intellectual property, or IP, rights;
• our ability to prevent the theft or misappropriation of our IP, know-how or technologies;
• potential advantages that our competitors and potential competitors may have in securing funding, obtaining the rights to critical IP or developing competing technologies or products;
• our ability to obtain additional capital that may be necessary to expand our business;
• our strategic collaborators’ ability to obtain additional capital that may be necessary to develop and commercialize products under our strategic alliance agreements;
• business interruptions such as power outages, strikes, acts of terrorism, or natural disasters; and
• our ability to use our net operating loss carryforwards to offset future taxable income.

Due to the various factors mentioned herein, and others, the results of any of our prior quarterly or annual periods should not be relied upon as indications of our future operating performance.

The net losses we incur may fluctuate significantly from quarter-to-quarter and year-to-year, such that a period-to-period comparison of our results of operations may not be a good indication of our future performance. In any particular quarter or quarters, our operating results could be below the expectations of securities analysts or investors, which could cause our stock price to decline. As a general matter, we do not currently plan to provide forward-looking guidance on the expected timing of the progress, including clinical progress, of our individual development candidates and investigational medicines, or on the discovery of new potential development candidates or other research activities. This may lead to speculation or negative perception by investors, shareholders, analysts, and other market participants, as well as in the media, as to the progress of our individual development candidates, investigational medicines, or our programs as a whole, which may have a material adverse impact on our stock price or valuation. We currently anticipate disclosing clinical trial results as we deem appropriate, for example, upon substantial completion or at medical conferences in the ordinary course of business. Our stock price may decline as a result of unexpected clinical trial results in one or more of our programs, including adverse safety events reported for any of our programs.

Our business is highly dependent on the clinical advancement of our programs and modalities. Delay or failure to advance programs or modalities could adversely impact our business.

Using our platform, we are developing product features for medicines based on mRNA. Over time, our platform work led to commonalities, where a specific combination of mRNA technologies, delivery technologies, and manufacturing processes generated a set of product features shared by multiple programs. This is what we call a “modality.” We have historically utilized, and expect to continue to utilize, earlier programs in a modality to understand the technology risks within the modality, including manufacturing and pharmaceutical properties. Even if our earlier programs in a modality are successful in any phase of development any of such earlier programs may fail at a later phase of development, and other programs within the same modality may still fail at
any phase of development including at phases where earlier programs in that modality were successful. This may be a result of technical challenges unique to that program or due to biology risk which is unique to every program. As we progress our programs through clinical development, there may be new technical challenges that arise that cause an entire modality to fail.

While we aim to segregate risk using modalities, there may be foreseen and unforeseen risks across modalities in whole or in part. These include, but are not limited to, mRNA, chemical modifications, and LNPs and their components. In addition, if any one or more of our clinical programs encounter safety, tolerability, or efficacy problems, developmental delays, regulatory issues, or other problems, our platform approach and business could be significantly harmed.

In addition, the biology risk across the majority of our pipeline represents targets and pathways not clinically validated by one or more approved drugs. Only our H10N8 vaccine (mRNA-1440), H7N9 vaccine (mRNA-1851), phenylketonuria, or PKU, (mRNA-3283), and Fabry disease (mRNA-3630) programs pursue pathways where an approved pharmaceutical product has validated the vaccine and therapeutic intervention points. While we believe we have made progress in seeking to reduce biology risk in certain settings, such as for vaccine targets for which we and others have shown the utility of neutralizing antibodies, the risk that the targets or pathways that we have selected may not be effective will continue to apply across the majority of our current and future programs.

While we attempt to diversify our risks by developing one or more programs in each modality, there are risks that are unique to each modality and risks that are applicable across modalities. These risks may impair our ability to advance one or more of our programs in clinical development, obtain regulatory approval or ultimately commercialize our programs, or cause us to experience significant delays in doing so, any of which may materially harm our business.

Certain features in our development candidates and investigational medicines, including those related to mRNA, chemical modifications, surface chemistries, LNPs, and their components, may result in foreseen and unforeseen risks that are active across some or all of our modalities. Any such portfolio spanning risks, whether known or unknown, if realized in any one of our programs would have a material and adverse effect on our other programs and on our business as a whole.

There are specific additional risks to certain of our modalities and our programs as a whole. For example, prophylactic vaccines typically require clinical testing in thousands to tens of thousands of healthy volunteers to define an approvable benefit-risk profile. The need to show a high degree of safety and tolerability when dosing healthy individuals could result in rare and even spurious safety findings, negatively impacting a program prior to or after commercial launch. While we believe that certain safety, tolerability, and levels of immunogenicity we have observed in the early-stage clinical trials in our prophylactic vaccine programs is sufficient to initiate additional trials, there can be no assurance that we will observe acceptable safety or efficacy profiles in later-stage trials required for approval of these programs. For neoantigen cancer vaccines, to date, no molecular (non-cell-based) therapeutic protein vaccine has been shown to be effective against cancer and there are many clinical and manufacturing challenges to personalized medicines, including cell-based therapeutics and vaccines. These risks include: a rapid production turn-around time that is measured in weeks in order to supply patients in our clinical trials before further progression and mutation of their tumors, the significant costs incurred in making individualized vaccines, and potential lack of immune responses potentially due to the biology of the tumor or immune status of the patient. These and other risks apply to our personalized cancer vaccine, or PCV, and other neoepitope investigational medicine programs. Additionally, there may be challenges in delivering an adequate quantity of active pharmaceutical ingredient, or API, required to drive efficacy due to the limitation in volume of API that can be delivered to a specific location, like a tumor or injured tissue. Our therapies for local injections often require specialized skills for conducting a clinical trial that could delay trials or slow or impair commercialization of the approved investigational medicine due to the poor adoption of injected local therapeutics or intratumoral therapies. In addition, the uncertain translatability of target selection from preclinical
animal models, including mouse and non-human primate models, to successful clinical trial results may be impossible, particularly for immuno-oncology and systemic therapies, and cancer vaccines. In general, several biological steps are required for delivery of mRNA to translate into therapeutically active medicines. These processing steps may differ between individuals or tissues, and this could lead to variable levels of therapeutic protein, its activity, immunogenicity, or targeted or broad distribution to tissues for a therapeutic effect. Gene therapies and mRNA based medicines may activate one or more immune responses against any and all components of the drug product (e.g., the mRNA or the delivery vehicle, such as a lipid nanoparticle) as well as against the encoded protein, giving rise to potential immune reaction related adverse events. Eliciting an immune response against the encoded protein may impede our ability to achieve a pharmacologic effect upon repeat administration or a side-effect. These risks apply to all of our programs, including our systemic secreted therapeutics and systemic intracellular therapeutics modalities.

Risks related to the research, development, regulatory review, and approval of our existing and future pipeline

Preclinical development is lengthy and uncertain, especially for a new category of medicines such as mRNA, and therefore our preclinical programs or development candidates may be delayed, terminated, or may never advance to the clinic, any of which may affect our ability to obtain funding and may have a material adverse impact on our platform or our business.

Much of our pipeline is in preclinical development, and these programs could be delayed or not advance into the clinic. Before we can initiate clinical trials for a development candidate, we must complete extensive preclinical studies, including IND-enabling GLP toxicology testing, that support our planned Investigational New Drug applications, or INDs, in the United States, or similar applications in other jurisdictions. We must also complete extensive work on Chemistry, Manufacturing, and Controls, or CMC, activities (including yield, purity and stability data) to be included in the IND filing. CMC activities for a new category of medicines such as mRNA require extensive manufacturing processes and analytical development, which is uncertain and lengthy. For instance, batch failures as we scale up our manufacturing have occurred and may continue to occur. In addition, we have in the past and may in the future have difficulty identifying appropriate buffers and storage conditions to enable sufficient shelf life of batches of our preclinical or clinical development candidates. If we are required to produce new batches of our development candidates due to insufficient shelf life, it may delay the commencement or completion of preclinical or clinical trials of such development candidates. For example, we cannot be certain of the timely completion or outcome of our preclinical testing and studies and cannot predict if the FDA or other regulatory authorities will accept the results of our preclinical testing or our proposed clinical programs or if the outcome of our preclinical testing, studies, and CMC activities will ultimately support the further development of our programs. As a result, we cannot be sure that we will be able to submit INDs or similar applications for our preclinical programs on the timelines we expect, if at all, and we cannot be sure that submission of INDs or similar applications will result in the FDA or other regulatory authorities allowing clinical trials to begin.

Clinical development is lengthy and uncertain, especially with a new category of medicines such as mRNA medicines. Clinical trials of our investigational medicines may be delayed, and certain programs may never advance in the clinic or may be more costly to conduct than we anticipate, any of which can affect our ability to fund the Company and would have a material adverse impact on our platform or our business.

Clinical testing is expensive and complex and can take many years to complete, and its outcome is inherently uncertain. We may not be able to initiate, may experience delays in, or may have to discontinue clinical trials for our investigational medicines. We and our strategic collaborators may experience numerous unforeseen events during, or as a result of, any clinical trials that we or our strategic collaborators conduct that could delay or prevent us or our strategic collaborators from successfully developing our investigational medicines, including:

- the FDA, other regulators, institutional review boards, or IRBs, or ethics committees may not authorize us or our investigators to commence a clinical trial or conduct a clinical trial at a prospective trial site for any number of reasons, including concerns regarding safety and aspects of the clinical trial design;
• we may experience delays in reaching, or fail to reach, agreement on favorable terms with prospective trial sites and prospective contract research organizations, or CROs, the terms of which can be subject to extensive negotiation and may vary significantly among different CROs and trial sites;

• we have in the past and may continue to optimize our manufacturing processes, including through changes to the scale and site of manufacturing, which may lead to potentially significant changes in our clinical trial designs, requiring additional cost and time, and, as a consequence, lead to a delay in plans for progressing one or more investigational medicines;

• the outcome of our preclinical studies and our early clinical trials may not be predictive of the success of later clinical trials, and interim results of a clinical trial do not necessarily predict final results;

• we may be unable to establish clinical endpoints that applicable regulatory authorities would consider clinically meaningful;

• in an effort to optimize product features, we have in the past and may continue to make changes to our investigational medicines after we commence clinical trials of a medicine which may require us to repeat earlier stages of clinical testing or delay later stage testing of the medicine;

• clinical trials of any investigational medicines may fail to show safety or efficacy, or produce negative or inconclusive results, and we may decide, or regulators may require us, to conduct additional nonclinical studies or clinical trials, or we may decide to abandon product development programs;

• differences in trial design between early stage clinical trials and later-stage clinical trials make it difficult to extrapolate the results of earlier clinical trials to later clinical trials;

• preclinical and clinical data are often susceptible to varying interpretations and analyses, and many investigational medicines believed to have performed satisfactorily in preclinical studies and clinical trials have nonetheless failed to obtain marketing approval;

• our investigational medicines may have undesirable side effects, such as the immunogenicity of the LNPs or their components, the immunogenicity of the protein made by the mRNA, or degradation products, any of which could lead to serious adverse events, or SAEs, or other unexpected characteristics. One or more of such effects or events could cause regulators to impose a clinical hold on the applicable trial, or cause us or our investigators, IRBs, or ethics committees to suspend or terminate the trial of that investigational medicine or any other of our investigational medicines for which a clinical trial may be ongoing;

• the number of trial participants required for clinical trials of any investigational medicines may be larger than we anticipate, identification of trial participants for such trials may be limited, enrollment in these clinical trials may be slower than we anticipate due to perceived adverse effects, competitive trials, or other reasons, or participants may withdraw from clinical trials or fail to return for post-treatment follow-up at a higher rate than we anticipate;

• our third-party contractors may fail to comply with regulatory requirements or meet their contractual obligations to us in a timely manner, or at all, or may deviate from the clinical trial protocol or withdraw from the trial, which may require that we add new clinical trial sites;

• regulators may elect to impose a clinical hold, or we or our investigators, IRBs, or ethics committees may elect to suspend or terminate clinical research or trials for various reasons, including noncompliance with regulatory requirements or a finding that the participants are being exposed to unacceptable benefit risk ratio;

• the cost of preclinical or nonclinical testing and studies and clinical trials of any investigational medicines may be greater than we anticipate;

• the supply or quality of our investigational medicines or other materials necessary to conduct clinical trials may be insufficient or inadequate;
safety or efficacy concerns regarding our investigational medicines may result from any safety or efficacy concerns arising from nonclinical or clinical testing of other therapies targeting a similar disease state or other therapies, such as gene therapy, that are perceived as similar to ours; and

the FDA or other regulatory authorities may require us to submit additional data such as long-term toxicology studies, or impose other requirements before permitting us to initiate a clinical trial.

We could also encounter delays if a clinical trial is suspended or terminated by us, the FDA or other regulatory authorities, ethics committees, or the IRBs of the institutions in which such trials are being conducted, or if such trial is recommended for suspension or termination by the Data Safety Monitoring Board, or DSMB, for such trial. We have in the past, and may in the future, be delayed in gaining clearance from the FDA or other regulators to initiate clinical trials through the imposition of a clinical hold in order to address comments from such regulators on our clinical trial design or other elements of our clinical trials. A suspension or termination may be imposed due to a number of factors, including failure to conduct the clinical trial in accordance with regulatory requirements or our clinical protocols, inspection of the clinical trial operations or trial site by the FDA or other regulatory authorities resulting in the imposition of a clinical hold, unforeseen safety issues, or adverse side effects, failure to demonstrate a benefit, or adequate benefit risk ratio, from using an investigational medicine, failure to establish or achieve clinically meaningful trial endpoints, changes in governmental regulations or administrative actions, or lack of adequate funding to continue the clinical trial. Many of the factors that cause, or lead to, a delay in the commencement or completion of clinical trials may also ultimately lead to the denial of regulatory approval of our investigational medicines. We must also complete extensive work on CMC activities that require extensive manufacturing processes and analytical development, which is uncertain and lengthy. For instance, batch failures as we scale up our manufacturing have occurred and may continue to occur. In addition, we have in the past and may in the future have difficulty identifying appropriate buffers and storage conditions to enable sufficient shelf life of batches of our clinical development candidates or investigational medicines. If we are required to produce new batches of our development candidates or investigational medicines due to insufficient shelf life, it may delay the commencement or completion of clinical trials of such development candidates or investigational medicines.

Moreover, the FDA has indicated that prior to commencing later stage clinical trials for our programs we will need to develop assays to measure and predict the potency of a given dose of our investigational medicines. Any delay in developing assays that are acceptable to the FDA or other regulators could delay the start of future clinical trials. Further, the FDA or other regulatory authorities may disagree with our clinical trial design and our interpretation of data for our clinical trials, or may change the requirements for approval even after they have reviewed and commented on the design for our clinical trials.

Significant preclinical or nonclinical testing and studies or clinical trial delays for our investigational medicines also could allow our competitors to bring products to market before we do, potentially impairing our ability to successfully commercialize our investigational medicines and harming our business and results of operations. Any delays in the development of our investigational medicines may harm our business, financial condition, and prospects significantly.

mRNA medicines are a novel approach, and negative perception of the efficacy, safety, or tolerability of any investigational medicines that we develop could adversely affect our ability to conduct our business, advance our investigational medicines, or obtain regulatory approvals.

As a potential new category of medicines, no mRNA medicines have been approved to date by the FDA or other regulators. Adverse events in clinical trials of our investigational medicines or in clinical trials of others developing similar products and the resulting publicity, as well as any other adverse events in the field of mRNA medicine, or other products that are perceived to be similar to mRNA medicines, such as those related to gene therapy or gene editing, could result in a decrease in the perceived benefit of one or more of our programs, increased regulatory scrutiny, decreased confidence by patients and clinical trial collaborators in our investigational medicines, and less demand for any product that we may develop. Our large pipeline of
development candidates and investigational medicines could result in a greater quantity of reportable adverse events, including suspected unexpected serious adverse reactions, or SUSARs, other reportable negative clinical outcomes, manufacturing reportable events or material clinical events that could lead to clinical delay or hold by the FDA or applicable regulatory authority or other clinical delays, any of which could negatively impact the perception of one or more of our programs, as well as our business as a whole. In addition, responses by U.S., state or foreign governments to negative public perception may result in new legislation or regulations that could limit our ability to develop any investigational medicines or commercialize any approved products, obtain or maintain regulatory approval, or otherwise achieve profitability. More restrictive statutory regimes, government regulations, or negative public opinion would have an adverse effect on our business, financial condition, results of operations, and prospects and may delay or impair the development of our investigational medicines and, commercialization of any approved products or demand for any products we may develop.

*Because we are developing some of our development candidates or investigational medicines for the treatment of diseases in which there is little clinical experience and, in some cases, using new endpoints or methodologies, the FDA or other regulatory authorities may not consider the endpoints of our clinical trials to provide clinically meaningful results.*

There are no pharmacologic therapies approved to treat the underlying causes of many diseases that we currently attempt to address or may address in the future. For instance, for methylmalonic acidemia, or MMA, or propionic acidemia, or PA, few clinical trials have been attempted. In addition, there has been limited clinical trial experience for the development of pharmaceuticals to treat these rare diseases in general, and we are not aware of a registrational trial that led to approval of a drug to treat these diseases. There have been some historical trials with other agents to address organic acidemias which may have utilized clinical endpoints that are less applicable to our efforts with our MMA and PA programs that address the underlying defect. As a result, the design and conduct of clinical trials of investigational medicines for the treatment of these disorders and other disorders may take longer, be more costly, or be less effective as part of the novelty of development in these diseases.

Even if the FDA does find our success criteria to be sufficiently validated and clinically meaningful, we may not achieve the pre-specified endpoint to a degree of statistical significance in any pivotal or other clinical trials we or our strategic collaborators may conduct for our programs. Further, even if we do achieve the pre-specified criteria, our trials may produce results that are unpredictable or inconsistent with the results of the more traditional efficacy endpoints in the trial. The FDA also could give overriding weight to other efficacy endpoints over a primary endpoint, even if we achieve statistically significant results on that endpoint, if we do not do so on our secondary efficacy endpoints. The FDA also weighs the benefits of a product against its risks and the FDA may view the efficacy results in the context of safety as not being supportive of licensure. Other regulatory authorities in Europe and other countries may make similar findings with respect to these endpoints.

*Some of our investigational medicines are classified as gene therapies by the FDA and the EMA, and the FDA has indicated that our investigational medicines will be reviewed within its Center for Biologics Evaluation and Research, or CBER. Even though our mRNA investigational medicines are designed to have a different mechanism of action from gene therapies, the association of our investigational medicines with gene therapies could result in increased regulatory burdens, impair the reputation of our investigational medicines, or negatively impact our platform or our business.*

There have been few approvals of gene therapy products in the United States or foreign jurisdictions, and there have been well-reported significant adverse events associated with their testing and use. Gene therapy products have the effect of introducing new DNA and potentially irreversibly changing the DNA in a cell. In contrast, mRNA is highly unlikely to localize to the nucleus, integrate into the DNA, or otherwise make any permanent changes to cell DNA. Consequently, we expect that our investigational medicines will have a different potential side effect profile from gene therapies because they lack risks associated with altering cell DNA irreversibly. Further, we may avail ourselves of ways of mitigating side effects in developing our investigational medicines to address safety concerns that are not available to all gene therapies, such as lowering the dose of our investigational medicines during repeat dosing or stopping treatment to potentially ameliorate undesirable side effects.
Regulatory requirements governing gene and cell therapy products have evolved and may continue to change in the future, and the implications for mRNA-based therapies is unknown. For example, the FDA has established the Office of Tissues and Advanced Therapies within CBER to consolidate the review of gene therapy and related products, and convenes the Cellular, Tissue and Gene Therapies Advisory Committee to advise CBER on its review. In the EU, mRNA has been characterized as a Gene Therapy Medicinal Product. In certain countries, mRNA therapies have not yet been classified or any such classification is not known to us, specifically, in Japan, the PMDA has not taken a position on the regulatory classification. Notwithstanding the differences between our mRNA investigational medicines and gene therapies, the classification of some of our mRNA investigational medicines as gene therapies in the United States, the EU and potentially other countries could adversely impact our ability to develop our investigational medicines, and could negatively impact our platform and our business. For instance, a clinical hold on gene therapy products across the field due to risks associated with altering cell DNA irreversibly may apply to our mRNA investigational medicines irrespective of the mechanistic differences between gene therapies and mRNA.

Adverse events reported with respect to gene therapies or genome editing therapies could adversely impact one or more of our programs. Although our mRNA development candidates and investigational medicines are designed not to make any permanent changes to cell DNA, regulatory agencies or others could believe that adverse effects of gene therapies products caused by introducing new DNA and irreversibly changing the DNA in a cell could also be a risk for our mRNA investigational therapies, and as a result may delay one or more of our trials or impose additional testing for long-term side effects. Any new requirements and guidelines promulgated by regulatory review agencies may have a negative effect on our business by lengthening the regulatory review process, requiring us to perform additional or larger studies, or increasing our development costs, any of which could lead to changes in regulatory positions and interpretations, delay or prevent advancement or approval and commercialization of our investigational medicines or lead to significant post-approval studies, limitations, or restrictions. As we advance our investigational medicines, we will be required to consult with these regulatory agencies and advisory committees and comply with applicable requirements and guidelines. If we fail to do so, we may be required to delay or discontinue development of some or all of our investigational medicines.

A breakthrough therapy designation or fast track designation by the FDA for a drug may not lead to a faster development or regulatory review or approval process, and it would not increase the likelihood that the drug will receive marketing approval.

We may seek a breakthrough therapy designation for one or more of our investigational medicines. A breakthrough therapy is defined as a drug that is intended, alone or in combination with one or more other drugs, to treat a serious or life-threatening disease or condition, and preliminary clinical evidence indicates that the drug may demonstrate substantial improvement over existing therapies on one or more clinically significant endpoints, such as substantial treatment effects observed early in clinical development. For drugs that have been designated as breakthrough therapies, interaction and communication between the FDA and the sponsor of the trial can help to identify the most efficient path for clinical development while minimizing the number of patients placed in ineffective control regimens. Drugs designated as breakthrough therapies by the FDA are also eligible for priority review if supported by clinical data at the time of the submission of the BLA.

Designation as a breakthrough therapy is at the discretion of the FDA. Accordingly, even if we believe that one of our investigational medicines meets the criteria for designation as a breakthrough therapy, the FDA may disagree and instead determine not to make such designation. In any event, the receipt of a breakthrough therapy designation for a drug may not result in a faster development process, review, or approval compared to drugs considered for approval under conventional FDA procedures and it would not assure ultimate approval by the FDA. In addition, even if one or more of our investigational medicines qualify as breakthrough therapies, the FDA may later decide that the investigational medicine no longer meets the conditions for qualification or it may decide that the time period for FDA review or approval will not be shortened.

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We may seek Fast Track Designation for some of our investigational medicines. If a therapy is intended for the treatment of a serious or life-threatening condition and the therapy demonstrates the potential to address significant unmet medical needs for this condition, the drug sponsor may apply for Fast Track Designation. The FDA has broad discretion whether or not to grant this designation, and even if we believe a particular investigational medicine is eligible for this designation, we cannot assure you that the FDA would decide to grant it. Even if we do receive Fast Track Designation, we may not experience a faster development process, review, or approval compared to conventional FDA procedures. The FDA may withdraw Fast Track Designation if it believes that the designation is no longer supported by data from our clinical development program. Fast Track Designation alone does not guarantee qualification for the FDA's priority review procedures.

We may experience delays in identifying and enrolling participants in our clinical trials which would delay the progress of our investigational medicines and result in increased expenses.

We depend on enrollment of participants in our clinical trials for our investigational medicines. We may find it difficult to enroll trial participants in our clinical studies, which could delay or prevent clinical studies of our investigational medicines. Identifying and qualifying trial participants to participate in clinical studies of our investigational medicines is critical to our success. The timing of our clinical studies depends on the speed at which we can recruit trial participants to participate in testing our investigational medicines. Delays in enrollment may result in increased costs or may affect the timing or outcome of the planned clinical trials, which could prevent completion of these trials and adversely affect our ability to advance the development of our investigational medicines. If trial participants are unwilling to participate in our studies because of negative publicity from adverse events in our trials or other trials of similar products, or those related to specific therapeutic area, or for other reasons, including competitive clinical studies for similar patient populations, the timeline for recruiting trial participants, conducting studies, and obtaining regulatory approval of potential products may be delayed. These delays could result in increased costs, delays in advancing our product development, delays in testing the effectiveness of our product, or termination of the clinical studies altogether.

We may not be able to identify, recruit, and enroll a sufficient number of trial participants, or those with required or desired characteristics to achieve diversity in a study, to complete our clinical studies in a timely manner. Patient and subject enrollment is affected by factors including:

- severity of the disease under investigation;
- complexity and design of the study protocol;
- size of the patient population;
- eligibility criteria for the study in question;
- proximity and availability of clinical study sites for prospective trial participants;
- availability of competing therapies and clinical studies, including between our own clinical trials;
- efforts to facilitate timely enrollment in clinical studies;
- patient referral practices of physicians;
- ability to monitor trial participants adequately during and after treatment;
- ability to recruit clinical trial investigators with the appropriate competencies and experience;
- clinicians' and trial participants' perceptions as to the potential advantages and side effects of the investigational medicine being studied in relation to other available therapies, including any new drugs or treatments that may be approved for the indications we are investigating;
- our ability to obtain and maintain participant informed consent; and
- the risk that trial participants enrolled in clinical trials will not complete a clinical trial.
In addition, our clinical trials will compete with other clinical trials for investigational medicines that are in the same therapeutic areas as our investigational medicines, and this competition will reduce the number and types of trial participants available to us, because some trial participants who might have opted to enroll in our trials may instead opt to enroll in a trial being conducted by a third party. Since the number of qualified clinical investigators is limited, we expect to conduct some of our clinical trials at the same clinical trial sites that some of our competitors use, which will reduce the number of trial participants who are available for our clinical trials at such clinical trial sites. Moreover, because in some cases our investigational medicines represent a departure from more traditional methods for disease treatment and prevention, potential trial participants and their doctors may be inclined to use conventional therapies or other new therapies rather than enroll trial participants in any future clinical trial involving mRNA investigational medicines. Additionally, if new investigational medicines, such as gene editing therapies, show encouraging results, potential trial participants and their doctors may be inclined to enroll trial participants in clinical trials using those investigational medicines. If such new investigational medicines show discouraging results or other adverse safety indications, potential trial participants and their doctors may be less inclined to enroll trial participants in our clinical trials.

In particular, certain conditions for which we plan to evaluate our current development candidates, including MMA (mRNA-3704), PA (mRNA-3927), PKU (mRNA-3283), and Fabry disease (mRNA-3630), are rare diseases with limited patient pools from which to draw for clinical studies. mRNA-3704 is our mRNA development candidate to address MMA, a serious metabolic disorder affecting approximately 500-2,000 patients in the United States. mRNA-3927 is our mRNA development candidate to address PA, a serious metabolic disorder with significant morbidity and mortality that is closely related to MMA. There are approximately 325-2,000 patients suffering with PA in the United States. mRNA-3283 is our mRNA development candidate to address PKU, which, based on current population estimates, affects approximately 21,000-32,000 patients in the United States. mRNA-3630 is our development candidate to address Fabry disease. The eligibility criteria of our clinical studies will further limit the pool of available study participants. Additionally, the process of finding and diagnosing patients may prove costly.

We may fail to obtain and maintain orphan drug designations from the FDA for our future investigational medicines, as applicable.

Our strategy includes filing for orphan drug designation where available for our investigational medicines. Under the Orphan Drug Act, the FDA may grant orphan drug designation to a drug or biologic intended to treat a rare disease or condition, which is defined as one occurring in a patient population of fewer than 200,000 in the United States, or a patient population greater than 200,000 in the United States where there is no reasonable expectation that the cost of developing the drug or biologic will be recovered from sales in the United States. In the United States, orphan drug designation entitles a party to financial incentives, such as opportunities for grant funding toward clinical trial costs, tax advantages, and user-fee waivers. In addition, if a product that has orphan drug designation subsequently receives the first FDA approval for the disease for which it has such designation, the product is entitled to orphan drug exclusivity, which means that the FDA may not approve any other applications, including a full new drug application, or NDA, or BLA, to market the same drug or biologic for the same indication for seven years, except in limited circumstances, such as a showing of clinical superiority to the product with orphan drug exclusivity or where the original manufacturer is unable to assure sufficient product quantity.

In addition, exclusive marketing rights in the United States may be limited if we seek approval for an indication broader than the orphan-designated indication or may be lost if the FDA later determines that the request for designation was materially defective. Further, even if we obtain orphan drug exclusivity for a product, that exclusivity may not effectively protect the product from competition because different drugs with different active moieties may receive and be approved for the same condition, and only the first applicant to receive approval will receive the benefits of marketing exclusivity. Even after an orphan-designated product is approved, the FDA can subsequently approve a later drug with the same active moiety for the same condition if the FDA concludes that the later drug is clinically superior if it is shown to be safer, more effective, or makes a major contribution to
patient care. Orphan drug designation neither shortens the development time or regulatory review time of a drug, nor gives the drug any advantage in the regulatory review or approval process. In addition, while we may seek orphan drug designation for our investigational medicines, we may never receive such designations.

Our investigational medicines may face competition from biosimilars approved through an abbreviated regulatory pathway.

The Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act of 2010, or collectively the ACA, includes a subtitle called the Biologics Price Competition and Innovation Act of 2009, or BPCIA, which created an abbreviated approval pathway for biological products that are biosimilar to or interchangeable with an FDA-approved reference biological product. Under the BPCIA, an application for a biosimilar product may not be submitted to the FDA until four years following the date that the reference product was first approved by the FDA. In addition, the approval of a biosimilar product may not be made effective by the FDA until 12 years from the date on which the reference product was first approved. During this 12-year period of exclusivity, another company may still market a competing version of the reference product if the FDA approves a BLA for the competing product containing the sponsor’s own preclinical data and data from adequate and well-controlled clinical trials to demonstrate the safety, purity, and potency of the other company’s product. The law is complex and is still being interpreted and implemented by the FDA. As a result, its ultimate impact, implementation, and meaning are subject to uncertainty.

We believe that any of our investigational medicines approved as a biological product under a BLA should qualify for the 12-year period of exclusivity. However, there is a risk that this exclusivity could be shortened due to congressional action or otherwise, or that the FDA will not consider our investigational medicines to be reference products for competing products, potentially creating the opportunity for generic competition sooner than anticipated. Other aspects of the BPCIA, some of which may impact the BPCIA exclusivity provisions, have also been the subject of recent litigation. Moreover, the extent to which a biosimilar, once approved, will be substituted for any one of our reference products in a way that is similar to traditional generic substitution for non-biological products is not yet clear, and will depend on a number of marketplace and regulatory factors that are still developing.

Any clinical trials of our oncology-related products that we conduct with a seamless trial design may not be acceptable to regulatory authorities in the form submitted, or at all, which may delay our clinical development and limit or change the type of information we may gather from our clinical trials.

We may pursue a development program for our oncology-related products that relies upon a seamless trial design, which presents additional risks compared to traditional three-phase development programs. A seamless trial design can be achieved through a first-in-human, or FIH, multiple expansion cohort trial, which has a single protocol with an initial dose-escalation phase and also contains three or more additional patient cohorts with cohort-specific objectives. FIH multiple expansion cohort trials are intended to expedite development by seamlessly proceeding from initial determination of a potential effective dose to individual cohorts that have trial objectives typical of Phase 2 trials. Challenges and risks associated such seamless trial designs include challenges in the timely dissemination of new safety information to investigators, IRBs, and regulators, exposing a large number of patients across cohorts to potentially suboptimal or toxic doses of an investigational drug, exposing more patients than is needed to achieve the cohort’s objectives, and missed interpretations of preliminary trial results and unplanned analyses which can lead to delays in clinical development. Regulatory authorities may find our seamless trial designs unacceptable based on these and other risks of utilizing such designs.

If we are not able to obtain, or if there are delays in obtaining, required regulatory approvals, we will not be able to commercialize, or will be delayed in commercializing, investigational medicines we may develop, and our ability to generate revenue will be materially impaired.

Even if we complete the necessary preclinical studies and clinical trials, the marketing approval process is expensive, time-consuming, and uncertain, and may prevent us from obtaining approvals for the
commercialization of any development candidates and investigational medicines we may develop. Any mRNA medicine we may develop and the activities associated with its development and commercialization, including design, testing, manufacture, recordkeeping, labeling, storage, approval, advertising, promotion, sale, and distribution, are subject to comprehensive regulation by the FDA and by comparable global health authorities. To obtain the requisite regulatory approvals to commercialize any of our investigational medicines, we and our strategic collaborators must demonstrate through extensive preclinical studies and clinical trials that our products are safe, pure, and potent or effective in humans, including the target population. Successful completion of clinical trials is a prerequisite to submitting a BLA to the FDA, a Marketing Authorization Application, or MAA, to the EMA, and similar marketing applications to comparable global regulatory authorities, for each investigational medicine and, consequently, the ultimate approval and commercial marketing of any investigational medicines.

Failure to obtain marketing approval for an investigational medicine will prevent us from commercializing the investigational medicine in a given jurisdiction. We have not received approval to market any investigational medicines from regulatory authorities in any jurisdiction, and it is possible that none of our investigational medicines or any investigational medicines we may seek to develop in the future will ever obtain regulatory approval. We have limited experience in filing and supporting the applications necessary to gain marketing approvals and may need to rely on third-party contract research organizations, or CROs, or regulatory consultants to assist us in this process. To our knowledge, there is no current precedent for an mRNA based medicine such as the types we are developing being approved for sale by the FDA or any other global regulatory agency. Although we expect to submit BLAs for our mRNA based investigational medicines in the United States, other jurisdictions may consider our mRNA based investigational medicines to be new drugs, not biologics, and require different marketing applications. Securing regulatory approval requires the submission of extensive preclinical and clinical data and supporting information to the various regulatory authorities for each therapeutic indication to establish the investigational medicine’s safety and efficacy. Securing regulatory approval also requires the submission of information about the product manufacturing process to, and inspection of manufacturing facilities by, the relevant regulatory authority. Any investigational medicines we develop may not be effective, may be only moderately effective, or may prove to have undesirable or unintended side effects, toxicities or other characteristics that may preclude our obtaining marketing approval or prevent or limit commercial use.

The process of obtaining marketing approvals, both in the United States and abroad, is expensive, may take many years if additional clinical trials are required, if approval is obtained at all, and can vary substantially based upon a variety of factors, including the type, complexity, and novelty of the investigational medicines involved. Changes in marketing approval policies during the development period, changes in or the enactment of additional statutes or regulations, or changes in regulatory review for each submitted product application, may cause delays in the approval or rejection of an application. The FDA and comparable authorities in other countries have substantial discretion in the approval process and may refuse to accept any application or may decide that our data are insufficient for approval and require additional preclinical, clinical, or other studies. In addition, varying interpretations of the data obtained from preclinical and clinical testing could delay, limit, or prevent marketing approval of an investigational medicine. Any marketing approval we ultimately obtain may be limited or subject to restrictions or post-approval commitments that render the approved product not commercially viable. Additional delays or non-approval may result if an FDA Advisory Committee or other regulatory authority recommends non-approval or restrictions on approval. In addition, we may experience delays or rejections based upon additional government regulation from future legislation or administrative action, or changes in regulatory agency policy during the period of product development, clinical studies, and the review process.

Regulatory agencies also may approve an mRNA medicine for fewer or more limited indications than requested or may grant approval subject to the performance of post-marketing studies. In addition, regulatory agencies may not approve the labeling claims that are necessary or desirable for the successful commercialization of our treatment candidates.
The FDA and other regulatory agencies review the CMC section of regulatory filings. Any aspects found unsatisfactory by regulatory agencies may result in delays in clinical trials and commercialization. In addition, the regulatory agencies conduct pre-approval inspections, or PAIs, at the time of a BLA. Any findings by regulatory agencies and failure to comply with requirements may lead to delay in approval and failure to commercial the potential mRNA investigational medicine.

If we experience delays in obtaining approval or if we fail to obtain approval of any investigational medicines we may develop, the commercial prospects for those investigational medicines will be harmed, and our ability to generate revenues will be materially impaired.

We may never obtain EMA or other foreign regulatory body approval for any of our investigational medicines, and even if we do, we may never be able to commercialize any of our investigational medicines in any other jurisdiction, which would limit our ability to realize their full market potential.

Approval by the FDA in the United States, if obtained, does not ensure approval by regulatory authorities in other countries or jurisdictions. In order to eventually market any of our investigational medicines in any particular foreign jurisdiction, we must establish and comply with numerous and varying regulatory requirements on a jurisdiction-by-jurisdiction basis regarding safety and efficacy. In addition, clinical trials conducted in one country may not be accepted by regulatory authorities in other countries, and regulatory approval in one country does not guarantee regulatory approval in any other country. Approval processes vary among countries and can involve additional product testing and validation and additional administrative review periods.

Seeking foreign regulatory approval could result in difficulties and costs for us and require additional preclinical studies or clinical trials which could be costly and time-consuming. Regulatory requirements can vary widely from country to country and could delay or prevent the introduction of our products in those countries. The foreign regulatory approval process involves all of the risks associated with FDA approval. We do not have any investigational medicines approved for sale in any jurisdiction, including international markets, and we do not have experience in obtaining regulatory approval in international markets. If we fail to comply with regulatory requirements in international markets or to obtain and maintain required approvals, or if regulatory approvals in international markets are delayed, our target market will be reduced and our ability to realize the full market potential of our products will be unrealized.

Our planned clinical trials or those of our strategic collaborators may reveal significant adverse events not seen in our preclinical or nonclinical studies and may result in a safety profile that could delay or terminate clinical trials, or delay or prevent regulatory approval or market acceptance of any of our investigational medicines.

There is typically an extremely high rate of attrition for product candidates across categories of medicines proceeding through clinical trials. These product candidates may fail to show the desired safety and efficacy profile in later stages of clinical trials despite having progressed through nonclinical studies and initial clinical trials. A number of companies in the biopharmaceutical industry have suffered significant setbacks in later-stage clinical trials due to lack of efficacy or unacceptable safety profiles, notwithstanding promising results in earlier trials. Most investigational medicines that commence clinical trials are never approved as products and there can be no assurance that any of our current or future clinical trials will ultimately be successful or support further clinical development of any of our investigational medicines.

Some of our investigational medicines are developed or intended to be co-administered with other developmental therapies or approved medicines. For example, our PCV investigational medicine (mRNA-4157) and our KRAS investigational medicine in collaboration with Merck & Co., or Merck, (mRNA-5671) may be co-administered with Merck’s anti-PD-1 therapy, pembrolizumab. Our IL12 investigational medicine in collaboration with AstraZeneca (MEDI1191) is being developed to be co-administered with checkpoint inhibitors (e.g., anti-PD-L1, anti-CTLA4). These combinations may have additional side effects. The uncertainty resulting from the use of our
investigational medicines in combination with other therapies may make it difficult to accurately predict side effects in future clinical trials.

Most of our investigational medicines are formulated and administered in an LNP which may lead to systemic side effects related to the components of the LNP which may not have ever been tested in humans. While we have continued to optimize our LNPs, there can be no assurance that our LNPs will not have undesired effects. Our LNPs could contribute, in whole or in part, to one or more of the following: immune reactions, infusion reactions, complement reactions, opsonation reactions, antibody reactions including IgA, IgM, IgE or IgG or some combination thereof, or reactions to the PEG from some lipids or PEG otherwise associated with the LNP. Certain aspects of our investigational medicines may induce immune reactions from either the mRNA or the lipid as well as adverse reactions within liver pathways or degradation of the mRNA or the LNP, any of which could lead to significant adverse events in one or more of our clinical trials. Many of these types of side effects have been seen for legacy LNPs. There may be resulting uncertainty as to the underlying cause of any such adverse event, which would make it difficult to accurately predict side effects in future clinical trials and would result in significant delays in our programs.

If significant adverse events or other side effects are observed in any of our current or future clinical trials, we may have difficulty recruiting trial participants to any of our clinical trials, trial participants may withdraw from trials, or we may be required to abandon the trials or our development efforts of one or more development candidates or investigational medicines altogether. We, the FDA or other applicable regulatory authorities, or an IRB, may impose a clinical hold, suspend or terminate clinical trials of an investigational medicine at any time for various reasons, including a belief that participants in such trials are being exposed to unacceptable health risks or adverse side effects. Some potential therapeutics developed in the biotechnology industry that initially showed therapeutic promise in early-stage trials have later been found to cause side effects that prevented their further development. Even if the side effects do not preclude the drug from obtaining or maintaining marketing approval, unfavorable benefit risk ratio may inhibit market acceptance of the approved product due to its tolerability versus other therapies. Any of these developments could materially harm our business, financial condition, and prospects.

**Even if we obtain regulatory approval for an investigational medicine, our products will remain subject to regulatory scrutiny.**

Even if we obtain regulatory approval in a jurisdiction, the applicable regulatory authority may still impose significant restrictions on the indicated uses or marketing of our product, or impose ongoing requirements for potentially costly post-approval studies or post-market surveillance. For example, the holder of an approved BLA is obligated to monitor and report adverse events and any failure of a product to meet the specifications in the BLA. The holder of an approved BLA must also submit new or supplemental applications and obtain FDA approval for certain changes to the approved product, product labeling, or manufacturing process. Advertising and promotional materials must comply with FDA rules and are subject to FDA review, in addition to other potentially applicable federal and state laws.

If we fail to comply with applicable regulatory requirements following approval of any of our investigational medicines, a regulatory agency may:

- issue a warning letter asserting that we are in violation of the law;
- seek an injunction or impose civil or criminal penalties or monetary fines;
- suspend or withdraw regulatory approval or revoke a license;
- suspend any ongoing clinical studies;
- refuse to approve a pending BLA or supplements to a BLA submitted by us;
- seize product; or
- refuse to allow us to enter into supply contracts, including government contracts.
Any government investigation of alleged violations of law could require us to expend significant time and resources in response and could generate negative publicity. The occurrence of any event or penalty described above may inhibit our ability to commercialize any approved products and generate revenues.

If any of our investigational medicines cause undesirable side effects, it could delay or prevent their regulatory approval, limit the commercial potential, or result in significant negative consequences following any potential marketing approval. Investigational medicines we may develop may be associated with an adverse immune response or other serious adverse events, undesirable side effects, or unexpected characteristics. In addition to serious adverse events or side effects caused by any of our investigational medicines, the administration process or related procedures also can cause undesirable side effects. If any such events occur, the clinical trials of any of our investigational medicines could be suspended or terminated.

If in the future we are unable to demonstrate that such adverse events were caused by factors other than our investigational medicine, the FDA, the EMA, or other regulatory authorities could order us to cease further development of, or deny approval of, any of our investigational medicines for any or all targeted indications. Even if we are able to demonstrate that all future serious adverse events are not product-related, such occurrences could affect patient recruitment or the ability of enrolled trial participants to complete the trial. Moreover, if we elect, or are required, to delay, suspend, or terminate any clinical trial of any of our investigational medicine, the commercial prospects of such investigational medicines may be harmed and our ability to generate product revenues from any of these investigational medicines may be delayed or eliminated. Any of these occurrences may harm our ability to identify and develop investigational medicines, and may harm our business, financial condition, result of operations, and prospects significantly.

Additionally, if we successfully obtain regulatory approval for an investigational medicine, the FDA or other regulatory authority could require us to adopt a Risk Evaluation and Mitigation Strategy, or REMS, to ensure that the benefits of treatment with such investigational medicine outweigh the risks for each potential patient, which may include, among other things, a medication guide outlining the risks of the product for distribution to patients, a communication plan to health care practitioners, extensive patient monitoring, or distribution systems and processes that are highly controlled, restrictive, and more costly than what is typical for the industry. Furthermore, if we or others later identify undesirable side effects caused by any product that we develop, several potentially significant negative consequences could result, including:

- regulatory authorities may suspend or withdraw approvals or revoke licenses of such product;
- regulatory authorities may require additional warnings on the label;
- we may be required to change the way a product is administered or conduct additional clinical trials;
- we could be sued and held liable for harm caused to patients and their children; and
- our reputation may suffer.

Any of these events could prevent us from achieving or maintaining market acceptance of any products we may identify and develop and could have a material adverse impact on our business, financial condition, results of operations, and prospects.

If we are successful in gaining approval for any of our investigational medicines we will continue to face significant regulatory oversight of the manufacturing and distribution of our products. Product manufacturers and their facilities are subject to payment of user fees and continual review and periodic inspections by the FDA and other regulatory authorities for compliance with cGMP and adherence to commitments made in the BLA. If we or a regulatory agency discovers previously unknown problems with a product such as adverse events of unanticipated severity or frequency, or problems with the facility where the product is manufactured, a regulatory agency may impose restrictions relative to that product or the manufacturing facility, including requiring recall or withdrawal of the product from the market or suspension of manufacturing.
Our ability to generate product revenue is dependent on the success of one or more of our development candidates or investigational medicines, each of which is at an early-stage of development and will require significant additional development and clinical testing before we can seek marketing approval and begin commercial sales.

Our ability to generate product revenue is highly dependent on our or our strategic collaborators’ ability to develop, obtain regulatory approval of, and successfully commercialize one or more of our development candidates or investigational medicines. Our development candidates or investigational medicines are in the early stages of development and will require additional clinical and nonclinical development, regulatory review and approval in each jurisdiction in which we intend to market the products. In addition, substantial investment, access to sufficient commercial manufacturing capacity, and significant marketing efforts will be required before we can generate any revenue from product sales. To date, our investigational medicines including RSV vaccine (mRNA-1777), CMV vaccine (mRNA-1647), hMPV+PIV3 vaccine (mRNA-1653), H10N8 vaccine (mRNA-1440), H7N9 vaccine (mRNA-1851), Zika vaccine (mRNA-1325), Chikungunya vaccine (mRNA-1388), PCV (mRNA-4157), OX40L (mRNA-2416), and VEGF-A (AZD8601) have been tested in fewer than 1,000 subjects in the aggregate. Before obtaining marketing approval from regulatory authorities for the sale of our investigational medicines, we must conduct extensive clinical studies to demonstrate the safety and efficacy of the investigational medicines in humans. We cannot be certain that any of our investigational medicines will be successful in clinical studies and they may not receive regulatory approval even if they are successful in clinical studies. Even if approved, our investigational medicines also need to demonstrate health economic benefit in order to establish pricing and reimbursement. We may also need to conduct additional evaluation of safety and health outcomes in a post-approval setting.

Risks related to the manufacturing of our development candidates, investigational medicines and our future pipeline

Our mRNA development candidates and investigational medicines are based on novel technologies and any development candidates and investigational medicines we develop may be complex and difficult to manufacture. We may encounter difficulties in manufacturing, product release, shelf life, testing, storage, supply chain management or shipping. If we or any of our third-party manufacturers encounter such difficulties, our ability to supply material for clinical trials or any approved product could be delayed or stopped.

The manufacturing processes for our development candidates and investigational medicines are novel and complex. There are no mRNA medicines commercialized to date or manufactured at such scale. Due to the novel nature of this technology and limited experience at larger scale production, we may encounter difficulties in manufacturing, product release, shelf life, testing, storage and supply chain management, or shipping. These difficulties could be due to any number of reasons including, but not limited to, complexities of producing batches at larger scale, equipment failure, choice and quality of raw materials and excipients, analytical testing technology, and product instability. In an effort to optimize product features, we have in the past and may in the future make changes to our development candidates or investigational medicines in their manufacturing and stability formulation and conditions. This has in the past resulted in and may in the future result in our having to resupply batches for preclinical or clinical activities when there is insufficient product stability during storage and insufficient supply. Insufficient stability or shelf life of our development candidates and investigational medicines could materially delay our or our strategic collaborators’ ability to continue the clinical trial for that development candidate or investigational medicine or require us to begin a new clinical trial with a newly formulated drug product, due to the need to manufacture additional preclinical or clinical supply.

Our rate of innovation is high, which has resulted in and will continue to cause a high degree of technology change that can negatively impact product comparability during and after clinical development. Furthermore, technology changes may drive the need for changes in, modification to, or the sourcing of new manufacturing infrastructure or may adversely affect third-party relationships.

The process to generate mRNA investigational medicines encapsulated in LNPs is complex and, if not developed and manufactured under well-controlled conditions, can adversely impact pharmacological activity. Furthermore,
we have not manufactured mRNA medicines at commercial scale. We may encounter difficulties in scaling up our manufacturing process, thereby potentially impacting clinical and commercial supply.

We are scaling up our batch size to accommodate the clinical supply requirements of some of our programs. However, in many cases, we may have to utilize multiple batches of drug substance and drug product to meet the clinical supply requirement of a single clinical trial. Failure in our ability to scale up batch size or failure in any batch may lead to a substantial delay in our clinical trials.

As we continue developing new manufacturing processes for our drug substance and drug product, the changes we implement to manufacturing process may in turn impact specification and stability of the drug product. Changes in our manufacturing processes may lead to failure of lots and this could lead to a substantial delay in our clinical trial. Our mRNA investigational medicines may prove to have a stability profile that leads to a lower than desired shelf life of the final approved mRNA medicine. This poses risk in supply requirements, wasted stock, and higher cost of goods.

We are dependent on a number of equipment providers who are also implementing novel technology. Further, we have developed our own custom manufacturing equipment for certain of our investigational medicines. If such equipment malfunctions or we encounter unexpected performance issues, we could encounter delays or interruptions to clinical and commercial supply.

Due to the number of different programs, we may have cross contamination of products inside of our factories, CROs, suppliers, or in the clinic that affect the integrity of our products.

As we scale the manufacturing output for particular programs, we plan to continuously improve yield, purity, and the pharmaceutical properties of our development candidates from IND-enabling studies through commercial launch, including shelf life stability, and solubility properties of drug product and drug substance. Because of continuous improvement in manufacturing processes, we may switch processes for a particular program during development. However, after the change in process, more time is required for pharmaceutical property testing, such as 6 or 12 month stability testing. That may require resupplying clinical material, or making additional cGMP batches to keep up with clinical trial demand before such pharmaceutical property testing is completed.

We are utilizing a number of raw materials and excipients that are either new to the pharmaceutical industry or are being employed in a novel manner. Some of these raw materials and excipients have not been scaled to a level to support commercial supply and could experience unexpected manufacturing or testing failures, or supply shortages. Such issues with raw materials and excipients could cause delays or interruptions to clinical and commercial supply of our investigational medicines. Further, now and in the future one or more of our programs may have a single source of supply for raw materials and excipients.

We have established a number of analytical assays, and may have to establish several more, to assess the quality of our mRNA investigational medicines. We may identify gaps in our analytical testing strategy that might prevent release of product or could require product withdrawal or recall. For example, we may discover new impurities that have an impact on product safety, efficacy, or stability. This may lead to an inability to release mRNA investigational medicines until the manufacturing or testing process is rectified.

Our product and product intermediates are extremely temperature sensitive, and we may learn that any or all of our products are less stable than desired. We may also find that transportation conditions negatively impact product quality. This may require changes to the formulation or manufacturing process for one or more of our investigational medicines and result in delays or interruptions to clinical or commercial supply. In addition, the cost associated with such transportation services and the limited pool of vendors may also add additional risks of supply disruptions.
As our drug development pipeline increases and matures, the increased demand for clinical and commercial supplies from our facilities and third parties may impact our ability to operate. We will require increased capacity across our entire supply chain. Furthermore, we rely on many service providers, including those that provide manufacturing or testing services, all of whom have inherent risks in their operations that may adversely impact our operations.

We currently utilize, and expect to continue to utilize, third parties to, among other things, manufacture raw materials, components, parts, and consumables, and to perform quality testing. If the field of mRNA and other nucleic acid medicines continues to expand, we may encounter increasing competition for these materials and services. Demand for third-party manufacturing or testing facilities may grow at a faster rate than their existing capacity, which could disrupt our ability to find and retain third-party manufacturers capable of producing sufficient quantities of such raw materials, components, parts, and consumables required to manufacture our mRNA investigational medicines. The use of service providers and suppliers could expose us to risks including but not limited to:

- termination or non-renewal of supply and service agreements with third parties in a manner or at a time that is costly or damaging to us;
- disruptions to the operations of these suppliers and service providers caused by conditions unrelated to our business or operations, including the bankruptcy of the supplier or service provider; and
- inspections of third-party facilities by regulatory authorities that could have a negative outcome and result in delays to or termination of their ability to supply our requirement.

We are subject to regulatory and operational risks associated with the physical and digital infrastructure at both our internal manufacturing facilities and at those of our external service providers.

In 2018, we completed construction of a new manufacturing facility in Norwood, MA, or Norwood, that, among other things, is intended for cGMP manufacture of drug substance and drug product. While the design of the facility is based on current standards for biotechnology facilities, it has not been reviewed or pre-approved by any regulatory agency, nor has the facility been inspected by any regulatory agency such as the FDA. We have only recently begun producing drug substance and drug product at Norwood for our preclinical and clinical use. We could incur delays in implementing the full operational state of the facility, causing delays to clinical supply or extended use of third-party service providers, resulting in unplanned expenses. In constructing the Norwood facility, we have incurred substantial expenditures, and expect to incur significant additional expenditures in validating and operating the facility in the future.

We have designed Norwood to incorporate a significant level of automation of equipment with integration of several digital systems to improve efficiency of operations. We have attempted to achieve a high level of digitization for a clinical manufacturing facility relative to industry standards. While this is meant to improve operational efficiency, this may pose additional risk of process equipment malfunction and even overall manufacturing system failure or shutdown due to internal or external factors including, but not limited to, design issues, system compatibility, or potential cybersecurity breaches. This may lead to delay in supply or shutdown of our facility. Any disruption in our manufacturing capabilities at Norwood could cause delays in our production capacity for our drug substances or drug products, impose additional costs, or may require us to identify, qualify, and establish an alternative manufacturing site, the occurrence of which could have a material adverse effect on our business, financial condition, results of operations, and prospects.

As we expand our development and commercial capacity, we may establish additional manufacturing capabilities inside the Norwood footprint or expand to other locations or geographies, which may lead to regulatory delays or prove costly. If we fail to select the correct location, complete the construction in an efficient manner, recruit the required personnel, and generally manage our growth effectively, the development and production of our investigational medicines could be delayed or curtailed. Additional investments may be needed if changes in our manufacturing process lead to required changes in Norwood infrastructure.
There are risks inherent in pharmaceutical manufacturing operations that could affect our ability and the ability of the third-party manufacturers or contract manufacturing organizations to meet our delivery requirements or provide adequate amounts of material.

The convergence of process and analytical technology, raw materials, consumables, equipment, physical infrastructure, including a clean room environment, and air handling and other utilities, results in complex procedures and systems that have to work effectively to manufacture our investigational medicines. Failure or process defects in any of the interrelated systems at either our manufacturing facilities or those of our third-party providers, could adversely impact our ability to manufacture and supply our investigational medicines.

Our investigational medicines are inherently sensitive to shipping and storage conditions and could be subject to risk of loss or damage.

Our investigational medicines are sensitive to temperature, storage, and handling conditions. Loss in investigational medicines could occur if the product or product intermediates are not stored or handled properly. Shelf life for our investigational medicines may vary by product and is not fully quantified and is expected to be variable, and it is possible that our investigational medicines could be lost due to expiration prior to use. This has in the past and could in the future lead to additional manufacturing costs and delays in our ability to supply required quantities for clinical trials or otherwise.

We are subject to significant regulatory oversight with respect to manufacturing our mRNA investigational medicines. Our manufacturing facilities or the manufacturing facilities of our third-party manufacturers or suppliers may not meet regulatory requirements. Failure to meet cGMP requirements set forth in regulations promulgated by the FDA, EMA, and other global health authorities could result in significant delays in and costs of our products.

The manufacturing of vaccines and therapeutics for clinical trials or commercial sale is subject to extensive regulation. Components of a finished product approved for commercial use or used in clinical trials must be manufactured in accordance with cGMP requirements. These regulations govern manufacturing processes and procedures, including record keeping, and the implementation and operation of quality systems to control and assure the quality of products and materials used in clinical trials. Poor control of the cGMP production processes can lead to product quality failures that can impact our ability to supply product, resulting in cost overruns and delays to clinical timelines, which could be extensive. Such production process issues include but are not limited to:

- critical deviations in the manufacturing process;
- facility and equipment failures;
- contamination of the product due to an ineffective quality control strategy;
- facility contamination as assessed by the facility and utility environmental monitoring program;
- ineffective process, equipment or analytical change management, resulting in failed lot release criteria;
- raw material failures due to ineffective supplier qualification or regulatory compliance issues at critical suppliers;
- ineffective product stability;
- failed lot release or facility and utility QC testing;
- ineffective corrective actions or preventative actions taken to correct or avoid critical deviations due to our developing understanding of the manufacturing process as we scale; and
- failed or defective components or consumables.
We must supply all necessary documentation in support of a BLA or other marketing authorization application on a timely basis and must adhere to the FDA’s, EMA’s and other countries’ cGMP requirements which are enforced, in the case of the FDA, in part through its facilities inspection program.

Regulatory authorities typically require representative manufacturing site inspections to assess adequate compliance with cGMPs and manufacturing controls as described in the filing. If either we or one of our third-party manufacturing sites fails to provide sufficient quality assurance or control, the product approval to commercialize may not be granted. Inspections by regulatory authorities may occur at any time during the development or commercialization phase of products. The inspections may be product specific or facility specific for broader cGMP inspections or as a follow up to market or development issues that the regulatory agency may identify. Deficient inspection outcomes may influence the ability of our third-party manufacturers or suppliers to fulfill their supply obligations, impacting or delaying supply or delaying programs.

The manufacturing process for any products that we may develop is subject to the FDA and foreign regulatory authority approval process, and we may need to contract with manufacturers who we believe can meet applicable FDA and foreign regulatory authority requirements on an ongoing basis. If we or our third-party manufacturers are unable to reliably produce investigational medicines to specifications acceptable to the FDA or other regulatory authorities, we or our strategic collaborators may not obtain or maintain the approvals we or they need to commercialize such products. Even if we or our strategic collaborators obtain regulatory approval for any of our mRNA medicines, there is no assurance that either we or our contract manufacturing organizations will be able to manufacture the approved medicine to specifications acceptable to the FDA or other regulatory authorities, to produce it in sufficient quantities to meet the requirements for the potential launch of the product, or to meet potential future demand. Any of these challenges could delay completion of clinical trials, require bridging clinical trials or the repetition of one or more clinical trials, increase clinical trial costs, delay approval of our investigational medicines, impair commercialization efforts or increase our cost of goods. The occurrence of any of the foregoing could have an adverse effect on our business, financial condition, results of operations, and growth prospects.

In addition, we may not have direct control over the ability of our contract manufacturers to maintain adequate quality control, quality assurance, and qualified personnel. Furthermore, all of our contract manufacturers are engaged with other companies to supply or manufacture materials or products for such companies, which exposes our contract manufacturers to regulatory risks for the production of such materials and products. As a result, failure to meet the regulatory requirements for the production of those materials and products may generally affect the regulatory status of our contract manufacturers’ facility. Our failure, or the failure of our third-party manufacturers, to comply with applicable regulations could result in sanctions being imposed on us, including clinical holds, fines, injunctions, civil penalties, delays, suspension or withdrawal of approvals, license revocation, seizures or recalls of investigational medicines or products, operating restrictions, and criminal prosecutions, any of which could significantly and adversely affect supplies of our products and investigational medicines (including those of our strategic collaborators) and our overall business operations. Our potential future dependence upon others for the manufacture of our investigational medicines and raw materials may adversely affect our future profit margins and our ability to commercialize any products that receive regulatory approval on a timely and competitive basis.

The FDA, the EMA, and other foreign regulatory authorities may require us to submit product samples of any lot of any approved product together with the protocols showing the results of applicable tests at any time. Under some circumstances, the FDA, the EMA, or other foreign regulatory authorities may require that we do not distribute a lot or lots until the relevant agency authorizes such release. Deviations in the manufacturing process, including those affecting quality attributes and stability, may result in unacceptable changes in the product that could result in lot failures or product recalls. Our third-party contract manufacturers have, in the past, experienced lot failures and some may have experienced product recalls. Lot failures have in the past caused, and lot failures or product recalls in the future with respect to product produced by either our own facilities or those of our third-party manufacturers could cause, us and our strategic collaborators to delay clinical trials or product
launches, which could be costly to us and otherwise harm our business, financial condition, results of operations, and prospects.

We also may encounter problems hiring and retaining the experienced scientific, quality-control, and manufacturing personnel needed to operate our manufacturing processes and operations, which could result in delays in production or difficulties in maintaining compliance with applicable regulatory requirements. While we will train and qualify all personnel around the appropriate handling of our products and materials, we may not be able to control for or ultimately detect intentional sabotage or negligence by any employee or contractor.

Risks specific to certain investigational medicines

Our PCV investigational medicine is uniquely manufactured for each patient using a novel, complex manufacturing process and we may encounter difficulties in production. We currently manufacture PCV at only one facility operated by a third party.

We custom design and manufacture PCVs that are unique and tailored specifically for each patient. Manufacturing unique lots of PCVs is susceptible to product loss or failure due to issues with:

- logistics associated with the collection of a patient’s tumor, blood or other tissue sample;
- shipping such samples to a facility for genetic sequencing;
- next generation sequencing of the tumor mRNA;
- identification of appropriate tumor-specific mutations;
- the use of a software program, including proprietary and open source components, which is hosted in the cloud and a part of our investigational medicine, to assist with the design of the patient-specific mRNA, which software must be maintained and secured;
- effective design of the patient-specific mRNA that encodes for the required neoantigens;
- batch specific manufacturing failures or issues that arise due to the uniqueness of each patient-specific batch that may not have been foreseen;
- quality control testing failures;
- unexpected failures of batches placed on stability;
- shortages or quality control issues with single-use assemblies, consumables, or critical parts sourced from third-party vendors that must be changed out for each patient-specific batch;
- significant costs associated with individualized manufacturing that may adversely affect our ability to continue development;
- successful and timely manufacture and release of the patient-specific batch;
- shipment issues encountered during transport of the batch to the patient site of care;
- the ability to define a consistent safety profile at a given dose when each participant receives a unique vaccine; and
- our reliance on a single third-party to manufacture this product at this time.

We also continue to evolve our own custom manufacturing equipment for PCV which has been incorporated into a personalized vaccine unit in Norwood. This equipment may not function as designed which may lead to deviations in the drug product being produced. This can lead to increased batch failure and the inability to supply patients enrolled in the clinical trial. If our clinical development plans are expanded, due to the custom nature of the equipment and single-use assemblies, we may not be able to supply this expanded need reliably without significant investments. In addition, there will be considerable time to scale up our facilities or build new...
facilities before we can begin to meet any commercial demand if our PCV product is approved. This expansion or addition of new facilities could also lead to product comparability issues which can further delay introduction of new capacity.

Because our PCVs are manufactured for each individual patient, we will be required to maintain a chain of identity with respect to each patient’s tissue sample, sequence data derived from such tissue sample, results of analysis of such patient’s genomic analysis, and the custom manufactured product for each patient. Maintaining such a chain of identity is difficult and complex, and failure to do so could result in product mix up, adverse patient outcomes, loss of product, or regulatory action including withdrawal of any approved products from the market. Further, as our PCV investigational medicine is developed through early-stage clinical studies to later-stage clinical trials towards approval and commercialization, we expect that multiple aspects of the complicated collection, analysis, manufacture, and delivery process will be modified in an effort to optimize processes and results. These changes may not achieve the intended objectives, and any of these changes could cause our PCVs to perform differently than we expect, potentially affecting the results of clinical trials.

**Risks related to our reliance on third parties**

*We have in the past entered into, and in the future may enter into, strategic alliances with third parties to develop investigational medicines. If these strategic alliances are not successful, our business could be adversely affected.*

We have limited resources to conduct clinical operations and have not yet established infrastructure for sales, marketing, or distribution. Accordingly, we have entered into strategic alliances under which our strategic collaborators have provided, and may in the future provide, funding and other resources for developing and potentially commercializing our investigational medicines. We expect to enter into additional strategic alliances to access additional funding, capabilities, and expertise in the future. Our existing strategic alliances, and any future strategic alliances we enter into, may pose a number of risks, including the following:

- strategic collaborators may not perform their obligations as expected;
- the clinical trials conducted as part of such strategic alliance may not be successful;
- strategic collaborators may not pursue development and commercialization of any investigational medicines that achieve regulatory approval or may elect not to continue or renew development or commercialization of programs based on clinical trial results, changes in the strategic collaborators’ focus or available funding, or external factors, such as an acquisition, that divert resources or create competing priorities;
- strategic collaborators may delay clinical trials, provide insufficient funding for clinical trials, stop a clinical trial, abandon an investigational medicine, repeat or conduct new clinical trials, or require a new formulation of an investigational medicine for clinical testing;
- strategic collaborators could independently develop, or develop with third parties, products that compete directly or indirectly with our investigational medicines if the strategic collaborators believe that competitive products are more likely to be successfully developed or can be commercialized under terms that are more economically attractive than ours;
- investigational medicines developed in strategic alliances with us may be viewed by our strategic collaborators as competitive with their own investigational medicines or products, which may cause strategic collaborators to cease to devote resources to the development or commercialization of our investigational medicines;
- a strategic collaborator with marketing and distribution rights to one or more of our investigational medicines that achieve regulatory approval may not commit sufficient resources to the marketing and distribution of any such product;
- disagreements with strategic collaborators, including disagreements over proprietary rights, contract interpretation, or the preferred course of development of any investigational medicines, may cause delays or
termination of the research, development, or commercialization of such investigational medicines, may lead to additional responsibilities for us with respect to such investigational medicines, or may result in litigation or arbitration, any of which would be time-consuming and expensive;

• strategic collaborators may not properly maintain or defend our IP rights or may use our proprietary information in such a way as to invite litigation that could jeopardize or invalidate our intellectual property or proprietary information or expose us to potential litigation;

• disputes may arise with respect to the ownership of intellectual property developed pursuant to our strategic alliances;

• strategic collaborators may infringe the intellectual property rights of third parties, which may expose us to litigation and potential liability;

• strategic alliances may be terminated for the convenience of the strategic collaborator and, if terminated, the development of our investigational medicines may be delayed, and we could be required to raise additional capital to pursue further development or commercialization of the applicable investigational medicines;

• future relationships may require us to incur non-recurring and other charges, increase our near- and long-term expenditures, issue securities that dilute our existing stockholders, or disrupt our management and business;

• we could face significant competition in seeking appropriate strategic collaborators and the negotiation process is time-consuming and complex; and

• our international operations through any future collaborations, acquisitions, or joint ventures may expose us to certain operating, legal, and other risks not encountered in the United States.

If our strategic alliances do not result in the successful development and commercialization of programs, or if one of our strategic collaborators terminates its agreement with us, we may not receive any future research funding or milestone, earn-out, royalty, or other contingent payments under the strategic alliances. If we do not receive the funding we expect under these agreements, our development of investigational medicines could be delayed and we may need additional resources to develop our investigational medicines. In addition, in general our strategic collaborators have the right to terminate their agreement with us for convenience. A strategic collaborator has in the past terminated its agreement with us. If one of our strategic collaborators terminates its agreement with us, we may find it more difficult to attract new strategic collaborators and the perception of us in the business and financial communities could be adversely affected. All of the risks relating to product development, regulatory approval, and commercialization described in this prospectus apply to the activities of our strategic collaborators.

Our strategic collaborators control aspects of our clinical trials, regulatory activities, and other aspects of our strategic alliances, which could result in delays and other obstacles in the development and commercialization of our proposed products and materially harm our results of operations.

For some programs, we depend on strategic collaborators to design and conduct clinical trials for our investigational medicines. As a result, we may not control the manner or time schedule in which these clinical trials are conducted, which may negatively impact our business operations. In addition, if any of our strategic collaborators withdraws support for one or more of our programs or proposed products or otherwise impairs their development, our business could be negatively affected.

We may seek to establish additional strategic alliances and, if we are not able to establish them on commercially reasonable terms, we may have to alter our development and commercialization plans. Certain of our strategic alliance agreements may restrict our ability to develop certain products.

Our development programs and the potential commercialization of our development candidates and investigational medicines will require substantial additional cash to fund expenses. For some of our
investigational medicines, we may decide to collaborate with pharmaceutical and biotechnology companies for the development and potential commercialization of those investigational medicines.

We face significant competition in seeking appropriate strategic collaborators. Whether we reach a definitive agreement for any additional strategic alliances will depend, among other things, upon our assessment of the strategic collaborator’s resources and expertise, the terms and conditions of the proposed strategic alliance and the proposed strategic collaborator’s evaluation of a number of factors. Those factors may include the design or results of clinical trials, the likelihood of approval by the FDA or similar regulatory authorities outside the United States, the potential market for the subject investigational medicine, the costs and complexities of manufacturing and delivering such investigational medicine to trial participants, the potential of competing drugs, the existence of uncertainty with respect to our ownership of technology, which can exist if there is a challenge to such ownership without regard to the merits of the challenge, and industry and market conditions generally. The strategic collaborator may also consider alternative investigational medicines or technologies for similar indications that may be available to collaborate on and whether such a collaboration could be more attractive than the one with us for our investigational medicine. The terms of any additional strategic alliances or other arrangements that we may establish may not be favorable to us.

We are also restricted under our existing strategic alliance agreements from entering into certain future agreements on certain terms with potential strategic collaborators to pursue other targets on our own. These restrictions on working with targets, polypeptides, routes of administration, and fields could limit our ability to enter into strategic collaborations with future strategic collaborators or to pursue certain potentially valuable development candidates or investigational medicines.

We may not be able to negotiate additional strategic alliances on a timely basis, on favorable terms, or at all. Strategic alliances are complex and time-consuming to negotiate and document. If we are unable to negotiate and enter into new strategic alliances, we may have to curtail the development of the investigational medicine for which we are seeking to collaborate, reduce or delay its development program or one or more of our other development programs, delay its potential commercialization or reduce the scope of any sales or marketing activities, or increase our expenditures and undertake development or commercialization activities at our own expense. If we elect to increase our expenditures to fund development or commercialization activities on our own, we may need to obtain additional capital, which may not be available to us on favorable terms or at all. If we do not have sufficient funds, we may not be able to further develop our investigational medicines or bring them to market and generate product revenue.

We are dependent on single-source suppliers for some of the components and materials used in, and the processes required to develop, our development candidates and investigational medicines.

We currently depend on single-source suppliers for some of the components and materials used in, and manufacturing processes required to develop, our development candidates and investigational medicines. We cannot ensure that these suppliers or service providers will remain in business, have sufficient capacity or supply to meet our needs, or that they will not be purchased by one of our competitors or another company that is not interested in continuing to work with us. Our use of single-source suppliers of raw materials, components, key processes, and finished goods exposes us to several risks, including disruptions in supply, price increases, or late deliveries. There are, in general, relatively few alternative sources of supply for substitute components. These vendors may be unable or unwilling to meet our future demands for our clinical trials or commercial sale. Establishing additional or replacement suppliers who meet regulatory requirements. Any disruption in supply from any single-source supplier or service provider could lead to supply delays or interruptions which would damage our business, financial condition, results of operations, and prospects.

If we have to switch to a replacement supplier, the manufacture and delivery of our development candidates or investigational medicines could be interrupted for an extended period, which could adversely affect our business.
Establishing additional or replacement suppliers for any of the components or processes used in our investigational medicines, if required, may not be accomplished quickly. If we are able to find a replacement supplier, the replacement supplier would need to be qualified and may require additional regulatory authority approval, which could result in further delay. While we seek to maintain adequate inventory of the single source components and materials used in our products, any interruption or delay in the supply of components or materials, or our inability to obtain components or materials from alternate sources at acceptable prices in a timely manner, could impair our ability to meet the demand for our investigational medicines.

In addition, as part of the FDA’s approval of our investigational medicines, we will also require FDA review of the individual components of our process, which include the manufacturing processes and facilities of our single-source suppliers.

Our reliance on these suppliers, service providers, and manufacturers subjects us to a number of risks that could harm our reputation, business, and financial condition, including, among other things:

- delays to the development timelines for our development candidates or investigational medicines;
- interruption of supply resulting from modifications to or discontinuation of a supplier’s operations;
- delays in product shipments resulting from uncorrected defects, reliability issues, or a supplier’s variation in a component;
- a lack of long-term supply arrangements for key components with our suppliers;
- inability to obtain adequate supply in a timely manner, or to obtain adequate supply on commercially reasonable terms;
- difficulty and cost associated with locating and qualifying alternative suppliers for our components in a timely manner;
- production delays related to the evaluation and testing of components from alternative suppliers, and corresponding regulatory qualifications;
- delay in delivery due to our suppliers’ prioritizing other customer orders over ours;
- damage to our reputation caused by defective components produced by our suppliers; and
- fluctuation in delivery by our suppliers due to changes in demand from us or their other customers.

If any of these risks materialize, costs could significantly increase and our ability to meet demand for our products could be impacted.

We rely on and expect to continue to rely on third parties to conduct aspects of our research, preclinical studies, protocol development, and clinical trials for our development candidates or investigational medicines. If these third parties do not perform satisfactorily, comply with regulatory requirements, or meet expected deadlines, we may not be able to obtain regulatory approval for or commercialize our investigational medicines and our business could be substantially harmed.

We currently rely and expect to continue to rely on third parties, such as contract research organizations, or CROs, clinical data management organizations, medical institutions, and clinical investigators, to conduct our clinical trials. We currently rely and expect to continue to rely on third parties to conduct certain research and preclinical testing activities. In some cases, these third parties may terminate their engagements with us. If we need to enter into alternative arrangements, it would delay our discovery or product development activities.

Our reliance on these third parties for research and development activities will reduce our control over these activities but will not relieve us of our regulatory or contractual responsibilities. We will be responsible for ensuring that each of our preclinical studies and clinical trials is conducted in accordance with the applicable
We and our CROs will be required to comply with regulations, including GCPs, for conducting, monitoring, recording, and reporting the results of preclinical studies and clinical trials to ensure that the data and results are scientifically credible and accurate and that the trial participants are adequately informed, among other things, of the potential risks of participating in clinical trials. We also are responsible for ensuring that the rights of our clinical trial participants are protected. These regulations are enforced by the FDA, the Competent Authorities of the Member States of the European Economic Area, and comparable foreign regulatory authorities for any investigational medicines in clinical development. The FDA enforces GCP regulations through periodic inspections of clinical trial sponsors, principal investigators, and trial sites. If we or our CROs fail to comply with applicable GCPs, the clinical data generated in our clinical trials may be deemed unreliable and the FDA or comparable foreign regulatory authorities may require us to perform additional clinical trials before approving our marketing applications. We cannot assure you that, upon inspection, the FDA will determine that any of our future clinical trials will comply with GCPs. In addition, our clinical trials must be conducted with investigational medicines produced in accordance with the requirements in cGMP regulations. Our failure or the failure of our CROs to comply with these regulations may require us to repeat clinical trials, which would delay the regulatory approval process and could also subject us to enforcement action.

Although we intend to design the clinical trials for certain of our investigational medicines, our strategic collaborators will design the clinical trials that they are managing (in some cases, with our input) and in the case of clinical trials controlled by us, we expect that CROs will conduct all of the clinical trials. As a result, many important aspects of our development programs, including their conduct and timing, will be outside of our direct control. Our reliance on third parties to conduct future preclinical studies and clinical trials will also result in less direct control over the management of data developed through preclinical studies and clinical trials than would be the case if we were relying entirely upon our own staff. Communicating with outside parties can also potentially lead to mistakes as well as difficulties in coordinating activities. Outside parties may:

- have staffing difficulties;
- fail to comply with contractual obligations;
- experience regulatory compliance issues;
- undergo changes in priorities or become financially distressed;
- form relationships with other entities, some of which may be our competitors;
- have human errors; or
- be subject to cyber attacks.

These factors may materially adversely affect the willingness or ability of third parties to conduct our preclinical studies and clinical trials and may subject us to unexpected cost increases that are beyond our control. If the CROs do not perform preclinical studies and clinical trials in a satisfactory manner, breach their obligations to us or fail to comply with regulatory requirements, the development, regulatory approval, and commercialization of our investigational medicines may be delayed, we may not be able to obtain regulatory approval and
commercialize our investigational medicines, or our development programs may be materially and irreversibly harmed. If we are unable to rely on preclinical and clinical data collected by our CROs, we could be required to repeat, extend the duration of, or increase the size of any clinical trials we conduct and this could significantly delay commercialization and require significantly greater expenditures.

We also expect to rely on other third parties to transport, store, and distribute the required materials for our clinical trials. In the past certain of our third-party vendors have mishandled our materials, resulting in loss of full or partial lots of material. Any further performance failure on the part of these third parties could result in damaged products and could delay clinical development or marketing approval of any investigational medicines we may develop or commercialization of our medicines, if approved, producing additional losses and depriving us of potential product revenue, causing us to default on our contractual commitments, result in losses that are not covered by insurance, and damage our reputation and overall perception of our products in the marketplace.

Risks related to our intellectual property

Other companies or organizations may challenge our patent rights or may assert patent rights that prevent us from developing and commercializing our products.

mRNA medicines is a relatively new scientific field, the continued development and potential use of which has resulted in many different patents and patent applications from organizations and individuals seeking to obtain intellectual property protection in the field. We have obtained grants and issuances of patents on mRNA medicines and our delivery technology. The issued patents and pending patent applications in the United States and in key markets around the world that we own, claim many different methods, compositions, and processes relating to the discovery, development, manufacture, and commercialization of mRNA medicines and our delivery technology, including LNPs.

As the field of mRNA therapeutics and vaccines is maturing, patent applications are being processed by national patent offices around the world. There is uncertainty about which patents will issue, and, if they do, as to when, to whom, and with what claims. It is likely that there will be significant litigation and other proceedings, such as interference, reexamination, and opposition proceedings, as well as inter partes and post-grant review proceedings introduced by provisions of the America Invents Act, which became available to third-party challengers on September 16, 2012, in various patent offices relating to patent rights in the mRNA field. We expect that oppositions will be filed in the European Patent Office, or EPO, and elsewhere relating to patents and patent applications in our portfolio. In many cases, the possibility of appeal exists for either us or our opponents, and it may be years before final, unappealable rulings are made with respect to these patents in certain jurisdictions. The timing and outcome of these and other proceedings is uncertain and may adversely affect our business if we are not successful in defending the patentability and scope of our pending and issued patent claims. For example, a third party filed a request for an ex parte reexamination of one of our U.S. patents, which relates to our influenza vaccine program. We cannot be certain that such patent will survive or that the claims will remain in the current form. In addition, third parties may attempt to invalidate our intellectual property rights. Even if our rights are not directly challenged, disputes could lead to the weakening of our intellectual property rights. Our defense against any attempt by third parties to circumvent or invalidate our intellectual property rights could be costly to us, could require significant time and attention of our management and could have a material adverse impact on our business and our ability to successfully compete in the field of mRNA therapeutics.

There are many issued and pending patents that claim aspects of oligonucleotide delivery technologies that we may need for our mRNA therapeutic and vaccine candidates. There are also many issued patents that claim targeting genes or portions of genes that may be relevant for mRNA medicines we wish to develop. For example, we are aware of a third-party patent directed to methods of using mRNA to treat Fabry disease. In addition, there may be issued and pending patent applications that may be asserted against us in a court proceeding or otherwise based upon the asserting party’s belief that we may need such patents for our mRNA therapeutic candidates.
Thus, it is possible that one or more organizations will hold patent rights to which we may need a license, or hold patent rights which could be asserted against us. If those organizations refuse to grant us a license to such patent rights on reasonable terms or a court rules that we need such patent rights that have been asserted against us and we are not able to obtain a license on reasonable terms, we may be unable to perform research and development or other activities or market products covered by such patents.

If we become involved in patent litigation or other proceedings related to a determination of rights, we could incur substantial costs and expenses, substantial liability for damages or be required to stop our product development and commercialization efforts.

Our commercial success depends in part on our avoiding infringement of the patents and proprietary rights of third parties. There is a substantial amount of litigation, both within and outside the United States, involving patent and other intellectual property rights in the biotechnology and pharmaceutical industries, including patent infringement lawsuits, interferences, oppositions, ex parte reexaminations, post-grant review, and inter partes review proceedings before the U.S. Patent and Trademark Office, or USPTO, and corresponding foreign patent offices. Numerous U.S. and foreign issued patents and pending patent applications, which are owned by third parties, exist in the fields in which we are pursuing development candidates. In certain instances, we have instituted and may in the future institute inter partes review proceedings against issued U.S. patents and opposition proceedings against European patents owned by third parties in the field of mRNA medicines. We have a number of these proceedings ongoing against third-party patents related to cancer vaccinations and mRNA delivery. As the biotechnology and pharmaceutical industries expand and more patents are issued, the risk increases that our development candidates may be subject to claims of infringement of the patent rights of third parties.

Third parties may assert that we are employing their proprietary technology without authorization. There may be third-party patents or patent applications with claims to materials, formulations, methods of manufacture, or methods for treatment related to the use or manufacture of our investigational medicines. Because patent applications can take many years to issue, there may be currently pending patent applications which may later result in issued patents that our investigational medicines may infringe. In addition, third parties may obtain patents in the future and claim that our technologies infringe upon these patents. If any third-party patents were held by a court of competent jurisdiction to cover the manufacturing process of any of our investigational medicines, any molecules formed during the manufacturing process or any final product itself, the holders of any such patents may obtain injunctive or other equitable relief, which could effectively block our ability to commercialize such investigational medicine unless we obtained a license under the applicable patents, or until such patents expire. Similarly, if any third-party patents were held by a court of competent jurisdiction to cover aspects of our formulations, processes for manufacture or methods of use, including combination therapy, the holders of any such patents may be able to block our ability to develop and commercialize the applicable investigational medicine unless we obtained a license or until such patent expires. In either case, such a license may not be available on commercially reasonable terms or at all. For example, if we are unsuccessful in invalidating certain of the third-party patents that we are currently challenging, those third parties may attempt to assert those patents against us should certain of our investigational medicines obtain regulatory approval.

Defense of infringement and other claims, regardless of their merit, would involve substantial litigation expense and would be a substantial diversion of employee resources from our business. In the event of a successful claim of infringement against us, we may have to pay substantial damages, including treble damages and attorneys’ fees for willful infringement, pay royalties, redesign our infringing products, or obtain one or more licenses from third parties, which may not be made available on commercially favorable terms, if at all, or may require substantial time and expense.

In addition, such licenses are likely to be non-exclusive and, therefore, our competitors may have access to the same technology licensed to us. If we fail to obtain a required license and are unable to design around a patent, we may be unable to effectively market some of our technology and products, which could limit our ability to
generate revenues or achieve profitability and possibly prevent us from generating revenue sufficient to sustain our operations. Moreover, we expect that a number of our collaborations will provide that royalties payable to us for licenses to our intellectual property may be offset by amounts paid by our collaborators to third parties who have competing or superior intellectual property positions in the relevant fields, which could result in significant reductions in our revenues from products developed through collaborations.

In addition, in connection with certain license and strategic alliance agreements, we have agreed to indemnify certain third parties for certain costs incurred in connection with litigation relating to intellectual property rights or the subject matter of the agreements. The cost to us of any litigation or other proceeding relating to intellectual property rights, even if resolved in our favor, could be substantial, and litigation would divert our management’s efforts. Some of our competitors may be able to sustain the costs of complex patent litigation more effectively than we can because they have substantially greater resources. Uncertainties resulting from the initiation and continuation of any litigation could delay our research and development efforts and limit our ability to continue our operations.

We may not be successful in obtaining or maintaining necessary intellectual property rights to product components and manufacturing processes for our development pipeline.

Presently we have rights to certain intellectual property, through licenses from third parties and under patents that we own, to develop our development candidates or investigational medicines. Because our pipeline may involve additional development candidates that could require the use of proprietary rights held by third parties, the growth of our business could depend in part on our ability to acquire, in-license, or use these proprietary rights. In addition, our development candidates or investigational medicines may require specific formulations to work effectively and efficiently and these rights may be held by others. We may be unable to acquire or in-license any compositions, methods of use, processes, or other third-party intellectual property rights from third parties that we identify. The licensing and acquisition of third-party intellectual property rights is a competitive area, and a number of more established companies are also pursuing strategies to license or acquire third-party intellectual property rights that we may consider attractive. These established companies may have a competitive advantage over us due to their size, cash resources, and greater clinical development and commercialization capabilities.

For example, we sometimes collaborate with U.S. and foreign academic institutions to accelerate our preclinical research or development under written agreements with these institutions. Typically, these institutions provide us with an option to negotiate a license to any of the institution’s rights in technology resulting from the collaboration. Regardless of such right of first negotiation for intellectual property, we may be unable to negotiate a license within the specified time frame or under terms that are acceptable to us. If we are unable to do so, the institution may offer the intellectual property rights to other parties, potentially blocking our ability to pursue our program.

In addition, companies that perceive us to be a competitor may be unwilling to assign or license rights to us. We also may be unable to license or acquire third-party intellectual property rights on terms that would allow us to make an appropriate return on our investment. If we are unable to successfully obtain rights to required third-party intellectual property rights, our business, financial condition, and prospects for growth could suffer.

If we are not able to obtain and enforce patent protection for our discoveries, our ability to effectively compete using our development candidates will be harmed.

Our success depends, in part, on our ability to protect proprietary methods and technologies that we develop under the patent and other intellectual property laws of the United States and other countries, so that we can prevent others from unlawfully using our inventions and proprietary information. However, we may not hold proprietary rights to some patents required for us to develop, manufacture, and commercialize our proposed products.
Because certain U.S. patent applications are confidential until the patents issue, such as applications filed prior to November 29, 2000, or applications filed after such date which will not be filed in foreign countries, third parties may have filed patent applications for technology covered by our pending patent applications without our being aware of those applications, and our patent applications may not have priority over those applications. For this and other reasons, we may be unable to secure desired patent rights, thereby losing exclusivity. Further, we may be required to obtain licenses under third-party patents to market our proposed products or conduct our research and development or other activities. If licenses are not available to us on favorable terms, we may not be able to market the affected products or conduct the desired activities.

Our strategy depends on our ability to rapidly identify and seek patent protection for our discoveries. In addition, we may rely on third-party strategic collaborators to file patent applications relating to proprietary technology that we develop jointly as a part of certain strategic alliances. The process of obtaining patent protection is expensive and time-consuming. If our present or future strategic collaborators fail to file and prosecute all necessary and desirable patent applications at a reasonable cost and in a timely manner, our business may be adversely affected. Despite our efforts and the efforts of our strategic collaborators to protect our proprietary rights, unauthorized parties may be able to obtain and use information that we regard as proprietary. While issued patents are presumed valid, this does not guarantee that the patent will survive a validity challenge or be held enforceable. Any patents we have obtained, or obtain in the future, may be challenged, invalidated, adjudged unenforceable, or circumvented by parties attempting to design around our intellectual property. Moreover, third parties or the USPTO may commence interference proceedings involving our patents or patent applications. Any challenge to, finding of unenforceability or invalidation, or circumvention of, our patents or patent applications, would be costly, would require significant time and attention of our management, could reduce or eliminate royalty payments to us from third-party licensors and could have a material adverse impact on our business.

Our pending patent applications may not result in issued patents. The patent position of pharmaceutical or biotechnology companies, including ours, is generally uncertain and involves complex legal and factual considerations. The standards that the USPTO and its foreign counterparts use to grant patents are not always applied predictably or uniformly and can change. Similarly, the ultimate degree of protection that will be afforded to biotechnology inventions, including ours, in the United States and foreign countries, remains uncertain and is dependent upon the scope of the protection decided upon by patent offices, courts, and lawmakers. Moreover, there are periodic discussions in the Congress of the United States and in international jurisdictions about modifying various aspects of patent law. For example, the America Invents Act, which took effect in March 2013, included a number of changes to the patent laws of the United States. If any of the enacted changes prevent us from adequately protecting our discoveries, including our ability to pursue infringers of our patents to obtain injunctive relief or for substantial damages, our business could be adversely affected. One major provision of the America Invents Act changed U.S. patent practice from a first-to-invent to a first-to-file system. If we fail to file an invention before a competitor files on the same invention, we no longer have the ability to provide proof that we were in possession of the invention prior to the competitor’s filing date, and thus would not be able to obtain patent protection for our invention. There is also no uniform, worldwide policy regarding the subject matter and scope of claims granted or allowable in pharmaceutical or biotechnology patents. In certain countries, for example, methods for the medical treatment of humans are not patentable.

Accordingly, we do not know the degree of future protection for our proprietary rights or the breadth of claims that will be allowed in any patents issued to us or to others. We also rely to a certain extent on trade secrets, know-how, and technology, which are not protected by patents, to maintain our competitive position. If any trade secret, know-how, or other technology not protected by a patent were to be disclosed to or independently developed by a competitor, our business and financial condition could be materially adversely affected.
We license patent rights from third-party owners. If such owners do not properly or successfully obtain, maintain or enforce the patents underlying such licenses, our competitive position and business prospects may be harmed.

We are a party to licenses that give us rights to third-party intellectual property that is necessary or useful for our business. In particular, we have obtained licenses from Cellscript, LLC and its affiliates to patent rights covering modified mRNA chemistries and from certain other parties for intellectual property useful in our formulation efforts. We may enter into additional licenses to third-party intellectual property in the future.

Our success will depend in part on the ability of our licensors to obtain, maintain, and enforce patent protection for our licensed intellectual property. Our licensors may not successfully prosecute the patent applications we license. Even if patents issue in respect of these patent applications, our licensors may fail to maintain these patents, may determine not to pursue litigation against other companies that are infringing these patents, or may pursue such litigation less aggressively than we would. Without protection for the intellectual property we license, other companies might be able to offer substantially identical products for sale, which could adversely affect our competitive business position and harm our business prospects. In addition, we sublicense our rights under various third-party licenses to our strategic collaborators. Any impairment of these sublicensed rights could result in reduced revenues under our strategic alliance agreements or result in termination of an agreement by one or more of our strategic collaborators.

Disputes may also arise between us and our licensors regarding intellectual property subject to a license agreement, including:

- the scope of rights granted under the license agreement and other interpretation-related issues;
- whether and the extent to which our technology and processes infringe on intellectual property of the licensor that is not subject to the licensing agreement;
- our right to sublicense patent and other rights to third parties under collaborative development relationships;
- our diligence obligations with respect to the use of the licensed technology in relation to our development and commercialization of our investigational medicines, and what activities satisfy those diligence obligations; and
- the ownership of inventions and know-how resulting from the joint creation or use of intellectual property by our licensors and us and our strategic collaborators.

If disputes over intellectual property that we have licensed prevent or impair our ability to maintain our current licensing arrangements on favorable terms, we may be unable to successfully develop and commercialize the affected development candidates.

We are generally also subject to all of the same risks with respect to protection of intellectual property that we license, as we are for intellectual property that we own, which are described below. If we or our licensors fail to adequately protect this intellectual property, our ability to commercialize products could suffer.

If we fail to comply with our obligations in the agreements under which we license intellectual property rights from third parties or otherwise experience disruptions to our business relationships with our licensors, we could lose license rights that are important to our business.

Licensing of intellectual property is important to our business and involves complex legal, business and scientific issues and is complicated by the rapid pace of scientific discovery in our industry. We are a party to certain intellectual property license agreements that are important to our business and expect to enter into additional license agreements in the future. Our existing license agreements impose, and we expect that future license agreements will impose, various diligence, milestone payment, royalty, and other obligations on us. If we fail to comply with our obligations under these agreements, or we are subject to a bankruptcy, the licensor may have the right to terminate the license, in which event we would not be able to market products covered by the license.
In some cases, patent prosecution of our licensed technology is controlled solely by the licensor. If our licensors fail to obtain and maintain patent or other protection for the proprietary intellectual property we license from them, we could lose our rights to the intellectual property and our competitors could market competing products using the intellectual property. In certain cases, we control the prosecution of patents resulting from licensed technology. In the event we breach any of our obligations related to such prosecution, we may incur significant liability to our strategic collaborators. Disputes may arise regarding intellectual property subject to a licensing agreement, including:

- the scope of rights granted under the license agreement and other interpretation-related issues;
- the extent to which our technology and processes that are not subject to the licensing agreement infringe on intellectual property of the licensor;
- the sublicensing of patent and other rights under our collaborative development relationships;
- our diligence obligations under such license agreement and what activities satisfy those diligence obligations;
- the ownership of inventions and know-how resulting from the joint creation or use of intellectual property by our licensors and us and our strategic collaborators; and
- the priority of invention of patented technology.

If disputes over intellectual property that we have licensed prevent or impair our ability to maintain our current licensing arrangements on favorable terms, we may be unable to successfully develop and commercialize the affected development candidates or investigational medicines.

**If we are unable to protect the confidentiality of our trade secrets, our business and competitive position would be harmed.**

In addition to patent protection, we rely heavily upon know-how and trade secret protection, as well as non-disclosure agreements and invention assignment agreements with our employees, consultants, and third-parties, to protect our confidential and proprietary information, especially where we do not believe patent protection is appropriate or obtainable. In addition to contractual measures, we try to protect the confidential nature of our proprietary information using physical and technological security measures. Such measures may not, for example, in the case of misappropriation of a trade secret by an employee or third party with authorized access, provide adequate protection for our proprietary information. Our security measures may not prevent an employee or consultant from misappropriating our trade secrets and providing them to a competitor, and recourse we take against such misconduct may not provide an adequate remedy to protect our interests fully. Enforcing a claim that a party illegally disclosed or misappropriated a trade secret can be difficult, expensive, and time-consuming, and the outcome is unpredictable. In addition, trade secrets may be independently developed by others in a manner that could prevent legal recourse by us. If any of our confidential or proprietary information, such as our trade secrets, were to be disclosed or misappropriated, or if any such information was independently developed by a competitor, our competitive position could be harmed.

Certain former employees have obtained employment with companies or academic institutions that could be considered competitive with us and are operating their business in areas that are similar to ours, including in their business model, product discovery efforts, mRNA based product development, or formulation technology such as our LNPs. This competition may be limited by contractual provisions which may or may not be enforceable by us in the Commonwealth of Massachusetts or other jurisdictions. In addition, we may not be aware of such competitive employment arrangements until after our trade secrets have been disclosed to potentially competitive companies.
We may be subject to claims that our employees, consultants, or independent contractors have wrongfully used or disclosed confidential information of third parties or that our employees have wrongfully used or disclosed alleged trade secrets of their former employers.

We employ individuals who were previously employed at universities or other biotechnology or pharmaceutical companies, including our competitors or potential competitors. Although we try to ensure that our employees, consultants, and independent contractors do not use the proprietary information or know-how of others in their work for us, we may be subject to claims that we, or our employees, consultants, or independent contractors, have inadvertently or otherwise used or disclosed intellectual property, including trade secrets or other proprietary information, of any of our employees’ former employers or other third parties. Litigation may be necessary to defend against these claims. If we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights or personnel, which could adversely impact our business. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management and other employees.

We may be subject to claims challenging the inventorship or ownership of our patents and other intellectual property.

We may be subject to claims that former employees, collaborators, or other third parties have an ownership interest in our patents or other intellectual property. Ownership disputes may arise, for example, from conflicting obligations of consultants or others who are involved in developing our development candidates. Litigation may be necessary to defend against these and other claims challenging inventorship or ownership. If we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights, such as exclusive ownership of, or right to use, valuable intellectual property. Such an outcome could have a material adverse impact on our business. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management and other employees.

Obtaining and maintaining our patent protection depends on compliance with various procedural, document submission, fee payment and other requirements imposed by governmental patent agencies, and our patent protection could be reduced or eliminated for non-compliance with these requirements.

Periodic maintenance fees, renewal fees, annuity fees, and various other governmental fees on patents or applications will be due to be paid to the USPTO and various governmental patent agencies outside of the United States in several stages over the lifetime of the patents or applications. We have systems in place to remind us to pay these fees, and we employ an outside firm and rely on our outside counsel to pay these fees due to non-U.S. patent agencies. The USPTO and various non-U.S. governmental patent agencies require compliance with a number of procedural, documentary, fee payment, and other similar provisions during the patent application process. We employ reputable law firms and other professionals to help us comply, and in many cases, an inadvertent lapse can be cured by payment of a late fee or by other means in accordance with the applicable rules. However, there are situations in which non-compliance can result in abandonment or lapse of the patent or patent application, resulting in partial or complete loss of patent rights in the relevant jurisdiction. In such an event, our competitors might be able to enter the market and this circumstance would have a material adverse impact on our business.

Issued patents covering our development candidates and investigational medicines could be found invalid or unenforceable if challenged in court.

If we or one of our strategic collaborators initiated legal proceedings against a third party to enforce a patent covering one of our development candidates or investigational medicines, the defendant could counterclaim that the patent covering our development candidate or investigational medicine is invalid or unenforceable. In patent litigation in the United States, defendant counterclaims alleging invalidity or unenforceability are commonplace. Grounds for a validity challenge could be an alleged failure to meet any of several statutory requirements,
including patent eligible subject matter, lack of novelty, obviousness, or non-enablement. Grounds for an unenforceability assertion could be an
allegation that someone connected with prosecution of the patent withheld relevant information from the USPTO, or made a misleading statement,
during prosecution. Third parties may also raise similar claims before administrative bodies in the United States or abroad, even outside the context of
litigation. Such mechanisms include reexamination, post grant review, and equivalent proceedings in foreign jurisdictions (e.g., opposition
proceedings). Such proceedings could result in revocation of or amendment to our patents in such a way that they no longer cover our development
candidates or investigational medicines. The outcome following legal assertions of invalidity and unenforceability is unpredictable. With respect to
the validity question, for example, we cannot be certain that there is no invalidating prior art, of which we and the patent examiner were unaware
during prosecution. If a defendant were to prevail on a legal assertion of invalidity and/or unenforceability, we would lose at least part, and perhaps all,
of the patent protection on our development candidates and investigational medicines. Such a loss of patent protection would have a material adverse
impact on our business.

Changes in U.S. patent law could diminish the value of patents in general, thereby impairing our ability to protect our products.

As is the case with other biotechnology companies, our success is heavily dependent on intellectual property, particularly patents. Obtaining and
enforcing patents in the biotechnology industry involve both technological and legal complexity, and therefore obtaining and enforcing
biotechnology patents is costly, time-consuming and inherently uncertain. In addition, the United States has recently enacted and is currently
implementing wide-ranging patent reform legislation. Recent U.S. Supreme Court rulings have narrowed the scope of patent protection available in
certain circumstances and weakened the rights of patent owners in certain situations. In addition to increasing uncertainty with regard to our ability to
obtain patents in the future, this combination of events has created uncertainty with respect to the value of patents, once obtained. Depending on
decisions by the U.S. Congress, the federal courts, and the USPTO, the laws and regulations governing patents could change in unpredictable ways that
would weaken our ability to obtain new patents or to enforce our existing patents and patents that we might obtain in the future.

We may not be able to protect our intellectual property rights throughout the world.

Filing, prosecuting, and defending patents on development candidates and investigational medicines in all countries throughout the world would be
prohibitively expensive, and our intellectual property rights in some countries outside the United States can be less extensive than those in the United
States. In addition, the laws of some foreign countries do not protect intellectual property rights to the same extent as federal and state laws in the
United States. Consequently, we may not be able to prevent third parties from practicing our inventions in all countries outside the United States, or
from selling or importing products made using our inventions in and into the United States or other jurisdictions. Competitors may use our
technologies in jurisdictions where we have not obtained patent protection to develop their own products and further, may export otherwise infringing
products to territories where we have patent protection, but enforcement is not as strong as that in the United States. These products may compete with
our products and our patents or other intellectual property rights may not be effective or sufficient to prevent them from competing.

Many companies have encountered significant problems in protecting and defending intellectual property rights in foreign jurisdictions. The legal
systems of certain countries, particularly certain developing countries, do not favor the enforcement of patents, trade secrets and other intellectual
property protection, particularly those relating to biotechnology products, which could make it difficult for us to stop the infringement of our patents
or marketing of competing products in violation of our proprietary rights generally. Proceedings to enforce our patent rights in foreign jurisdictions
could result in substantial costs and divert our efforts and attention from other aspects of our business, could put our patents at risk of being invalidated
or interpreted narrowly and our patent applications at risk of not issuing and could provoke third parties to assert claims against us. We may not prevail
in any lawsuits that we initiate and the damages or other remedies awarded, if any, may not be

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commercially meaningful. Accordingly, our efforts to enforce our intellectual property rights around the world may be inadequate to obtain a significant commercial advantage from the intellectual property that we develop or license.

**Our reliance on government funding for certain of our programs adds uncertainty to our research and development efforts with respect to those programs and may require measures to increase the costs of commercialization and production of any programs developed under those government-funded programs.**

The development of each of our Zika vaccine (mRNA-1325), our antibody against Chikungunya virus (mRNA-1944), and our Chikungunya vaccine (mRNA-1388), are currently being funded through subcontracts with funding from either BARDA or DARPA. Contracts and grants funded by the U.S. government and its agencies, including our agreements funded by BARDA and DARPA, include provisions that reflect the government’s substantial rights and remedies, many of which are not typically found in commercial contracts, including powers of the government to:

- terminate agreements, in whole or in part, for any reason or no reason;
- reduce or modify the government’s obligations under such agreements without the consent of the other party;
- claim rights, including intellectual property rights, in products and data developed under such agreements;
- audit contract-related costs and fees, including allocated indirect costs;
- suspend the contractor or grantee from receiving new contracts pending resolution of alleged violations of procurement laws or regulations;
- impose U.S. manufacturing requirements for products that embody inventions conceived or first reduced to practice under such agreements;
- suspend or debar the contractor or grantee from doing future business with the government;
- control and potentially prohibit the export of products;
- pursue criminal or civil remedies under the False Claims Act, False Statements Act, and similar remedy provisions specific to government agreements; and
- limit the government’s financial liability to amounts appropriated by the U.S. Congress on a fiscal-year basis, thereby leaving some uncertainty about the future availability of funding for a program even after it has been funded for an initial period.

We may not have the right to prohibit the U.S. government from using certain technologies developed by us, and we may not be able to prohibit third-party companies, including our competitors, from using those technologies in providing products and services to the U.S. government. The U.S. government generally takes the position that it has the right to royalty-free use of technologies that are developed under U.S. government contracts.

In addition, government contracts and grants, and subcontracts and subawards awarded in the performance of those contracts and grants, normally contain additional requirements that may increase our costs of doing business, reduce our profits, and expose us to liability for failure to comply with these terms and conditions. These requirements include, for example:

- specialized accounting systems unique to government contracts and grants;
- mandatory financial audits and potential liability for price adjustments or recoupment of government funds after such funds have been spent;
- public disclosures of certain contract and grant information, which may enable competitors to gain insights into our research program; and
mandatory socioeconomic compliance requirements, including labor standards, non-discrimination, and affirmative action programs, and environmental compliance requirements.

As an organization, we are relatively new to government contracting and new to the regulatory compliance obligations that such contracting entails. If we fail to maintain compliance with those obligations, we may be subject to potential liability and to termination of our contracts.

As a U.S. government contractor, we are subject to financial audits and other reviews by the U.S. government of our costs and performance on their contracts, as well as our accounting and general business practices related to these contracts. Based on the results of its audits, the government may adjust our contract-related costs and fees, including allocated indirect costs. Although adjustments arising from government audits and reviews have not had a material adverse impact on our financial condition or results of operations in the past, we cannot assure you that future audits and reviews will not have those effects.

Risks related to commercialization of our pipeline

We have no sales, distribution, or marketing experience, and may invest significant financial and management resources to establish these capabilities. If we are unable to establish such capabilities or enter into agreements with third parties to market and sell our future products, if approved, we may be unable to generate any revenues.

Given our stage of development, we have no sales, distribution, or marketing experience. To successfully commercialize any products that may result from our development programs, we will need to develop sales and marketing capabilities in the United States, Europe, and other regions, either on our own or with others. We may enter into strategic alliances with other entities to utilize their mature marketing and distribution capabilities, but we may be unable to enter into marketing agreements on favorable terms, if at all. If our future strategic collaborators do not commit sufficient resources to commercialize our future products, if any, and we are unable to develop the necessary marketing capabilities on our own, we may be unable to generate sufficient product revenue to sustain our business. We will be competing with many companies that currently have extensive and well-funded marketing and sales operations. Without a significant internal team or the support of a third party to perform marketing and sales functions, we may be unable to compete successfully against these more established companies.

The pharmaceutical market is intensely competitive. If we are unable to compete effectively with existing drugs, new treatment methods and new technologies, we may be unable to commercialize successfully any drugs that we develop.

The pharmaceutical market is intensely competitive and rapidly changing. Many large pharmaceutical and biotechnology companies, academic institutions, governmental agencies, and other public and private research organizations are pursuing the development of novel drugs for the same diseases that we are targeting or expect to target. Many of our competitors have:

- greater financial, technical, and human resources than we have at every stage of the discovery, development, manufacture, and commercialization of products;
- more extensive experience in preclinical testing, conducting clinical trials, obtaining regulatory approvals, and in manufacturing, marketing, and selling drug products;
- investigational medicines that are based on previously tested or accepted technologies;
- products that have been approved or are in late stages of development; and
- collaborative arrangements in our target markets with leading companies and research institutions.

We will face intense competition from drugs that have already been approved and accepted by the medical community for the treatment of the conditions for which we may develop drugs. We also expect to face
competition from new drugs that enter the market. There are a number of drugs currently under development, which may become commercially available in the future, for the treatment of conditions for which we are trying, or may in the future try, to develop drugs. These drugs may be more effective, safer, less expensive, or marketed and sold more effectively, than any products we develop.

We anticipate competing with the largest pharmaceutical companies in the world, many of which are all currently conducting research in the fields of infectious diseases, immuno-oncology, rare genetic diseases, and cancer vaccines. Some of these companies have greater financial and human resources than we currently have. In addition to these large pharmaceutical companies, we may directly compete with fully-integrated biopharmaceutical companies and other immunotherapy-focused oncology companies, as well as a number of companies focused on mRNA medicines or shared tumor antigen and neoantigen therapeutics, some of which have entered into collaboration and funding agreements with larger pharmaceutical or biotechnology companies.

If we successfully develop investigational medicines, and obtain approval for them, we will face competition based on many different factors, including:

- the safety and effectiveness of our products relative to alternative therapies, if any;
- the ease with which our products can be administered and the extent to which patients accept relatively new routes of administration;
- the timing and scope of regulatory approvals for these products;
- the availability and cost of manufacturing, marketing, and sales capabilities;
- the price of any approved mRNA medicine;
- reimbursement coverage; and
- patent position.

Our competitors may develop or commercialize products with significant advantages over any products we develop based on any of the factors listed above or on other factors. In addition, our competitors may develop strategic alliances with or receive funding from larger pharmaceutical or biotechnology companies, providing them with an advantage over us. Our competitors may therefore be more successful in commercializing their products than we are, which could adversely affect our competitive position and business. Competitive products may make any products we develop obsolete or noncompetitive before we can recover the expenses of developing and commercializing our products, if approved.

The commercial success of any current or future investigational medicine, if approved, will depend upon the degree of market acceptance by physicians, patients, third-party payors, and others in the medical community.

Ethical, social, and legal concerns about genetic research could result in additional regulations restricting or prohibiting the products and processes we may use. Even with the requisite approvals, the commercial success of our products will depend in part on the medical community, patients, and third-party or governmental payors accepting mRNA medicines in general, and our products in particular, as medically useful, cost-effective, and safe. Any product that we bring to the market may not gain market acceptance by physicians, trial participants, third-party payors, and others in the medical community. If these products do not achieve an adequate level of acceptance, we may not generate significant product revenue and may not become profitable. The degree of market acceptance of our investigational medicines, if approved for commercial sale, will depend on a number of factors, including:

- the potential efficacy and potential advantages over alternative treatments;
- the ability to offer our products, if approved, at competitive prices;
- the prevalence and severity of any side effects, including any limitations or warnings contained in a product’s approved labeling;
the prevalence and severity of any side effects resulting from checkpoint inhibitors or other drugs or therapies with which our products are administered;

relative convenience and ease of administration;

any restrictions on the use of our products, if approved, together with other medications;

the willingness of the target patient population to try new therapies and of physicians to prescribe these therapies;

the strength of marketing and distribution support and timing of market introduction of competitive products;

publicity concerning our products or competing products and treatments; and

sufficient third-party insurance coverage or reimbursement, and patients’ willingness to pay out-of-pocket in the absence of third-party coverage or adequate reimbursement.

Even if a potential product displays a favorable efficacy and safety profile in preclinical and clinical studies, market acceptance of the product will not be known until after it is launched. Our efforts to educate the medical community and third-party payors on the benefits of the products may require significant resources and may never be successful. Our efforts to educate the marketplace may require more resources than are required by the conventional technologies marketed by our competitors due to the complexity and uniqueness of our programs.

Even if we are successful in getting marketing approval for any product, commercial success of any approved products will also depend in large part on the availability of coverage and adequate reimbursement from third-party payors, including government payors such as the Medicare and Medicaid programs and entry into managed care organizations, which may be affected by existing and future healthcare reform measures designed to reduce the cost of healthcare. Third-party payors could require us to conduct additional studies, including post-marketing studies related to the cost effectiveness of a product, to qualify for reimbursement, which could be costly and divert our resources. If government and other healthcare payors do not provide adequate coverage and reimbursement levels for any of our products once approved, whether due to healthcare reform legislation or otherwise, market acceptance and commercial success would be reduced.

In addition, if any of our products are approved for marketing, we or a strategic collaborator will be subject to significant regulatory obligations regarding the submission of safety and other post-marketing information and reports for such product, and will need to continue to comply (or ensure that our third-party providers comply) with current cGMP and GCPs for any clinical trials that we or a strategic collaborator conduct post-approval. In addition, there is always the risk that we or a strategic collaborator or regulatory authority might identify previously unknown problems with a product post-approval, such as adverse events of unanticipated severity or frequency. Compliance with these requirements is costly, and any such failure to comply or other issues with our investigational medicines identified post-approval could have a material adverse impact on our business, financial condition, and results of operations.

We may market our products outside of the United States, and we will be subject to the risks of doing business outside of the United States.

Because we plan to market our products, if approved, outside of the United States, our business is subject to risks associated with doing business outside of the United States including, an increase in our expenses, diversion of our management’s attention from the acquisition or development of investigational medicines, or forgoing profitable licensing opportunities in these geographies. Accordingly, our business and financial results in the future could be adversely affected due to a variety of factors, including:

- efforts to develop an international sales, marketing, and distribution organization;
- changes in a specific country’s or region’s political and cultural climate or economic condition;
In addition to FDA and related regulatory requirements in the United States and abroad, we are subject to extensive additional federal, state and foreign anti-bribery regulations, which include the U.S. Foreign Corrupt Practices Act, the U.K. Bribery Act, and similar laws in other countries outside of the United States. We are developing and implementing a corporate compliance program based on what we believe are current best practices in the pharmaceutical industry for companies similar to ours, but we cannot guarantee that we, our employees, our consultants, or our third-party contractors are or will be in compliance with all federal, state, and foreign regulations regarding bribery and corruption. Moreover, our strategic collaborators and third-party contractors located outside the United States may have inadequate compliance programs or may fail to respect the laws and guidance of the territories in which they operate. Even if we are not determined to have violated these laws, government investigations into these issues typically require the expenditure of significant resources and generate negative publicity, which could also have an adverse effect on our business, financial condition, and results of operations.

The insurance coverage and reimbursement status of newly-approved products, in a new category of medicines, is uncertain. Failure to obtain or maintain adequate coverage and reimbursement for new or current products could limit our ability to market those products and decrease our ability to generate revenue.

The availability and extent of reimbursement by governmental and private payors is essential for most patients to be able to afford expensive treatments such as the medicines that we hope to develop and sell. In addition, because our personalized cancer vaccine and intratumoral immunotherapy investigational medicines represent new approaches to the treatment of cancer, we cannot accurately estimate how these products would be priced, whether reimbursement could be obtained, or any potential revenue. Sales of our investigational medicines will depend substantially, both domestically and abroad, on the extent to which the costs of our investigational medicines will be paid by health maintenance, managed care, pharmacy benefit, and similar healthcare management organizations, or reimbursed by government health administration authorities, private health coverage insurers, and other third-party payors. If reimbursement is not available, or is available only to limited levels, we may not be able to successfully commercialize our investigational medicines. Even if coverage is provided, the approved reimbursement amount may not be high enough to allow us to establish or maintain pricing sufficient to realize a sufficient return on our investment in any of our products.

There is significant uncertainty related to the insurance coverage and reimbursement of newly approved products, including genetic medicines. In the United States, the principal decisions about reimbursement for new medicines are typically made by the Centers for Medicare & Medicaid Services, or CMS, an agency within the U.S. Department of Health and Human Services, or HHS, as CMS decides whether and to what extent a new medicine will be covered and reimbursed under Medicare. Private payors tend to follow CMS to a substantial degree. It is difficult to predict what CMS will decide with respect to reimbursement for novel products such as ours. Reimbursement agencies in Europe may be more conservative than CMS. For example, a number of cancer drugs have been approved for reimbursement in the United States and have not been approved for reimbursement in certain European countries.

Outside the United States, certain countries, including a number of member states of the European Union, set prices and reimbursement for pharmaceutical products, or medicinal products, as they are commonly referred to
in the European Union, with limited participation from the marketing authorization holders. We cannot be sure that such prices and reimbursement will be acceptable to us or our strategic collaborators. If the regulatory authorities in these foreign jurisdictions set prices or reimbursement levels that are not commercially attractive for us or our strategic collaborators, our revenues from sales by us or our strategic collaborators, and the potential profitability of our drug products, in those countries would be negatively affected. An increasing number of countries are taking initiatives to attempt to reduce large budget deficits by focusing cost-cutting efforts on pharmaceuticals for their state-run health care systems. These international price control efforts have impacted all regions of the world, but have been most drastic in the European Union. Additionally, some countries require approval of the sale price of a product before it can be marketed. In many countries, the pricing review period begins after marketing or product licensing approval is granted. As a result, we might obtain marketing approval for a product in a particular country, but then may experience delays in the reimbursement approval of our product or be subject to price regulations that would delay our commercial launch of the product, possibly for lengthy time periods, which could negatively impact the revenues we are able to generate from the sale of the product in that particular country.

Moreover, increasing efforts by governmental and third-party payors, in the United States and abroad, to cap or reduce healthcare costs may cause such organizations to limit both coverage and level of reimbursement for new products approved and, as a result, they may not cover or provide adequate payment for our investigational medicines. For example, the U.S. government recently released a “Blueprint”, or plan, to reduce the cost of drugs. This Blueprint contains certain measures that the HHS is already working to implement. At the state level, legislatures are increasingly passing legislation and implementing regulations designed to control pharmaceutical and biological product pricing, including price or patient reimbursement constraints, discounts, restrictions on certain product access, and marketing cost disclosure and transparency measures, and, in some cases, designed to encourage importation from other countries and bulk purchasing.

We expect to experience pricing pressures in connection with the sale of any of our investigational medicines, due to the trend toward managed healthcare, the increasing influence of health maintenance organizations and additional legislative changes. The downward pressure on healthcare costs in general, particularly prescription drugs and surgical procedures and other treatments, has become very intense. As a result, increasingly high barriers are being erected to the entry of new products.

**Healthcare legislative reform discourse and potential or enacted measures may have a material adverse impact on our business and results of operations and legislative or political discussions surrounding the desire for and implementation of pricing reforms may adversely impact our business.**

In the United States, there have been and continue to be a number of legislative initiatives to contain healthcare costs. For example, in March 2010, the ACA was passed, which substantially changes the way health care is financed by both governmental and private insurers, and significantly impacts the U.S. pharmaceutical industry. The ACA, among other things, increased the minimum Medicaid rebates owed by manufacturers under the Medicaid Drug Rebate Program and extended the rebate program to individuals enrolled in Medicaid managed care organizations, established annual fees and taxes on manufacturers of certain branded prescription drugs, and promoted a new Medicare Part D coverage gap discount program. Considerable uncertainty remains regarding the implementation and impact of the ACA.

Some of the provisions of the ACA have yet to be fully implemented, while certain provisions have been subject to judicial and Congressional challenges. The Tax Cuts and Jobs Act of 2017, or the TCJA, includes a provision repealing, effective January 1, 2019, the tax-based shared responsibility payment imposed by the ACA on certain individuals who fail to maintain qualifying health coverage for all or part of a year that is commonly referred to as the “individual mandate.” CMS has recently proposed regulations that would give states greater flexibility in setting benchmarks for insurers in the individual and small group marketplaces, which may have the effect of relaxing the essential health benefits required under the ACA for plans sold through such marketplaces. Further, on October 13, 2017, an Executive Order was signed terminating the cost-sharing reduction, or CSR, subsidies
that reimburse insurers under the ACA. The loss of the CSR payments is expected to increase premiums on certain policies issued by qualified health plans under the ACA. Several state Attorneys General filed suit to stop the administration from terminating the subsidies, but their request for a restraining order was denied by a federal judge in California on October 25, 2017. Another Executive Order was signed directing federal agencies with authorities and responsibilities under the ACA to waive, defer, grant exemptions from, or delay the implementation of any provision of the ACA that would impose a fiscal burden on states or a cost, fee, tax, penalty or regulatory burden on individuals, healthcare providers, health insurers, or manufacturers of pharmaceuticals or medical devices. With the current presidential administration and Congress, there may be additional administrative or legislative changes, including modification, repeal, or replacement of all, or certain provisions of, the ACA. However, it remains to be seen whether new legislation modifying the ACA will be enacted and, if so, precisely what the new legislation will provide, when it will be enacted and what impact it will have on the availability of healthcare and containing or lowering the cost of healthcare. The implications of a potential repeal or replacement of the ACA, for our and our strategic collaborators’ business and financial condition, if any, are not yet clear.

In addition, other legislative changes have been proposed and adopted in the United States since the ACA was enacted. The Budget Control Act of 2011, among other things, created measures for spending reductions by Congress. A Joint Select Committee on Deficit Reduction, tasked with recommending a targeted deficit reduction of at least $1.2 trillion for the years 2013 through 2021, was unable to reach required goals, thereby triggering the legislation’s automatic reduction to several government programs. This includes aggregate reductions of Medicare payments to providers up to 2% per fiscal year. These reductions will remain in effect through 2025 unless additional Congressional action is taken.

The delivery of healthcare in the EU, including the establishment and operation of health services and the pricing and reimbursement of medicines, is almost exclusively a matter for national, rather than EU, law and policy. National governments and health service providers have different priorities and approaches to the delivery of health care and the pricing and reimbursement of products in that context. In general, however, the healthcare budgetary constraints in most EU member states have resulted in restrictions on the pricing and reimbursement of medicines by relevant health service providers. Coupled with ever-increasing EU and national regulatory burdens on those wishing to develop and market products, this could prevent or delay marketing approval of our investigational medicines, restrict or regulate post-approval activities, and affect our ability to commercialize any products for which we obtain marketing approval.

We expect that additional foreign, state and federal healthcare reform measures or proposals will be adopted in the future, any of which could limit the amounts that federal and state governments will pay for healthcare products and services, which could result in reduced demand for our investigational medicines or additional pricing pressures. In the event that the pricing structures for healthcare products, such as the investigational medicines we are developing, change materially and limit payments for such investigational medicines, our business will be adversely impacted as our products may no longer be commercially viable based on their expected net present value; we may have invested significant resources in products that cannot be commercially developed; or we may determine that assets that have reached an early phase of development cannot or will not be taken into further development, notwithstanding their clinical viability. In addition, development assets or clinical programs that are part of our strategic alliances may no longer be deemed commercially viable to pursue based on our strategic collaborators’ assessments of the impact of any proposed, announced, or legislated pricing reforms.

We cannot predict what healthcare reform initiatives may be adopted in the future. Further federal, state, and foreign legislative and regulatory developments are likely, and we expect ongoing initiatives to increase pressure on drug pricing. Such reforms could have an adverse effect on anticipated revenues from investigational medicines that we may successfully develop and for which we may obtain regulatory approval, and may affect our overall financial condition and ability to develop investigational medicines.
Due to the novel nature of our technology, we face uncertainty related to pricing and reimbursement for these investigational medicines. Target patient populations for certain of our investigational medicines, such as those for rare genetic diseases, may be relatively small, and certain of our investigational medicines, like PCV, require customization on an individual scale. As a result, the pricing and reimbursement of our investigational medicines, if approved, must be adequate to support commercial infrastructure. If we are unable to obtain adequate levels of reimbursement, our ability to successfully market and sell our investigational medicines will be adversely affected. The manner and level at which reimbursement is provided for services related to our investigational medicines (e.g., for administration of our product to patients) is also important. Inadequate reimbursement for such services may lead to physician resistance and adversely affect our ability to market or sell our products.

If the market opportunities for our development candidates or investigational medicines are smaller than we believe they are, our revenue may be adversely affected and our business may suffer. Because the target patient populations for some of our programs are small, we must be able to successfully identify trial participants and achieve a significant market share to maintain profitability and growth.

An important area of focus of our research and product development activities is the development of treatments for severe rare genetic diseases. Our projections of both the number of people who have these diseases, as well as the subset of people with these diseases who have the potential to benefit from treatment with our programs, are based on estimates. These estimates may prove to be incorrect and new studies may change the estimated incidence or prevalence of these diseases. The number of trial participants in the United States, Europe and elsewhere may turn out to be lower than expected, may not be otherwise amenable to treatment with our products, or new trial participants may become increasingly difficult to identify or gain access to, all of which would adversely affect our results of operations and our business.

The market opportunities of some of our programs may be limited to those patients who are ineligible for or have failed prior treatments and for which the market opportunities may be small.

The FDA often approves new therapies initially only for use by patients with relapsed or refractory advanced disease. We expect to initially seek approval of our PCV and intratumoral immuno-oncology investigational medicines in this context. Subsequently, for those products that prove to be sufficiently beneficial, if any, we would expect to seek approval in earlier lines of treatment and potentially as a first line therapy but there is no guarantee that our investigational medicines, even if approved, would be approved for earlier lines of therapy, and, prior to any such approvals, we may have to conduct additional clinical trials.

Our projections of both the number of people who have the cancers we may be targeting, as well as the subset of people with these cancers in a position to receive second or third line therapy, and who have the potential to benefit from treatment with our investigational medicines, are based on our beliefs and estimates. These estimates have been derived from a variety of sources, including scientific literature, surveys of clinics, patient foundations, or market research, and may prove to be incorrect. Further, new studies may change the estimated incidence or prevalence of these cancers. The number of trial participants may turn out to be lower than expected. Additionally, the potentially addressable patient population for our investigational medicines may be limited or may not be amenable to treatment with our investigational medicines. Even if we obtain significant market share for our products, if approved, because the potential target populations are small, we may never achieve profitability without obtaining regulatory approval for additional indications.

Risks related to our business and operations

We will need to develop and expand our Company, and we may encounter difficulties in managing this development and expansion, which could disrupt our operations.

We have approximately 680 full-time employees and, in connection with the growth and advancement of our pipeline and becoming a public company, we expect to increase the number of employees and the scope of our
To manage our anticipated development and expansion, including potential expansion outside of the United States, we must continue to implement and improve our managerial, operational, and financial systems, expand our facilities, and continue to recruit and train additional qualified personnel. Also, our management may need to divert a disproportionate amount of its attention away from its day-to-day activities and devote a substantial amount of time to managing these development activities.

As a growing biotechnology company, we are actively pursuing development candidates and investigational medicines in many therapeutic areas and across a wide range of diseases. Successfully developing products for and fully understanding the regulatory and manufacturing pathways to all of these therapeutic areas and disease states requires a significant depth of talent, resources, and corporate processes in order to allow simultaneous execution across multiple areas. Due to our limited resources and early stage of growth, we may not be able to effectively manage this simultaneous execution and the expansion of our operations or recruit and train additional qualified personnel. This may result in weaknesses in our infrastructure, give rise to operational mistakes, loss of business opportunities, loss of employees, and reduced productivity among remaining employees. The physical expansion of our operations may lead to significant costs and may divert financial resources from other projects, such as the development of our investigational medicines. If our management is unable to effectively manage our expected development and expansion, our expenses may increase more than expected, our ability to generate or increase our revenue could be reduced and we may not be able to implement our business strategy. Our future financial performance and our ability to commercialize our investigational medicines, if approved, and compete effectively will depend, in part, on our ability to effectively manage the future development and expansion of our company.

Our future success depends on our ability to retain key employees, consultants, and advisors and to attract, retain, and motivate qualified personnel. We may not be able to retain employees or executives who have vested stock options that will become publicly tradable after the offering. Our ability to compete in the highly competitive biotechnology and pharmaceutical industries depends upon our ability to attract and retain highly qualified managerial, scientific, and medical personnel. We are highly dependent upon members of our management and scientific teams. Each of our executive officers and all of our employees, including key scientists and clinicians, are employed “at will,” meaning we or each officer or employee may terminate the employment relationship at any time. The loss of any of these persons’ services may adversely impact the achievement of our research, development, financing and commercialization objectives. We currently do not have “key person” insurance on any of our employees. Many of our key employees, including members of our executive team, have been with us for a long period of time, and have fully vested stock options or other long-term equity incentives which may become valuable and will be publicly tradable if we become a public company. We may not be able to retain these employees due to the competitive environment in the biotechnology industry, particularly in Cambridge, MA.

In addition, we rely on consultants, contractors and advisors, including scientific and clinical advisors, to assist us in formulating our research and development, regulatory approval, and commercialization strategy. Our consultants and advisors may be employed by employers other than us and may have commitments under consulting or advisory contracts with other entities that may limit their availability to us. The loss of the services of one or more of our current employees or advisors might impede the achievement of our research, development, regulatory approval and commercialization objectives. In addition, we have flexibly grown our workforce through the use of contractors and part time workers. We may not be able to retain the services of such personnel which might result in delays in the operation of our business.

Recruiting and retaining other qualified employees, consultants, and advisors for our business, including scientific and technical personnel, also will be critical to our success. Competition for skilled personnel, including in mRNA and LNP research, clinical operations, regulatory affairs, therapeutic area management, and manufacturing, is intense and the turnover rate can be high. We may not be able to attract and retain personnel on favorable terms given the competition among numerous pharmaceutical and biotechnology companies and
academic institutions for individuals with similar skill sets. In addition, adverse publicity, failure to succeed in preclinical or clinical trials or applications for marketing approval may make it more challenging to recruit and retain qualified personnel. The inability to recruit, or loss of services of certain executives, key employees, consultants, or advisors, may impede the progress of our research, development and commercialization objectives and have a material adverse impact on our business, financial condition, results of operations, and prospects.

Our employees, principal investigators, and consultants may engage in misconduct or other improper activities, including non-compliance with regulatory standards and requirements and insider trading.

We are exposed to the risk of fraud or other misconduct by our employees, principal investigators, and consultants. Misconduct by these parties could include intentional failures to comply with FDA regulations or the regulations applicable in the EU and other jurisdictions, provide accurate information to the FDA, the EMA and other regulatory authorities, comply with healthcare fraud and abuse laws and regulations in the United States and abroad, report financial information or data accurately or disclose unauthorized activities to us. Such misconduct also could involve the improper use of information obtained in the course of clinical trials or interactions with the FDA or other regulatory authorities, which could result in regulatory sanctions and cause serious harm to our reputation. Sales, marketing and business arrangements in the healthcare industry are subject to extensive laws and regulations intended to prevent fraud, misconduct, kickbacks, self-dealing, and other abusive practices. These laws and regulations restrict or prohibit a wide range of pricing, discounting, marketing and promotion, sales commission, customer incentive programs, and other business arrangements. We have adopted a code of conduct applicable to all of our employees, but it is not always possible to identify and deter employee misconduct, and the precautions we take to detect and prevent this activity may not be effective in controlling unknown or unmanaged risks or losses or in protecting us from government investigations or other actions or lawsuits stemming from a failure to comply with these laws or regulations. If any such actions are instituted against us, and we are not successful in defending ourselves or asserting our rights, those actions could have a significant impact on our business, financial condition, results of operations, and prospects, including the imposition of significant fines or other sanctions.

Employee litigation and unfavorable publicity could negatively affect our future business.

Our employees may, from time to time, bring lawsuits against us regarding injury, creating a hostile work place, discrimination, wage and hour disputes, sexual harassment, or other employment issues. In recent years there has been an increase in the number of discrimination and harassment claims generally. Coupled with the expansion of social media platforms and similar devices that allow individuals access to a broad audience, these claims have had a significant negative impact on some businesses. Certain companies that have faced employment- or harassment-related lawsuits have had to terminate management or other key personnel, and have suffered reputational harm that has negatively impacted their business. If we were to face any employment-related claims, our business could be negatively affected.

We have never generated any revenue from product sales and may never be profitable.

Our ability to generate revenue and achieve profitability depends on our ability, alone or with strategic collaborators, to successfully complete the development of, and obtain the regulatory approvals necessary to commercialize our investigational medicines. We do not anticipate generating revenues from product sales for the foreseeable future, if ever. Our ability to generate future revenues from product sales depends heavily on our success in:

• completing research, preclinical, and clinical development of our development candidates and investigational medicines;
• seeking and obtaining U.S. and foreign marketing approvals for investigational medicines for which we complete clinical studies;

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developing a sustainable, stable, consistent, and transferable manufacturing process or processes for our development candidates and investigational medicines;

developing a sustainable, scalable, consistent, time sensitive, and transferable manufacturing process for our personalized cancer vaccine investigational medicine;

furthering the development of our own manufacturing capabilities and manufacturing relationships with third parties in order to provide adequate (in amount and quality) products and services to support clinical development and the market demand for our investigational medicines, if approved;

obtaining market acceptance of our investigational medicines as a treatment option;

launching and commercializing investigational medicines for which we obtain marketing approval and reimbursement, either by collaborating with a strategic collaborator or, if launched independently, by establishing a sales force, marketing, and distribution infrastructure;

addressing any competing technological and market developments;

implementing additional internal systems and infrastructure;

negotiating favorable terms in any collaboration, licensing, or other arrangements into which we may enter;

maintaining, defending, protecting, and expanding our portfolio of intellectual property rights, including patents, trade secrets and know-how; and

attracting, hiring and retaining qualified personnel.

Even if one or more of the investigational medicines that we develop is approved for commercial sale, we anticipate incurring significant costs associated with commercializing any approved investigational medicine. Our expenses could increase beyond expectations if we are required by the FDA, the EMA, or other regulatory agencies to perform clinical and other studies or make changes to our manufacturing or quality systems in addition to those that we currently anticipate. Even if we are able to generate revenues from the sale of any approved products, we may not become profitable and may need to obtain additional funding to continue operations.

Our internal computer systems, or those of our strategic collaborators or other contractors or consultants, may fail or suffer security breaches, which could result in a material disruption of our product development programs and our manufacturing operations.

Our internal computer systems and those of our current and any future collaborators, vendors, and other contractors or consultants are vulnerable to damage from computer viruses, unauthorized access, natural disasters, terrorism, cybersecurity threats, war, and telecommunication and electrical failures. While we have not experienced any such material system failure, accident, or security breach to date that we are aware of, if such an event were to occur and cause interruptions in our operations, it could result in a material disruption of our development programs and our business operations, whether due to a loss of our trade secrets or other proprietary information or other similar disruptions. For example, the loss of clinical trial data from one or more ongoing or completed or future clinical trials could result in delays in our regulatory approval efforts and significantly increase our costs to recover or reproduce the data. In addition because of our approach to running multiple clinical trials in parallel, any breach of our computer systems may result in a loss of data or compromised data integrity across many of our programs in many stages of development. Any such breach, loss, or compromise of clinical trial participant personal data may also subject us to civil fines and penalties, either under the GDPR and relevant member state law in the EU, and HIPAA and other relevant state and federal privacy laws in the United States. To the extent that any disruption or security breach were to result in a loss of, or damage to, our data or applications, or inappropriate disclosure of confidential or proprietary information, we could incur liability, our competitive position could be harmed and the further development and commercialization of our investigational medicines could be delayed.
We may use our financial and human resources to pursue a particular research program or investigational medicine and fail to capitalize on programs or investigational medicines that may be more profitable or for which there is a greater likelihood of success.

Because we have limited resources, we must choose to pursue and fund the development of selected research programs or investigational medicines and may forego or delay pursuit of opportunities with other programs or investigational medicines that could later prove to have greater commercial potential. Our resource allocation decisions, or our contractual commitments to provide resources to our strategic collaborators under strategic alliance agreements, may cause us to fail to capitalize on viable commercial products or profitable market opportunities. Our spending on current and future research and development programs for investigational medicines may not yield any commercially viable products. If we do not accurately evaluate the commercial potential or target market for a particular investigational medicine, we may relinquish valuable rights to that investigational medicine through a strategic alliance, licensing, or other royalty arrangements in cases in which it would have been more advantageous for us to retain sole development and commercialization rights to such investigational medicine, or we may allocate internal resources to an investigational medicine in a therapeutic area in which it would have been more advantageous to enter into a strategic alliance.

If we are not successful in discovering, developing, and commercializing additional products beyond our current portfolio, our ability to expand our business and achieve our strategic objectives would be impaired.

Although a substantial amount of our efforts will focus on the clinical trials and potential approval of our existing investigational medicines, a key element of our strategy is to discover, develop, and potentially commercialize additional products beyond our current portfolio to treat various conditions and in a variety of therapeutic areas. We intend to do so by investing in our own drug discovery efforts, exploring potential strategic alliances for the development of new products, and in-licensing technologies. Identifying new investigational medicines requires substantial technical, financial, and human resources, whether or not any investigational medicines are ultimately identified. Even if we identify investigational medicines that initially show promise, we may fail to successfully develop and commercialize such products for many reasons, including the following:

- the research methodology used may not be successful in identifying potential investigational medicines;
- competitors may develop alternatives that render our investigational medicines obsolete;
- investigational medicines we develop may nevertheless be covered by third parties’ patents or other exclusive rights;
- an investigational medicine may, on further study, be shown to have harmful side effects or other characteristics that indicate it is unlikely to be effective or otherwise does not meet applicable regulatory criteria;
- an investigational medicine may not be capable of being produced in commercial quantities at an acceptable cost, or at all; and
- an approved product may not be accepted as safe and effective by trial participants, the medical community or third-party payors.

If we are unsuccessful in identifying and developing additional products, our potential for growth may be impaired.

Product liability lawsuits against us could cause us to incur substantial liabilities and could limit commercialization of any investigational medicine that we may develop.

We face an inherent risk of product liability exposure related to the testing of any of our current or future investigational medicines in clinical trials, and we may face an even greater risk if we commercialize any investigational medicine that we may develop. If we cannot successfully defend ourselves against claims that our
investigational medicines caused injuries, we could incur substantial liabilities. Regardless of merit or eventual outcome, liability claims may result in:

• decreased demand for any investigational medicine that we may develop;
• loss of revenue;
• substantial monetary awards to patients, healthy volunteers, or their children;
• significant time and costs to defend the related litigation;
• withdrawal of clinical trial participants;
• the inability to commercialize any investigational medicine(s) that we may develop; and
• injury to our reputation and significant negative media attention.

We carry product liability insurance which we believe to be sufficient in light of our current clinical programs; however, we may not be able to maintain insurance coverage at a reasonable cost or in sufficient amounts to protect us against losses due to liability. If and when we obtain marketing approval for investigational medicines, we intend to expand our insurance coverage to include the sale of commercial products; however, we may be unable to obtain product liability insurance on commercially reasonable terms or in adequate amounts. On occasion, large judgments have been awarded in class action lawsuits based on drugs or medical treatments that had unanticipated adverse effects. A successful product liability claim or series of claims brought against us could cause our stock price to decline and, if judgments exceed our insurance coverage, could adversely affect our results of operations and business.

We may be subject, directly or indirectly, to federal and state healthcare fraud and abuse laws, false claims laws, and health information privacy and security laws. If we are unable to comply, or have not fully complied, with such laws, we could face substantial penalties.

If we obtain FDA approval for any of our investigational medicines and begin commercializing those products in the United States, our operations will be directly, or indirectly through our prescribers, customers, and purchasers, subject to various federal and state fraud and abuse laws and regulations, including, without limitation, the federal Health Care Program Anti-Kickback Statute, the federal civil and criminal False Claims Act, and Physician Payments Sunshine Act and regulations. These laws will impact, among other things, our proposed sales, marketing, and educational programs. In addition, we may be subject to patient privacy laws enacted by both the federal government and the states in which we conduct our business. The laws that will affect our operations include, but are not limited to the following:

• The federal Health Care Program Anti-Kickback Statute, which prohibits, among other things, persons or entities from knowingly and willfully soliciting, receiving, offering or paying any remuneration (including any kickback, bribe, or rebate), directly or indirectly, overtly or covertly, in cash or in kind, in return for the purchase, recommendation, leasing, or furnishing of an item or service reimbursable under a federal healthcare program, such as the Medicare and Medicaid programs. This statute has been interpreted to apply to arrangements between pharmaceutical manufacturers on the one hand, and prescribers, purchasers, and formulary managers on the other. The ACA amends the intent requirement of the federal Anti-Kickback Statute to provide that a person or entity no longer needs to have actual knowledge of this statute or specific intent to violate it.
• The federal civil and criminal false claims laws and civil monetary penalty laws prohibit, among other things, individuals or entities from knowingly presenting, or causing to be presented, claims for payment or approval from Medicare, Medicaid, or other government payors that are false or fraudulent. The ACA provides, and recent government cases against pharmaceutical and medical device manufacturers support, the view that federal Anti-Kickback Statute violations and certain marketing practices, including off-label promotion, may implicate the False Claims Act.
• The federal Health Insurance Portability and Accountability Act of 1996, or HIPAA, which created new federal criminal statutes that prohibit a person from knowingly and willfully executing a scheme or making false or fraudulent statements to defraud any healthcare benefit program, regardless of the payor (e.g., public or private).

• HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act and their implementing regulations, imposes certain requirements relating to the privacy, security, and transmission of individually identifiable health information without appropriate authorization by entities subject to the rule, such as health plans, health care clearinghouses, and health care providers.

• The U.S. Federal Food, Drug and Cosmetic Act, which prohibits, among other things, the adulteration or misbranding of drugs, biologics, and medical devices.

• Federal transparency laws, including the federal Physician Payment Sunshine Act, which require disclosure of payments and other transfers of value provided to physicians and teaching hospitals, and ownership and investment interests held by physicians and other healthcare providers and their immediate family members and applicable group purchasing organizations.

• State law equivalents of each of the above federal laws, state laws that require drug manufacturers to report information related to payments and other transfers of value to physicians and other healthcare providers or marketing expenditures, and state laws governing the privacy and security of health information in certain circumstances are also applicable to us and many of them differ from each other in significant ways and may not have the same effect, thus complicating compliance efforts in certain circumstances.

Because of the breadth of these laws and the narrowness of the statutory exceptions and safe harbors available, it is possible that some of our business activities could be subject to challenge under one or more of such laws. If our operations are found to be in violation of any of the laws described above or any other government regulations that apply to us, we may be subject to penalties, including civil and criminal penalties, damages, fines, exclusion from participation in government health care programs, such as Medicare and Medicaid, imprisonment, and the curtailment or restructuring of our operations, any of which could adversely affect our ability to operate our business and our results of operations.

The provision of benefits or advantages to physicians to induce or encourage the prescription, recommendation, endorsement, purchase, supply, order or use of medicinal products is prohibited in the EU. The provision of benefits or advantages to physicians is also governed by the national anti-bribery laws of EU Member States, such as the UK Bribery Act 2010. Infringement of these laws could result in substantial fines and imprisonment.

Payments made to physicians in certain EU Member States must be publicly disclosed. Moreover, agreements with physicians often must be the subject of prior notification and approval by the physician’s employer, his or her competent professional organization or the regulatory authorities of the individual EU Member States. These requirements are provided in the national laws, industry codes, or professional codes of conduct, applicable in the EU Member States. Failure to comply with these requirements could result in reputational risk, public reprimands, administrative penalties, fines, or imprisonment.

The collection and use of personal health data in the European Union had previously been governed by the provisions of the Data Protection Directive, which has been replaced by the GDPR which became effective on May 25, 2018. While the Data Protection Directive did not apply to organizations based outside the EU, the GDPR has expanded its reach to include any business, regardless of its location, that provides goods or services to residents in the EU. This expansion would incorporate our clinical trial activities in EU member states. The GDPR imposes strict requirements on controllers and processors of personal data, including special protections for “sensitive information” which includes health and genetic information of data subjects residing in the EU. GDPR grants individuals the opportunity to object to the processing of their personal information, allows them to request deletion of personal information in certain circumstances, and provides the individual with an express right to seek legal remedies in the event the individual believes his or her rights have been violated.
GDPR imposes strict rules on the transfer of personal data out of the EU to the United States or other regions that have not been deemed to offer “adequate” privacy protections. Failure to comply with the requirements of the GDPR and the related national data protection laws of the EU Member States, which may deviate slightly from the GDPR, may result in significant fines. As a result of the implementation of the GDPR, we may be required to put in place additional mechanisms ensuring compliance with the new data protection rules.

There is significant uncertainty related to the manner in which data protection authorities will seek to enforce compliance with GDPR. For example, it is not clear if the authorities will conduct random audits of companies doing business in the EU, or if the authorities will wait for complaints to be filed by individuals who claim their rights have been violated. Enforcement uncertainty and the costs associated with ensuring GDPR compliance may be onerous and adversely affect our business, financial condition, results of operations, and prospects.

**If we fail to comply with environmental, health, and safety laws and regulations, we could become subject to fines or penalties or incur costs that could harm our business.**

We will become subject to numerous environmental, health, and safety laws and regulations, including those governing laboratory procedures and the handling, use, storage, treatment, and disposal of hazardous materials and wastes. Our operations will involve the use of hazardous and flammable materials, including chemicals and biological materials. Our operations also may produce hazardous waste products. We generally anticipate contracting with third parties for the disposal of these materials and wastes. We will not be able to eliminate the risk of contamination or injury from these materials. In the event of contamination or injury resulting from any use by us of hazardous materials, we could be held liable for any resulting damages, and any liability could exceed our resources. We also could incur significant costs associated with civil or criminal fines and penalties for failure to comply with such laws and regulations.

Although we maintain workers’ compensation insurance to cover us for costs and expenses we may incur due to injuries to our employees resulting from the use of hazardous materials, this insurance may not provide adequate coverage against potential liabilities. We do not maintain insurance for environmental liability or toxic tort claims that may be asserted against us in connection with our storage or disposal of biological or hazardous materials.

In addition, we may incur substantial costs in order to comply with current or future environmental, health, and safety laws and regulations. These current or future laws and regulations may impair our research, development, or production efforts. Our failure to comply with these laws and regulations also may result in substantial fines, penalties or other sanctions.

**Unfavorable U.S. or global economic conditions could adversely affect our business, financial condition, or results of operations.**

Our results of operations could be adversely affected by general conditions in the global economy and financial markets. The most recent global financial crisis caused extreme volatility and disruptions in the capital and credit markets. A severe or prolonged economic downturn, such as the most recent global financial crisis, could result in a variety of risks to our business, including weakened demand for our investigational medicines and our ability to raise additional capital when needed on favorable terms, if at all. A weak or declining economy could strain our suppliers, possibly resulting in supply disruption, or cause delays in payments for our services by third-party payors or our collaborators. Any of the foregoing could harm our business and we cannot anticipate all of the ways in which the current economic climate and financial market conditions could adversely impact our business.
We or the third parties upon whom we depend may be adversely affected by natural disasters or other business interruptions such as cybersecurity attacks and our business continuity and disaster recovery plans may not adequately protect us from a serious disaster.

Natural disasters could severely disrupt our operations, and have a material adverse impact on our business, results of operations, financial condition, and prospects. If a natural disaster, power outage, cybersecurity attack, or other event occurred that prevented us from using all or a significant portion of our headquarters, damaged critical infrastructure, such as our manufacturing facilities or those of our third-party contract manufacturers, limited our ability to access or use our digital information systems or that otherwise disrupted operations, it may be difficult or, in certain cases, impossible for us to continue our business for a substantial period of time. The disaster recovery and business continuity plans we have in place currently are limited and are unlikely to prove adequate in the event of a serious disaster or similar event. Cybersecurity liability insurance is difficult to obtain and may not cover any damages we would sustain based on any breach of our computer security protocols or other cybersecurity attack. We may incur substantial expenses as a result of the limited nature of our disaster recovery and business continuity plans, which could have a material adverse impact on our business.

If our products become subject to a product recall it could harm our reputation, business, and financial results.

The FDA and similar foreign governmental authorities have the authority to require the recall of certain commercialized products. In the case of the FDA, the authority to require a recall of a biologic product must be based on an FDA finding that a batch, lot of other quantity of the biologic product presents an imminent or substantial hazard to the public health. In addition, foreign governmental bodies have the authority to require the recall of any investigational medicine in the event of material deficiencies or defects in design or manufacture. Manufacturers may, under their own initiative, recall a product if any material deficiency in a product is found. A government-mandated or voluntary recall by us could occur as a result of manufacturing errors, design or labeling defects or other deficiencies and issues. Recalls of any of our investigational medicines would divert managerial and financial resources and have an adverse effect on our financial condition and results of operations. A recall announcement could harm our reputation with customers and negatively affect our sales, if any.

Comprehensive tax reform legislation could adversely affect our business and financial condition.

On December 22, 2017, the TCJA was signed into law, which significantly reforms the Internal Revenue Code of 1986, as amended, or the Code. The TCJA, among other things, contains significant changes to corporate taxation, including reduction of the corporate tax rate from a top marginal tax rate of 35% to a flat rate of 21%, limitation of the tax deduction for net business interest expense to 30% of adjusted taxable income (with certain excepted businesses), limitation of the deduction for net operating losses generated during or after 2018 to 80% of annual taxable income and elimination of net operating loss carrybacks, and modifying or repealing many business deductions and credits (including reducing the business tax credit for certain clinical testing expenses incurred in the testing of certain drugs for rare diseases or conditions generally referred to as “orphan drugs”). We continue to examine the impact this tax reform legislation may have on our business. However, the effect of the TCJA on our business, whether adverse or favorable, is uncertain and may not become evident for some period of time. We urge investors to consult with their legal and tax advisers regarding the implications of the TCJA on an investment in our common stock.

The amount of and our ability to use net operating losses and research and development credits to offset future taxable income may be subject to certain limitations and uncertainty.

As of December 31, 2017, we had federal and state net operating loss carryforwards of $380.4 million and $325.2 million, respectively, which begin to expire in 2030. As of December 31, 2017, we also had federal and state research and development tax credit carryforwards of $31.3 million and $19.3 million, respectively, which...
begin to expire in 2028. These net operating loss and tax credit carryforwards could expire unused and be unavailable to offset future income tax liabilities. In general, under Sections 382 and 383 of the Code, a corporation that undergoes an “ownership change” is subject to limitations on its ability to utilize its pre-change net operating losses or tax credits, or NOLs or credits, to offset future taxable income or taxes. For these purposes, an ownership change generally occurs where the aggregate stock ownership of one or more stockholders or groups of stockholders who owns at least 5% of a corporation’s stock increases its ownership by more than 50 percentage points over its lowest ownership percentage within a specified testing period. Our existing NOLs or credits may be subject to limitations if we undergo an ownership change in connection with or after this offering. Our ability to utilize NOLs or credits could be further limited by Sections 382 and 383 of the Code. In addition, future changes in our stock ownership, many of which are outside of our control, could result in an ownership change under Sections 382 and 383 of the Code. Our NOLs or credits may also be impaired under state law. Accordingly, we may not be able to utilize a material portion of our NOLs or credits. In addition, the rules regarding timing of revenue and expense recognition for tax purposes in connection with various transactions we have are complex and uncertain in various respects and could be subject to challenge by taxing authorities. In the event any such challenge is sustained, the net operating losses could be materially reduced and/or we could be determined to be a material cash taxpayer for one or more years. Furthermore, our ability to utilize our NOLs or credits is conditioned upon our attaining profitability and generating U.S. federal and state taxable income. As described above we have incurred significant net losses since our inception and anticipate that we will continue to incur significant losses for the foreseeable future, and therefore, we do not know whether or when we will generate the U.S. federal or state taxable income necessary to utilize our NOL or credit carryforwards. Under the TCJA, NOLs generated after December 31, 2017 will not be subject to expiration. The TCJA also reduced the corporate income tax rate to 21%, from a prior rate of 35%. This may cause a reduction in the potential economic benefit of our NOLs and other available deferred tax assets.

If we engage in future acquisitions, joint ventures, or strategic collaborations, this may increase our capital requirements, dilute our stockholders, cause us to incur debt or assume contingent liabilities, and subject us to other risks.

We may evaluate various acquisitions and collaborations, including licensing or acquiring complementary products, intellectual property rights, technologies, or businesses. Any potential acquisition, joint venture, or collaboration may entail numerous risks, including:

- increased operating expenses and cash requirements;
- the assumption of additional indebtedness or contingent liabilities;
- assimilation of operations, intellectual property, and products of an acquired company, including difficulties associated with integrating new personnel;
- the diversion of our management’s attention from our existing product programs and initiatives in pursuing such a strategic merger or acquisition;
- retention of key employees, the loss of key personnel, and uncertainties in our ability to maintain key business relationships;
- risks and uncertainties associated with the other party to such a transaction, including the prospects of that party and their existing products or investigational medicines and regulatory approvals; and
- our inability to generate revenue from acquired technology or products sufficient to meet our objectives in undertaking the acquisition or even to offset the associated acquisition and maintenance costs.

In addition, if we undertake acquisitions, we may utilize our cash, issue dilutive securities, assume or incur debt obligations, incur large one-time expenses and acquire intangible assets that could result in significant future amortization expense.

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Moreover, we may not be able to locate suitable acquisition or strategic collaboration opportunities and this inability could impair our ability to grow or obtain access to technology or products that may be important to the development of our business.

**Risks related to ownership of our common stock and this offering**

*The price of our common stock may be volatile and fluctuate substantially, which could result in substantial losses for purchasers of our common stock in this offering.*

Our stock price is likely to be volatile. The stock market in general, and the market for biopharmaceutical companies in particular, has experienced extreme volatility that has often been unrelated to the operating performance of particular companies. As a result of this volatility, you may not be able to sell your common stock at or above the initial public offering price. The market price for our common stock may be influenced by many factors, including:

- results of clinical trials of our investigational medicines or those of our competitors;
- the success of competitive products or technologies;
- commencement or termination of strategic alliances;
- regulatory or legal developments in the United States and other countries;
- developments or disputes concerning patent applications, issued patents, or other proprietary rights;
- the recruitment or departure of key personnel;
- the level of expenses related to any of our investigational medicines or clinical development programs;
- the results of our efforts to discover, develop, acquire, or in-license additional investigational medicines;
- actual or anticipated changes in estimates as to financial results, development timelines, or recommendations by securities analysts;
- variations in our financial results or those of companies that are perceived to be similar to us;
- changes in the structure of healthcare payment systems;
- market conditions in the pharmaceutical and biotechnology sectors;
- general economic, industry, and market conditions; and
- the numerous programs in our pipeline, the development of which could each generate news or significant adverse events that could impact financial results or recommendations by securities analysts.

If our quarterly or annual results fall below the expectations of investors or securities analysts, the price of our common stock could decline substantially. Furthermore, any quarterly or annual fluctuations in our results may, in turn, cause the price of our stock to fluctuate substantially. We believe that period-to-period comparisons of our results are not necessarily meaningful and should not be relied upon as an indication of our future performance.

In the past, following periods of volatility in the market price of a company’s securities, securities class-action litigation often has been instituted against that company. Such litigation, if instituted against us, could cause us to incur substantial costs to defend such claims and divert management’s attention and resources, which could seriously harm our business, financial condition, results of operations, and prospects.
As a public company, and particularly after we are no longer an “emerging growth company,” we will incur significant legal, accounting and other expenses that we did not incur as a private company. In addition, the federal securities laws, including the Sarbanes-Oxley Act of 2002 and rules subsequently implemented by the Securities and Exchange Commission and Nasdaq have imposed various requirements on public companies, including requirements to file annual, quarterly, and event driven reports with respect to our business and financial condition, and to establish and maintain effective disclosure and financial controls and corporate governance practices. Our management and other personnel will need to devote a substantial amount of time to these compliance initiatives. Moreover, these rules and regulations will increase our legal and financial compliance costs and will make some activities more time-consuming and costly. For example, we expect that these rules and regulations may make it more difficult and more expensive for us to obtain director and officer liability insurance. We may not be able to produce reliable financial statements or file these financial statements as part of a periodic report in a timely manner with the SEC or comply with the Nasdaq listing requirements. In addition, we could make errors in our financial statements that could require us to restate our financial statements.

Pursuant to Section 404 of the Sarbanes-Oxley Act of 2002, or Section 404, we will be required to furnish a report by our management on our internal control over financial reporting, including an attestation report on internal control over financial reporting issued by our independent registered public accounting firm. However, while we remain an emerging growth company, we will not be required to include an attestation report on internal control over financial reporting issued by our independent registered public accounting firm. To achieve compliance with Section 404 within the prescribed period, we will be engaged in a process to document and evaluate our internal control over financial reporting, which is both costly and challenging. In this regard, we will need to continue to dedicate internal resources, potentially engage outside consultants, and adopt a detailed work plan to assess and document the adequacy of internal control over financial reporting, continue steps to improve control processes as appropriate, validate through testing that controls are functioning as documented, and implement a continuous reporting and improvement process for internal control over financial reporting. Despite our efforts, there is a risk that neither we nor our independent registered public accounting firm will be able to conclude within the prescribed timeframe that our internal control over financial reporting is effective as required by Section 404. This could result in an adverse reaction in the financial markets due to a loss of confidence in the reliability of our financial statements.

In July 2010, the Dodd-Frank Wall Street Reform and Consumer Protection Act, or the Dodd-Frank Act, was enacted. There are significant corporate governance and executive compensation related provisions in the Dodd-Frank Act that require the SEC to adopt additional rules and regulations in these areas such as “say on pay” and proxy access. Recent legislation permits smaller “emerging growth companies” to implement many of these requirements over a longer period and up to five years from the pricing of this offering. We intend to take advantage of this new legislation but cannot guarantee that we will not be required to implement these requirements sooner than budgeted or planned and thereby incur unexpected expenses. Stockholder activism, the current political environment, and the current high level of government intervention and regulatory reform may lead to substantial new regulations and disclosure obligations, which may lead to additional compliance costs and impact the manner in which we operate our business in ways we cannot currently anticipate. Our management and other personnel will need to devote a substantial amount of time to these compliance initiatives.
We are in the early stages of developing our policies and practices regarding pre-approval access and any policy we develop and implement may result in a negative perception of our company and have a material adverse impact on our business.

As we advance our pipeline, patients and their physicians may seek access to our investigational medicines outside of sponsored clinical trials and prior to regulatory approval. While we will continue to review and respond to these early access requests, at this stage in our development of a new class of medicines, we are not providing access to our investigational medicines outside of the clinical trial setting. As our development programs progress further, we will continue our dialogue with patients and their families, advocacy leaders, physicians, and others on this and other topics. We will post our pre-approval access policies in accordance with regulatory guidelines.

As a general matter, we plan to report on the status of our development programs and anticipated next steps on a quarterly basis and periodically at industry conferences, but do not currently plan on providing forward-looking guidance regarding the expected timing of milestones in our business. We plan to report on the status of our programs, including the achievement of milestones and related data, on a retrospective basis, or as otherwise required by U.S. federal securities laws applicable to us, which may lead to speculation about our prospects that could have a material adverse effect on our business.

We believe the nature of our portfolio is not suitable to providing forward-looking guidance on the expected timing of individual program milestones, particularly data readout timing. While as a general matter we intend to periodically report on the status of our development programs, including articulating anticipated next steps in the form of development plans or potential data readouts, we do not currently plan to provide forward-looking guidance on the timing of those next steps. In addition, we do not control the timing of disclosure of any such milestones related to any of our programs that are managed by our strategic collaborators. Any disclosure by our strategic collaborators of data that is perceived as negative, whether or not such data is related to other data that we or others release, may have a material adverse impact on our stock price or overall valuation. Not providing forward-looking guidance on the expected timing of program milestones may lead to speculation by investors, shareholders, analysts, and other market participants and in the media as to the progress of our individual development candidates, investigational medicines, or our programs as a whole, which may have a material adverse impact on our stock price or valuation.

We are an “emerging growth company,” and the reduced disclosure requirements applicable to emerging growth companies may make our common stock less attractive to investors.

We are an “emerging growth company,” or EGC, as defined in the JOBS Act. We will remain an EGC until the earlier of:

(i) the last day of the fiscal year in which we have total annual gross revenues of $1.07 billion or more;

(ii) the last day of the fiscal year following the fifth anniversary of the date of the completion of this offering;

(iii) the date on which we have issued more than $1 billion in nonconvertible debt during the previous three years; or

(iv) the date on which we are deemed to be a large accelerated filer under the rules of the Securities and Exchange Commission or SEC, which means the first day of the year following the first year in which the market value of our common stock that is held by non-affiliates exceeds $700 million. For so long as we remain an EGC, we are permitted and intend to rely on exemptions from certain disclosure requirements that are applicable to other public companies that are not emerging growth companies. These exemptions include:

• not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act of 2002;

• not being required to comply with any requirement that may be adopted by the Public Company Accounting Oversight Board regarding mandatory audit firm rotation or a supplement to the auditor’s report providing additional information about the audit and the financial statements;

• reduced disclosure obligations regarding executive compensation; and
We may choose to take advantage of some, but not all, of the available exemptions. We have taken advantage of reduced reporting burdens in this prospectus. In particular, we have not included all of the executive compensation information that would be required if we were not an EGC. We cannot predict whether investors will find our common stock less attractive if we rely on certain or all of these exemptions. If some investors find our common stock less attractive as a result, there may be a less active trading market for our common stock and our stock price may be more volatile.

In addition, the JOBS Act provides that an EGC may take advantage of an extended transition period for complying with new or revised accounting standards. This allows an EGC to delay the adoption of certain accounting standards until those standards would otherwise apply to private companies. We have elected to avail ourselves of this exemption and, therefore, while we are an EGC we will not be subject to new or revised accounting standards at the same time that they become applicable to other public companies that are not EGCs.

A significant portion of our total outstanding shares of our common stock after this offering will be restricted from immediate resale but may be sold into the market in the near future. The large number of shares eligible for public sale or subject to rights requiring us to register them for public sale could cause the market price of our common stock to drop significantly, even if our business is performing well.

Sales of a substantial number of shares of our common stock in the public market could occur at any time, subject to certain restrictions described below. These sales, or the perception in the market that holders of a large number of shares intend to sell shares, could reduce the market price of our common stock. Based on shares of our common stock outstanding as of September 30, 2018, we will have shares of our common stock outstanding after this offering (or shares of common stock if the underwriters exercise their option to purchase additional shares in full).

In connection with our initial public offering, we, all of our directors and officers, and the holders of substantially all of our capital stock and securities convertible into or exchangeable for our capital stock have entered into lock-up agreements with the underwriters and/or are subject to market standoff agreements or other agreements with us under which we and they agreed, subject to specific exceptions, not to sell any of our stock for 180 days following the date of our initial public offering.

Upon completion of this offering, stockholders owning an aggregate of up to shares will be entitled, under contracts providing for registration rights, to require us to register shares owned by them for public sale in the United States. We also intend to file one or more registration statements on Form S-8 under the Securities Act to register all shares of common stock issued or issuable under our equity plans. Any such Form S-8 registration statements will automatically become effective upon filing. Accordingly, shares registered under such registration statements will be available for sale in the open market following the expiration of the applicable lock-up period. See the section titled “Shares Eligible for Future Sale” appearing elsewhere in this prospectus for a more detailed description of the restrictions on selling shares of our common stock.

Sales of our shares as restrictions end or pursuant to registration rights may make it more difficult for us to finance our operations through the sale of equity securities in the future at a time and at a price that we deem appropriate. These sales also could cause the trading price of our common stock to fall and make it more difficult for you to sell shares of our common stock.

If you purchase our common stock in this offering, you will incur immediate and substantial dilution in the book value of your shares.

You will suffer immediate and substantial dilution in the net tangible book value of our common stock if you purchase in this offering. Assuming an initial public offering price of $ per share, the midpoint of the price
range set forth on the cover page of this prospectus, after giving effect to this offering, purchasers of common stock in this offering will experience immediate dilution of $ per share in net tangible book value of our common shares. In addition, after giving effect to this offering, investors purchasing common stock in this offering will contribute % of the total amount invested by stockholders since inception but will only own % of the common stock outstanding. In the past, we issued options and other securities to acquire common stock at prices significantly below the initial public offering price. To the extent these outstanding securities are ultimately exercised, investors purchasing common stock in this offering will sustain further dilution. See the section titled “Dilution” appearing elsewhere in this prospectus for a more detailed description of the dilution to new investors in the offering.

Raising additional capital may cause dilution to our existing stockholders, restrict our operations, or require us to relinquish rights to our technologies or development candidates or investigational medicines.

We may seek additional capital through a combination of public and private equity offerings, debt financings, strategic alliances, and licensing arrangements. To the extent that we raise additional capital through the sale of equity or debt securities, your ownership interest will be diluted and the terms may include liquidation or other preferences that adversely affect your rights as a stockholder. The incurrence of indebtedness would result in increased fixed payment obligations and could involve restrictive covenants, such as limitations on our ability to incur additional debt, limitations on our ability to acquire or license intellectual property rights and other operating restrictions that could adversely impact our ability to conduct our business. If we raise additional funds through collaborations and alliances and licensing arrangements with third parties or through asset sales, we may have to relinquish valuable rights to our technologies or development candidates or investigational medicines, or grant licenses on terms unfavorable to us.

If securities analysts do not publish research or reports about our business or if they publish negative evaluations of our stock, the price of our stock could decline.

The trading market for our common stock will rely, in part, on the research and reports that industry or financial analysts publish about us or our business. We do not currently have, and may never obtain, research coverage by industry or financial analysts. If no, or few, analysts commence coverage of us, the trading price of our stock would likely decrease. Even if we do obtain analyst coverage, if one or more of the analysts covering our business down grade their evaluations of our stock, the price of our stock could decline. If one or more of these analysts cease to cover our stock, we could lose visibility in the market for our stock, which in turn could cause our stock price to decline.

Our principal stockholders and management own a significant percentage of our stock and will be able to exert significant control over matters subject to stockholder approval.

Our executive officers, directors, five percent stockholders, and their affiliates beneficially own approximately % of our common stock and, upon closing of this offering, that same group will beneficially own approximately % of our outstanding common stock. Therefore, even after this offering, these stockholders will have the ability to influence us through their ownership positions. For example, these stockholders, acting together, may be able to exert significant influence over matters such as elections of directors, amendments of our organizational documents, or approval of any merger, sale of assets, or other major corporate transaction. This may prevent or discourage unsolicited acquisition proposals or offers for our common stock that you may believe are in your best interest as one of our stockholders.

We have broad discretion in the use of our cash, cash equivalents and investments, including the net proceeds from this offering, and may not use them effectively.

Our management will have broad discretion in the application of our cash, cash equivalents and investments, including the net proceeds from this offering, and could spend the proceeds in ways that do not improve our
results of operations or enhance the value of our common stock. The failure by our management to apply these funds effectively could result in financial losses that could have a material adverse impact on our business, cause the price of our common stock to decline, and delay the development of our investigational medicines. Pending their use, we may invest our cash, cash equivalents and investments, including the net proceeds from this offering, in a manner that does not produce income or that loses value. See the section titled “Use of Proceeds” appearing elsewhere in this prospectus.

Provisions in our third amended and restated certificate of incorporation and by-laws, as well as provisions of Delaware law, could make it more difficult for a third party to acquire us or increase the cost of acquiring us, even if doing so would benefit our stockholders or remove our current management.

Our third amended and restated certificate of incorporation, by-laws, and Delaware law contain provisions that may have the effect of delaying or preventing a change in control of us or changes in our management. Our fourth amended and restated certificate of incorporation and amended and restated by-laws, which will become effective upon the closing of this offering, include provisions that:

• authorize “blank check” preferred stock, which could be issued by our board of directors without stockholder approval and may contain voting, liquidation, dividend, and other rights superior to our common stock;
• create a classified board of directors whose members serve staggered three-year terms;
• specify that special meetings of our stockholders can be called only by our board of directors, the chairperson of our board of directors, our chief executive officer, or our president;
• prohibit stockholder action by written consent;
• establish an advance notice procedure for stockholder approvals to be brought before an annual meeting of our stockholders, including proposed nominations of persons for election to our board of directors;
• provide that our directors may be removed only for cause;
• provide that vacancies on our board of directors may be filled only by a majority of directors then in office, even though less than a quorum;
• specify that no stockholder is permitted to cumulate votes at any election of directors;
• expressly authorize our board of directors to modify, alter, or repeal our amended and restated by-laws; and
• require supermajority votes of the holders of our common stock to amend specified provisions of our amended and restated certificate of incorporation and amended and restated by-laws.

These provisions, alone or together, could delay or prevent hostile takeovers and changes in control or changes in our management.

In addition, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporation Law, which limits the ability of stockholders owning in excess of 15% of our outstanding voting stock to merge or combine with us.

Any provision of our amended and restated certificate of incorporation or amended and restated by-laws or Delaware law that has the effect of delaying or deterring a change in control could limit the opportunity for our stockholders to receive a premium for their shares of our common stock, and could also affect the price that some investors are willing to pay for our common stock.

Because we do not anticipate paying any cash dividends on our capital stock in the foreseeable future, capital appreciation, if any, will be your sole source of gain.

We do not currently intend to declare or pay cash dividends on our capital stock. We currently intend to retain all of our future earnings, if any, to finance the growth and development of our business. In addition, the terms of
any future debt agreements may preclude us from paying dividends. As a result, capital appreciation, if any, of our common stock will be your sole source of gain for the foreseeable future.

**An active trading market for our common stock may not develop.**

Prior to this offering, there has been no public market for our common stock. The initial public offering price for our common stock will be determined through negotiations with the underwriters. Although we have applied to have our common stock listed on the Nasdaq Global Select Market, an active trading market for our shares may never develop or be sustained following this offering. If an active market for our common stock does not develop, it may be difficult for you to sell shares you purchase in this offering without depressing the market price for the shares, or at all.

**Our amended and restated by-laws will designate the Court of Chancery of the State of Delaware or the United States District Court for the District of Massachusetts as the exclusive forum for certain litigation that may be initiated by our stockholders, which could limit our stockholders' ability to obtain a favorable judicial forum for disputes with us.**

Pursuant to our amended and restated by-laws, as will be in effect upon the completion of this offering, unless we consent in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware will be the sole and exclusive forum for state law claims for (1) any derivative action or proceeding brought on our behalf; (2) any action asserting a claim of or based on a breach of a fiduciary duty owed by any of our current or former directors, officers, or other employees to us or our stockholders, (3) any action asserting a claim against us or any of our current or former directors, officers, employees, or stockholders arising pursuant to any provision of the Delaware General Corporation Law or our amended and restated by-laws, or (4) any action asserting a claim governed by the internal affairs doctrine. Our amended and restated by-laws will further provide that the United States District Court for the District of Massachusetts will be the exclusive forum for resolving any complaint asserting a cause of action arising under the Securities Act. In addition, our amended and restated by-laws will provide that any person or entity purchasing or otherwise acquiring any interest in shares of our common stock is deemed to have notice of and consented to the foregoing provisions; provided, however, that stockholders will not be deemed to have waived our compliance with the federal securities laws and the rules and regulations thereunder. We have chosen the United States District Court for the District of Massachusetts as the exclusive forum for such causes of action because our principal executive offices are located in Cambridge, MA. Some companies that have adopted similar federal district court forum selection provisions are currently subject to a suit in the Court of Chancery of the State of Delaware brought by stockholders who assert that the federal district court forum selection provision is not enforceable. We recognize that the federal district court forum selection clause may impose additional litigation costs on stockholders who assert the provision is not enforceable and may impose more general additional litigation costs in pursuing any such claims, particularly if the stockholders do not reside in or near the Commonwealth of Massachusetts. Additionally, the forum selection clauses in our amended and restated by-laws may limit our stockholders’ ability to obtain a favorable judicial forum for disputes with us. Alternatively, if the federal district court forum selection provision is found inapplicable to, or unenforceable in respect of, one or more of the specified types of actions or proceedings, we may incur additional costs associated with resolving such matters in other jurisdictions, which could have an adverse effect on our business, financial condition or results of operations. The United States District Court for the District of Massachusetts may also reach different judgments or results than would other courts, including courts where a stockholder considering an action may be located or would otherwise choose to bring the action, and such judgments may be more or less favorable to us than our stockholders.
This prospectus, including the sections entitled “Prospectus Summary,” “Risk Factors,” “Management’s Discussion and Analysis of Financial Condition and Results of Operations,” and “Business,” contains express or implied forward-looking statements that are based on our management’s belief and assumptions and on information currently available to our management. Although we believe that the expectations reflected in these forward-looking statements are reasonable, these statements relate to future events or our future operational or financial performance, and involve known and unknown risks, uncertainties, and other factors that may cause our actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by these forward-looking statements. Forward-looking statements in this prospectus include, but are not limited to, statements about:

- the initiation, timing, progress, results, and cost of our research and development programs and our current and future preclinical and clinical studies, including statements regarding the timing of initiation and completion of studies or trials and related preparatory work, the period during which the results of the trials will become available, and our research and development programs;
- our ability to identify research priorities and apply a risk-mitigated strategy to efficiently discover and develop investigational medicines, including by applying learnings from one program to other programs and from one modality to our other modalities;
- our ability and the potential to successfully manufacture our drug substances, delivery vehicles, and investigational medicines for preclinical use, for clinical trials and on a larger scale for commercial use, if approved;
- the ability and willingness of our third-party strategic collaborators to continue research and development activities relating to our development candidates and investigational medicines;
- our ability to obtain funding for our operations necessary to complete further development and commercialization of our investigational medicines;
- our ability to obtain and maintain regulatory approval of our investigational medicines;
- our ability to commercialize our products, if approved;
- the pricing and reimbursement of our investigational medicines, if approved;
- the implementation of our business model, and strategic plans for our business, investigational medicines, and technology;
- the scope of protection we are able to establish and maintain for intellectual property rights covering our investigational medicines and technology;
- estimates of our future expenses, revenues, capital requirements, and our needs for additional financing;
- the potential benefits of strategic collaboration agreements, our ability to enter into strategic collaborations or arrangements, and our ability to attract collaborators with development, regulatory and commercialization expertise;
- future agreements with third parties in connection with the commercialization of our investigational medicines and any other approved product;
- the size and growth potential of the markets for our investigational medicines, and our ability to serve those markets;
- our financial performance;
- the rate and degree of market acceptance of our investigational medicines;
- regulatory developments in the United States and foreign countries;
our ability to contract with third-party suppliers and manufacturers and their ability to perform adequately;
our ability to produce our products or investigational medicines with advantages in turnaround times or manufacturing cost;
the success of competing therapies that are or may become available;
our ability to attract and retain key scientific or management personnel;
the impact of laws and regulations;
our use of the proceeds from this offering;
developments relating to our competitors and our industry; and
other risks and uncertainties, including those listed under the caption “Risk Factors.”

In some cases, forward-looking statements can be identified by terminology such as “may,” “should,” “expects,” “intends,” “plans,” “anticipates,” “believes,” “estimates,” “predicts,” “potential,” “continue,” or the negative of these terms or other comparable terminology. These statements are only predictions. You should not place undue reliance on forward-looking statements because they involve known and unknown risks, uncertainties and other factors, which are, in some cases, beyond our control and which could materially affect results. Factors that may cause actual results to differ materially from current expectations include, among other things, those listed under the section entitled “Risk Factors” and elsewhere in this prospectus. If one or more of these risks or uncertainties occur, or if our underlying assumptions prove to be incorrect, actual events or results may vary significantly from those implied or projected by the forward-looking statements. No forward-looking statement is a guarantee of future performance. You should read this prospectus and the documents that we reference in this prospectus and have filed with the SEC as exhibits to the registration statement, of which this prospectus is a part, completely and with the understanding that our actual future results may be materially different from any future results expressed or implied by these forward-looking statements.

The forward-looking statements in this prospectus represent our views as of the date of this prospectus. We anticipate that subsequent events and developments will cause our views to change. However, while we may elect to update these forward-looking statements at some point in the future, we have no current intention of doing so except to the extent required by applicable law. You should therefore not rely on these forward-looking statements as representing our views as of any date subsequent to the date of this prospectus.

This prospectus includes statistical and other industry and market data that we obtained from industry publications and research, surveys and studies conducted by third parties. Industry publications and third-party research, surveys and studies generally indicate that their information has been obtained from sources believed to be reliable, although they do not guarantee the accuracy or completeness of such information. We are responsible for all of the disclosure contained in this prospectus, and we believe that these sources are reliable; however, we have not independently verified the information contained in such publications.
USE OF PROCEEDS

We estimate that our net proceeds from the sale of shares of our common stock in this offering will be approximately $\_ million, or $\_ million if the underwriters exercise in full their option to purchase additional shares, assuming an initial public offering price of $\_ per share, the midpoint of the price range set forth on the cover page of this prospectus, and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us.

A $1.00 increase (decrease) in the assumed initial public offering price of $\_ per share, the midpoint of the price range set forth on the cover page of this prospectus, would increase (decrease) our net proceeds from this offering by $\_ million, assuming the number of shares offered by us, as set forth on the cover page of this prospectus, remains the same and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us. A 1.0 million share increase (decrease) in the number of shares offered by us, as set forth on the cover page of this prospectus, would increase (decrease) our net proceeds from this offering by $\_ million, assuming no change in the assumed initial public offering price per share and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us.

The principal purposes of this offering are to create a public market for our common stock and thereby facilitate future access to the public equity markets, increase our visibility in the marketplace and obtain additional capital. We currently intend to use the net proceeds from this offering for the following:

• approximately $\_ million to $\_ million to fund drug discovery and clinical development, further expansion of our manufacturing platform and capabilities, and infrastructure to support our pipeline;

• approximately $\_ million to $\_ million to fund further development of our mRNA technology platform and the creation of new modalities; and

• the remainder to fund working capital and other general corporate purposes.

Our expected use of the net proceeds from this offering represents our intentions based upon our current plans and business conditions. As of the date of this prospectus, we cannot predict with certainty all of the particular uses for the net proceeds to be received upon the completion of this offering or the amounts that we will actually spend on the uses set forth above and we expect that we will require additional funds in order to fully accomplish the specified uses of the proceeds of this offering. We may also use a portion of the net proceeds to in-license, acquire, or invest in complementary businesses or technologies to continue to build our pipeline, research and development capabilities and our intellectual property position, although we currently have no agreements, commitments, or understandings with respect to any such transaction.

Due to the many inherent uncertainties in the development of our mRNA medicines, the amounts and timing of our actual expenditures may vary significantly depending on numerous factors, including the progress of our research and development, the timing of patient enrollment and evolving regulatory requirements, the timing and success of preclinical studies, our ongoing clinical studies or clinical studies we may commence in the future, the timing of regulatory submissions, any strategic alliances that we may enter into with third parties for our investigational medicines or strategic opportunities that become available to us, and any unforeseen cash needs.

Pending our use of the net proceeds from this offering, we intend to invest the net proceeds in a variety of capital preservation instruments, including short-term and long-term interest-bearing instruments, investment-grade securities, and direct or guaranteed obligations of the U.S. government. We cannot predict whether the proceeds invested will yield a favorable return. Our management will retain broad discretion in the application of the net proceeds we receive from our initial public offering, and investors will be relying on the judgment of our management regarding the application of the net proceeds.
DIVIDEND POLICY

We currently intend to retain all available funds and any future earnings to fund the growth and development of our business. We do not intend to pay cash dividends to our stockholders in the foreseeable future. Any future determination to declare dividends will be made at the discretion of our board of directors and will depend on our financial condition, operating results, capital requirements, general business conditions, and other factors that our board of directors may deem relevant.
On August 10, 2016, we completed a series of transactions pursuant to which Moderna LLC, a Delaware limited liability company, merged with and into MT MergerSub, Inc., a Delaware corporation and our wholly owned subsidiary, and Moderna LLC continued to exist as the surviving corporation and our wholly owned subsidiary. Throughout this prospectus, we refer to these transactions and the related transactions enumerated below, including the related contemporaneous ten-for-one forward stock split, collectively as the “2016 Reorganization.” To consummate the 2016 Reorganization, we filed a certificate of merger with the Secretary of State of the State of Delaware. In connection with the 2016 Reorganization:

- holders of Moderna LLC’s outstanding Series A preferred units received ten shares of our Series A preferred stock for each Series A preferred unit held immediately prior to the 2016 Reorganization, with an aggregate of 42,000,000 shares of our Series A preferred stock issued in the 2016 Reorganization;
- holders of Moderna LLC’s outstanding Series B preferred units received ten shares of our Series B preferred stock for each Series B preferred unit held immediately prior to the 2016 Reorganization, with an aggregate of 122,296,280 shares of our Series B preferred stock issued in the 2016 Reorganization;
- holders of Moderna LLC’s outstanding Series C preferred units received ten shares of our Series C preferred stock for each Series C preferred unit held immediately prior to the 2016 Reorganization, with an aggregate of 85,669,774 shares of our Series C preferred stock issued in the 2016 Reorganization;
- holders of Moderna LLC’s outstanding Series D preferred units received ten shares of our Series D preferred stock for each Series D preferred unit held immediately prior to the 2016 Reorganization, with an aggregate of 63,291,156 shares of our Series D preferred stock issued in the 2016 Reorganization;
- holders of Moderna LLC’s outstanding Series E preferred units received ten shares of our Series E preferred stock for each Series E preferred unit held immediately prior to the 2016 Reorganization, with an aggregate of 81,428,340 shares of our Series E preferred stock issued in the 2016 Reorganization;
- holders of Moderna LLC’s outstanding Series F preferred stock, Series G preferred stock, and Series H preferred stock are designated as preferred stock under our second amended and restated certificate of incorporation. Each of the Series A, Series B, Series C, Series D, Series E, Series F, and Series G preferred stock is convertible into common stock on a one-for-one basis, subject to adjustment for cash distributions previously made to the holders of such shares through the date of conversion by decreasing the number of shares of common stock into which the preferred stock will convert by an amount equal to the aggregate distributions divided by the

Subsequent to the 2016 Reorganization, we issued shares of Series F preferred stock, Series G preferred stock, and Series H preferred stock. Our Series A preferred stock, Series B preferred stock, Series C preferred stock, Series D preferred stock, Series E preferred stock, Series F preferred stock, Series G preferred stock, and Series H preferred stock are designated as preferred stock under our second amended and restated certificate of incorporation. Each of the Series A, Series B, Series C, Series D, Series E, Series F, and Series G preferred stock is convertible into common stock on a one-for-one basis, subject to adjustment for cash distributions previously made to the holders of such shares through the date of conversion by decreasing the number of shares of common stock into which the preferred stock will convert by an amount equal to the aggregate distributions divided by the
fair value of the common stock at the time of conversion. All such cash distributions to date were made prior to the 2016 Reorganization. As of September 30, 2018, the holders of Series A and Series B preferred stock have received cash distributions that will materially impact the applicable conversion ratio, while the holders of Series C, Series D and Series E preferred stock have received cash distributions that will not materially impact the applicable conversion ratio. The Series H preferred stock is not convertible at the option of the holder until after February 7, 2020, after which, it will be convertible into common stock on a one-for-2.485 basis because the applicable original issuance price for such series is $25.00 and the initial applicable conversion price is $10.06. In the event of an automatic conversion, the Series H preferred stock will convert at (a) in the case of an initial public offering, a conversion ratio equal to dividing the original issuance price of $25.00 by the greater of (i) the product of 0.9 multiplied by the initial public offering price per share of common stock set forth on the final prospectus of such offering and (ii) $10.06 or (b) in the case of a liquidation, dissolution, or winding up, a conversion ratio equal to dividing the original issuance price by the greater of (i) the product of 0.9 multiplied by the consideration per share payable to the holders of common stock, in their capacity as such, in connection with such transaction and (ii) $10.06.

If the initial public offering price is equal to the midpoint of the estimated offering price range set forth on the cover page of this prospectus, the shares of our Series A preferred stock will convert into shares of our common stock. The number of shares of common stock into which the Series A preferred stock is converted will be adjusted in respect of cash distributions made to the holders of Series A preferred stock through the date of conversion by decreasing the number of shares of common stock into which the Series A preferred stock will convert by a number of shares equal to such cash distributions divided by the price to the public per share of common stock sold pursuant to this prospectus. A $1.00 decrease in the initial public offering price would increase the number of shares of our common stock issuable upon conversion of our Series A preferred stock by shares, and a $1.00 increase in the initial public offering price would decrease the number of shares of our common stock issuable upon conversion of our Series A preferred stock by shares.

If the initial public offering price is equal to the midpoint of the estimated offering price range set forth on the cover page of this prospectus, the shares of our Series B preferred stock will convert into shares of our common stock. The number of shares of common stock into which the Series B preferred stock is converted will be adjusted in respect of cash distributions made to the holders of Series B preferred stock through the date of conversion by decreasing the number of shares of common stock into which the Series B preferred stock will convert by a number of shares equal to such cash distributions divided by the price to the public per share of common stock sold pursuant to this prospectus. A $1.00 decrease in the initial public offering price would increase the number of shares of our common stock issuable upon conversion of our Series B preferred stock by shares, and a $1.00 increase in the initial public offering price would decrease the number of shares of our common stock issuable upon conversion of our Series B preferred stock by shares.

If the initial public offering price is equal to the midpoint of the estimated offering price range set forth on the cover page of this prospectus, the shares of our Series H preferred stock will convert into shares of our common stock. The Series H preferred stock will convert into common stock at a conversion ratio equal to the quotient obtained by dividing the original issue price of $25.00 per preferred share by the greater of (i) the product of 0.9 multiplied by the initial public offering price per share of common stock sold pursuant to this prospectus and (ii) $10.06. A $1.00 decrease in the initial public offering price would increase the number of shares of our common stock issuable upon conversion of our Series H preferred stock by shares, and a $1.00 increase in the initial public offering price would decrease the number of shares of our common stock issuable upon conversion of our Series H preferred stock by shares.

In connection with the 2016 Reorganization, by operation of law, we acquired all assets of Moderna LLC and assumed all of its liabilities and obligations. The purpose of the 2016 Reorganization was to reorganize our corporate structure so that our Company would continue as a corporation and so that our existing investors would own our capital stock rather than equity interests in a limited liability company. For the convenience of the reader, except as context otherwise requires, all information included in this prospectus is presented giving effect to the 2016 Reorganization.
On July 16, 2018, Moderna LLC was merged into ModernaTX, Inc. with ModernaTX, Inc. continuing to exist as the surviving corporation and our wholly owned subsidiary. Additionally, on August 28, 2018, Moderna Therapeutics, Inc. changed its name to Moderna, Inc. Moderna Inc., a Delaware corporation, is the issuer of the shares of common stock offered by this prospectus.
## CAPITALIZATION

The following table sets forth our cash, cash equivalents, restricted cash, and investments and our capitalization as of September 30, 2018:

- on an actual basis;
- on a pro forma basis to give effect to (i) the conversion of all outstanding shares of our preferred stock into an aggregate of __ shares of common stock immediately prior to the completion of this offering (assuming an initial public offering price of $__ per share, the midpoint of the price range set forth on the cover page of this prospectus), (ii) the vesting of certain of our performance-based restricted stock units which will vest upon the closing of this offering, and (iii) the filing and effectiveness of our amended and restated certificate of incorporation upon the closing of this offering; and
- on a pro forma as adjusted basis to give further effect to our sale in this offering of __ shares of common stock at an assumed initial public offering price of $__ per share, the midpoint of the price range set forth on the cover page of this prospectus, after deducting the estimated underwriting discounts and commissions and estimated offering expenses payable by us.

The pro forma as adjusted information below is illustrative only, and our capitalization following the completion of this offering will be adjusted based on the actual initial public offering price and other terms of this offering determined at pricing.

The following table should be read together with “Management’s Discussion and Analysis of Financial Condition and Results of Operations,” “Description of Capital Stock,” and the consolidated financial statements and related notes appearing elsewhere in this prospectus.

<table>
<thead>
<tr>
<th>As of September 30, 2018</th>
<th>Actual</th>
<th>Pro Forma(1)</th>
<th>Pro Forma As Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>(in thousands, except share and per share data)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash, cash equivalents, restricted cash, and investments</td>
<td>$1,234,921</td>
<td>$1,234,921</td>
<td>$__</td>
</tr>
<tr>
<td>Redeemable convertible preferred stock (Series A, Series B, Series C, Series D, Series E, Series F, Series G, and Series H), $0.0001 par value; 508,539,515 shares authorized; 508,539,515 shares issued and outstanding, actual; no shares authorized, issued or outstanding, pro forma and pro forma as adjusted</td>
<td>$1,833,561</td>
<td>$__</td>
<td>$__</td>
</tr>
<tr>
<td>Stockholders’ (deficit) equity:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preferred stock, $0.0001 par value; no shares authorized, issued or outstanding, actual; shares authorized, no shares issued or outstanding, pro forma and pro forma as adjusted</td>
<td>$14</td>
<td>$__</td>
<td>$__</td>
</tr>
<tr>
<td>Common stock, $0.0001 par value; 775,000,000 shares authorized, 144,649,816 shares issued and outstanding, actual; shares authorized, shares issued and outstanding, pro forma and pro forma as adjusted</td>
<td>108,980</td>
<td>$757,129</td>
<td>$__</td>
</tr>
<tr>
<td>Accumulated other comprehensive loss</td>
<td>(922)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accumulated deficit</td>
<td>(865,201)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total stockholders’ (deficit) equity</td>
<td>$1,076,432</td>
<td>$__</td>
<td>$__</td>
</tr>
<tr>
<td>Total capitalization</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) If the initial public offering price is equal to the midpoint of the estimated offering price range set forth on the cover page of this prospectus, the shares of our Series A preferred stock will convert into __ shares of our common stock. The number of shares of common stock into which the Series A preferred stock is converted will be adjusted in respect of cash distributions made to the holders of Series A preferred stock through the date of conversion by decreasing the number of shares of common stock into which the Series A preferred stock will
convert by a number of shares equal to such cash distributions divided by the price to the public per share of common stock sold pursuant to this prospectus. A $1.00 decrease in the initial public offering price would increase the number of shares of our common stock issuable upon conversion of our Series A preferred stock by shares, and a $1.00 increase in the initial public offering price would decrease the number of shares of our common stock issuable upon conversion of our Series A preferred stock by shares.

If the initial public offering price is equal to the midpoint of the estimated offering price range set forth on the cover page of this prospectus, the shares of our Series B preferred stock will convert into shares of our common stock. The number of shares of common stock into which the Series B preferred stock is converted will be adjusted in respect of cash distributions made to the holders of Series B preferred stock through the date of conversion by decreasing the number of shares of common stock into which the Series B preferred stock will convert by a number of shares equal to such cash distributions divided by the price to the public per share of common stock sold pursuant to this prospectus. A $1.00 decrease in the initial public offering price would increase the number of shares of our common stock issuable upon conversion of our Series B preferred stock by shares, and a $1.00 increase in the initial public offering price would decrease the number of shares of our common stock issuable upon conversion of our Series B preferred stock by shares.

If the initial public offering price is equal to the midpoint of the estimated offering price range set forth on the cover page of this prospectus, the shares of our Series H preferred stock will convert into shares of our common stock. The Series H preferred stock will convert at into common stock at a conversion ratio equal to the quotient obtained by dividing the original issue price of $25.00 per preferred share by the greater of (i) the product of 0.9 multiplied by the initial public offering price per share of common stock sold pursuant to this prospectus and (ii) $10.06. A $1.00 decrease in the initial public offering price would increase the number of shares of our common stock issuable upon conversion of our Series H preferred stock by shares, and a $1.00 increase in the initial public offering price would decrease the number of shares of our common stock issuable upon conversion of our Series H preferred stock by shares.

A $1.00 increase (decrease) in the assumed initial public offering price of $ per share, the midpoint of the price range set forth on the cover page of this prospectus, would increase (decrease) the pro forma as adjusted amount of cash, common stock and additional paid-in capital, total stockholders' equity, and total capitalization by approximately $ million, assuming the number of shares offered by us, as set forth on the cover page of this prospectus, remains the same and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us. Similarly, each increase (decrease) of 1.0 million shares in the number of shares offered by us would increase (decrease) the pro forma as adjusted amount of cash, common stock and additional paid-in capital, total stockholders' equity and total capitalization by approximately $ million, assuming an initial public offering price of $ per share, the midpoint of the price range set forth on the cover page of this prospectus, remains the same, and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us. The pro forma as adjusted information is illustrative only, and our capitalization following the completion of this offering will be adjusted based on the actual initial public offering price and other terms of this offering determined at pricing.

The actual, pro forma, and pro forma as adjusted information set forth in the table excludes:

- 96,086,048 shares of common stock issuable upon the exercise of stock options outstanding as of September 30, 2018, at a weighted average exercise price of $4.84 per share;
- 1,000,000 shares of common stock issuable upon the vesting and settlement of restricted stock units that were outstanding as of September 30, 2018;
- shares of our common stock that will become available for future issuance under our 2018 Stock Plan, which will become effective in connection with the completion of this offering, inclusive of 10,000,000 shares of common stock issuable upon the exercise of a common stock option subject to service-based vesting to be granted to our Chief Executive Officer immediately following the effectiveness of the registration statement of which this prospectus is a part; and
- shares of our common stock that will become available for future issuance under our ESPP, which will become effective in connection with the completion of this offering.
DILUTION

If you invest in our common stock in this offering, your ownership interest will be diluted immediately to the extent of the difference between the initial public offering price per share of our common stock and the pro forma as adjusted net tangible book value per share of our common stock immediately after this offering.

Our historical net tangible book value as of September 30, 2018 was $1,076 million, or $7.44 per share of our common stock. Our historical net tangible book value is the amount of our total tangible assets less our total liabilities. Historical net tangible book value per share represents historical net tangible book value divided by the 144,649,816 shares of our common stock outstanding as of September 30, 2018.

Our pro forma net tangible book value as of September 30, 2018 was $        million, or $        per share of our common stock. Pro forma net tangible book value per share represents historical net tangible book value divided by the total number of shares of common stock outstanding as of September 30, 2018, after giving effect to the conversion of all shares of our preferred stock then outstanding into shares of common stock upon the closing of this offering (assuming an initial public offering price of $        per share, the midpoint of the price range set forth on the cover page of this prospectus) and the vesting of certain of our performance-based restricted stock units which will vest upon the closing of our initial public offering.

After giving further effect to the sale of shares of common stock upon the closing of this offering at the assumed initial public offering price of $        per share, the midpoint of the price range set forth on the cover page of this prospectus, and after deducting the estimated underwriting discounts and commissions and estimated offering expenses payable by us, our pro forma as adjusted net tangible book value as of would have been approximately $        million, or approximately $        per share. This amount represents an immediate increase in pro forma net tangible book value of $        per share to our existing stockholders and an immediate dilution in pro forma net tangible book value of approximately $        per share to investors participating in this offering.

Dilution per share to investors participating in this offering is determined by subtracting pro forma as adjusted net tangible book value per share after this offering from the assumed initial public offering price per share paid by investors participating in this offering. The following table illustrates this dilution (without giving effect to any exercise by the underwriters of their option to purchase up to additional shares of common stock in this offering):

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assumed initial public offering price per share</td>
<td>$</td>
</tr>
<tr>
<td>Historical net tangible book value per share as of September 30, 2018</td>
<td>$7.44</td>
</tr>
<tr>
<td>Pro forma decrease in historical net tangible book value attributable to pro forma adjustments described in preceding paragraphs</td>
<td></td>
</tr>
<tr>
<td>Pro forma net tangible book value per share as of September 30, 2018</td>
<td></td>
</tr>
<tr>
<td>Increase in pro forma net tangible book value per share attributable to investors participating in this offering</td>
<td></td>
</tr>
<tr>
<td>Pro forma as adjusted net tangible book value per share after this offering</td>
<td></td>
</tr>
<tr>
<td>Dilution per share to new investors participating in this offering</td>
<td>$</td>
</tr>
</tbody>
</table>

If the underwriters exercise their option to purchase additional shares of common stock in this offering in full at the assumed initial public offering price of $        per share, the midpoint of the price range set forth on the cover of this prospectus and assuming the number of shares offered by us, as set forth on the cover page of this prospectus, remains the same and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us, the pro forma as adjusted net tangible book value would be $        per share, and the dilution in pro forma net tangible book value per share to investors in this offering would be $        per share.
A $1.00 increase (decrease) in the assumed initial public offering price of $ per share, the midpoint of the price range set forth on the cover page of this prospectus, would increase (decrease) the pro forma as adjusted net tangible book value by $ per share and the dilution to investors participating in this offering by $ per share, assuming the number of shares offered by us, as set forth on the cover page of this prospectus, remains the same, and after deducting estimated underwriting discounts and commissions and estimated expenses payable by us. Similarly, each increase (decrease) of 1.0 million shares in the number of shares offered by us would increase (decrease) the pro forma as adjusted net tangible book value by $ per share and the dilution to investors participating in this offering by $ per share, assuming the assumed initial public offering price of $ per share, the midpoint of the price range set forth on the cover page of this prospectus, remains the same and after deducting estimated underwriting discounts and commissions and estimated expenses payable by us.

If the initial public offering price is equal to the midpoint of the estimated offering price range set forth on the cover page of this prospectus, the shares of our Series A preferred stock will convert into shares of our common stock. The number of shares of common stock into which the Series A preferred stock is converted will be adjusted in respect of cash distributions made to the holders of Series A preferred stock through the date of conversion by decreasing the number of shares of common stock into which the Series A preferred stock will convert by a number of shares equal to such cash distributions divided by the price to the public per share of common stock sold pursuant to this prospectus. A $1.00 decrease in the initial public offering price would increase the number of shares of our common stock issuable upon conversion of our Series A preferred stock by shares, and a $1.00 increase in the initial public offering price would decrease the number of shares of our common stock issuable upon conversion of our Series A preferred stock by shares.

If the initial public offering price is equal to the midpoint of the estimated offering price range set forth on the cover page of this prospectus, the shares of our Series B preferred stock will convert into shares of our common stock. The number of shares of common stock into which the Series B preferred stock is converted will be adjusted in respect of cash distributions made to the holders of Series B preferred stock through the date of conversion by decreasing the number of shares of common stock into which the Series B preferred stock will convert by a number of shares equal to such cash distributions divided by the price to the public per share of common stock sold pursuant to this prospectus. A $1.00 decrease in the initial public offering price would increase the number of shares of our common stock issuable upon conversion of our Series B preferred stock by shares, and a $1.00 increase in the initial public offering price would decrease the number of shares of our common stock issuable upon conversion of our Series B preferred stock by shares.

If the initial public offering price is equal to the midpoint of the estimated offering price range set forth on the cover page of this prospectus, the shares of our Series H preferred stock will convert into shares of our common stock. The Series H preferred stock will convert into common stock at a conversion ratio equal to the quotient obtained by dividing the original issue price of $25.00 per preferred share by the greater of (i) the product of 0.9 multiplied by the initial public offering price per share of common stock sold pursuant to this prospectus and (ii) $10.06. A $1.00 decrease in the initial public offering price would increase the number of shares of our common stock issuable upon conversion of our Series H preferred stock by shares, and a $1.00 increase in the initial public offering price would decrease the number of shares of our common stock issuable upon conversion of our Series H preferred stock by shares.
The following table summarizes, on a pro forma as adjusted basis, as of September 30, 2018, the difference between the number of shares of common stock purchased from us, the total consideration paid to us, and the average price per share paid by existing stockholders and by investors in this offering at an assumed initial public offering price of $ per share, the midpoint of the price range set forth on the cover page of this prospectus, before deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us.

<table>
<thead>
<tr>
<th>Shares Purchased</th>
<th>Total Consideration</th>
<th>Average Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
</tr>
<tr>
<td>Existing stockholders</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Investors in this offering</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The above discussion and tables are based on shares of common stock issued and outstanding as of September 30, 2018 and (i) includes additional shares of our common stock issuable upon the conversion of all outstanding shares of our preferred stock into shares of common stock upon the closing of this offering (assuming an initial public offering price of $ per share, the midpoint of the price range set forth on the cover page of this prospectus), (ii) the vesting of 750,000 performance-based restricted stock units which will vest upon the closing of this offering, and (iii) excludes:

- 96,086,048 shares of common stock issuable upon the exercise of stock options outstanding as of September 30, 2018, at a weighted average exercise price of $4.84 per share;
- 1,000,000 shares of common stock issuable upon the vesting and settlement of restricted stock units that were outstanding as of September 30, 2018;
- shares of our common stock that will become available for future issuance under our 2018 Stock Plan, which will become effective in connection with the completion of this offering, inclusive of 10,000,000 shares of common stock issuable upon the exercise of a common stock option subject to service-based vesting to be granted to our Chief Executive Officer immediately following the effectiveness of the registration statement of which this prospectus is a part; and
- shares of our common stock that will become available for future issuance under our ESPP, which will become effective in connection with the completion of this offering.

A $1.00 increase (decrease) in the assumed initial public offering price of $ per share, the midpoint of the price range set forth on the cover page of this prospectus, would increase (decrease) the total consideration paid by investors in this offering by approximately $ million, assuming the number of shares offered by us, as set forth on the cover page of this prospectus, remains the same and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us. Similarly, each increase (decrease) of 1.0 million shares in the number of shares offered by us would increase (decrease) the total consideration paid by investors in this offering by approximately $ million, assuming the assumed initial public offering price of $ per share, the midpoint of the price range set forth on the cover page of this prospectus, remains the same, and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us.

To the extent that outstanding options are exercised or shares are issued under our 2016 Plan or 2018 Stock Option and Incentive Plan, you will experience further dilution. In addition, we may choose to raise additional capital due to market conditions or strategic considerations even if we believe we have sufficient funds for our current or future operating plans. To the extent that additional capital is raised through the sale of equity or convertible debt securities, the issuance of these securities may result in further dilution to our stockholders.
SELECTED CONSOLIDATED FINANCIAL DATA

The selected consolidated financial data set forth below should be read together with our consolidated financial statements and the related notes to those statements, as well as the section of this prospectus titled “Management’s Discussion and Analysis of Financial Condition and Results of Operations.” The statements of operations data for the years ended December 31, 2016 and 2017 and the balance sheet data as of December 31, 2016 and 2017 have been derived from our audited consolidated financial statements included elsewhere in this prospectus. The statements of operations data for the nine months ended September 30, 2017 and 2018 and the balance sheet data as of September 30, 2018 have been derived from our unaudited condensed consolidated financial statements included elsewhere in this prospectus. In the opinion of management, the unaudited data reflects all adjustments, consisting only of normal recurring adjustments, necessary for a fair presentation of the financial information in those statements. Our historical results are not necessarily indicative of results that may be expected in the future.

<table>
<thead>
<tr>
<th>Statement of Operations Data:</th>
<th>Year Ended December 31,</th>
<th>Nine Months Ended September 30,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td></td>
<td>(in thousands, except share and per share data)</td>
<td></td>
</tr>
<tr>
<td>Revenue:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration revenue</td>
<td>$101,536</td>
<td>$176,974</td>
</tr>
<tr>
<td>Grant revenue</td>
<td>6,860</td>
<td>28,851</td>
</tr>
<tr>
<td>Total revenue</td>
<td>108,396</td>
<td>205,825</td>
</tr>
<tr>
<td>Operating expenses:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research and development</td>
<td>274,717</td>
<td>410,459</td>
</tr>
<tr>
<td>General and administrative</td>
<td>57,450</td>
<td>64,722</td>
</tr>
<tr>
<td>Total operating expenses</td>
<td>332,167</td>
<td>475,181</td>
</tr>
<tr>
<td>Loss from operations</td>
<td>(223,771)</td>
<td>(269,356)</td>
</tr>
<tr>
<td>Interest income</td>
<td>11,312</td>
<td>15,235</td>
</tr>
<tr>
<td>Other expense, net</td>
<td>(2,709)</td>
<td>(1,875)</td>
</tr>
<tr>
<td>Loss before provision for (benefit from) income taxes</td>
<td>(215,168)</td>
<td>(255,996)</td>
</tr>
<tr>
<td>Provision for (benefit from) income taxes</td>
<td>1,043</td>
<td>(80)</td>
</tr>
<tr>
<td>Net loss</td>
<td>(216,211)</td>
<td>(255,916)</td>
</tr>
<tr>
<td>Reconciliation of net loss to net loss attributable to common stockholders:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Premium paid on repurchase of redeemable stock</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Accretion of redeemable convertible preferred units to redemption value</td>
<td>(8,663)</td>
<td>—</td>
</tr>
<tr>
<td>Cumulative preferred stock dividends</td>
<td>(5,440)</td>
<td>(13,925)</td>
</tr>
<tr>
<td>Net loss attributable to common stockholders</td>
<td>$ (230,314)</td>
<td>$ (269,841)</td>
</tr>
<tr>
<td>Net loss per share attributable to common stockholders, basic and diluted(1)</td>
<td>$ (1.74)</td>
<td>$ (1.92)</td>
</tr>
<tr>
<td>Weighted average common shares used in net loss per share attributable to common stockholders, basic and diluted</td>
<td>132,429,389</td>
<td>140,604,647</td>
</tr>
<tr>
<td>Pro forma net loss per share attributable to common stockholders, basic and diluted (unaudited)(1)</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>Pro forma weighted average common shares used in pro forma net loss per share attributable to common stockholders, basic and diluted (unaudited)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Table of Contents

<table>
<thead>
<tr>
<th></th>
<th>As of December 31, (in thousands)</th>
<th>As of September 30, (in thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td>Cash, cash equivalents, restricted cash, and investments</td>
<td>$1,306,187</td>
<td>$914,629</td>
</tr>
<tr>
<td>Working capital (2)</td>
<td>924,350</td>
<td>591,762</td>
</tr>
<tr>
<td>Total assets</td>
<td>1,417,161</td>
<td>1,084,489</td>
</tr>
<tr>
<td>Total deferred revenue</td>
<td>501,989</td>
<td>339,668</td>
</tr>
<tr>
<td>Redeemable convertible preferred stock</td>
<td>1,176,661</td>
<td>1,176,661</td>
</tr>
<tr>
<td>Total stockholders' (deficit) equity</td>
<td>(334,810)</td>
<td>(551,365)</td>
</tr>
</tbody>
</table>

(1) Basic and diluted net loss per share attributable to common stockholders give effect to the conversion of all redeemable preferred units to preferred stock and give effect to the ten-for-one forward stock split completed in connection with the 2016 Reorganization. Additionally, basic and diluted pro forma net loss per share attributable to common stockholders give effect to the conversion of all shares of preferred stock into shares of common stock and the vesting of certain of our performance-based restricted stock units which will vest upon the closing of this offering, assuming such conversion or vesting occurred on the later of the first day in the period or the issuance date of the corresponding equity instruments and assuming an initial public offering price equal to the midpoint of the estimated offering price range set forth on the cover page of this prospectus.

(2) We define working capital as current assets less current liabilities.

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You should read the following discussion and analysis of our financial condition and results of operations together with our consolidated financial statements and related notes and other financial information appearing elsewhere in this prospectus. Some of the information contained in this discussion and analysis or set forth elsewhere in this prospectus, including information with respect to our plans and strategy for our business and related financing, includes forward-looking statements that involve risks and uncertainties. As a result of many factors, including those factors set forth in the “Risk Factors” section of this prospectus, our actual results could differ materially from the results described in or implied by the forward-looking statements contained in the following discussion and analysis.

Overview
We are creating a new category of transformative medicines based on mRNA to improve the lives of patients. From the beginning, we designed our strategy and operations to realize the full potential value and impact of mRNA over a long time horizon across a broad array of human diseases. We built and continue to invest in a platform to advance the technological frontier of mRNA medicines. We have made forward investments in scalable infrastructure and capabilities to pursue a pipeline of potential medicines that reflect the breadth of the mRNA opportunity. Since we nominated our first program in late 2014, we and our strategic collaborators have advanced in parallel a diverse development pipeline of 21 programs, 10 of which have entered clinical studies. Our therapeutic and vaccine development programs span infectious diseases, oncology, cardiovascular diseases, and rare genetic diseases. We have assembled an exceptional team of approximately 680 employees and have established strategic alliances with leading biopharmaceutical companies, including AstraZeneca, Merck & Co., or Merck, and Vertex Pharmaceuticals, or Vertex, as well as government-sponsored and private organizations focused on global health initiatives, including Biomedical Advanced Research and Development Authority, or BARDA, Defense Advanced Research Projects Agency, or DARPA, and the Bill & Melinda Gates Foundation. As of September 30, 2018, we have raised over $2.6 billion in total funding from our strategic collaborators and investors, and have cash, cash equivalents, and investments of $1.2 billion. As we unlock the inherent advantages of mRNA, we aim to address as many diseases and impact as many patients as our technology, talent, and capital permit.

The broad potential applications of mRNA medicines have led us to raise significant capital and adopt a long-term approach to capital allocation that balances near-term risks and long-term value creation. From inception to September 30, 2018 we have raised over $2.6 billion in total funding from a wide range of strategic sources, including $0.8 billion in upfront payments, milestone payments and option exercise payments from AstraZeneca, Merck, Alexion Pharma Holdings, or Alexion, and Vertex, and $1.8 billion of financing from equity investors. We use this capital to fund operations and investing activities across research for technology creation, drug discovery and clinical development programs, infrastructure and capabilities to enable the Research Engine and Early Development Engine (which includes our manufacturing facility in Norwood), our digital infrastructure, creation of our portfolio of intellectual property, and administrative support.

Since inception, we have incurred significant operating losses. Our net losses were $216.2 million and $255.9 million for the years ended December 31, 2016 and 2017, respectively, and $218.0 million and $243.3 million for the nine months ended September 30, 2017 and 2018, respectively. As of December 31, 2017 and September 30, 2018, our accumulated deficit was $621.9 million and $865.2 million, respectively. We expect to continue to incur significant expenses and operating losses for the foreseeable future. In addition, we anticipate that our expenses will increase significantly in connection with our ongoing activities, as we:

- continue our platform research and drug discovery and development efforts;
- conduct clinical studies for our investigational medicines;
- manufacture clinical study materials and develop large-scale manufacturing capabilities;
seek regulatory approval for our investigational medicines; maintain, expand, and protect our intellectual property; and hire additional personnel to support our program development effort to obtain regulatory approval and secure additional facilities for operations; and to operate as a public company upon the completion of this offering.

We do not expect to generate revenue from the sale of potential mRNA medicines unless and until we successfully complete clinical development and obtain regulatory approval for one or more of our investigational medicines. If we seek to obtain regulatory approval for any of our investigational medicines, we expect to incur significant commercialization expenses.

As a result, we will need substantial additional funding to support our continued operations and pursue our growth strategy. Until we can generate significant revenue from medicine sales, if ever, we expect to finance our operations through a combination of public or private equity offerings and debt financings, government funding arrangements, strategic alliances and marketing, distribution, and licensing arrangements. We may be unable to raise additional funds or enter into such other agreements on favorable terms, or at all. If we fail to raise capital or enter into such agreements as, and when needed, we may have to significantly delay, scale back, or discontinue the development and commercialization of one or more of our programs.

Because of the numerous risks and uncertainties associated with pharmaceutical development, we are unable to predict the timing or amount of increased expenses or when or if we will be able to achieve or maintain profitability. Even if we are able to generate revenues from the sale of our medicines, we may not become profitable. If we fail to become profitable or are unable to sustain profitability on a continuing basis, then we may be unable to continue our operations at planned levels and be forced to reduce our operations.

Financial operations overview

Revenue

To date, we have not generated any revenue from the sale of potential mRNA medicines. Our revenue has been primarily derived from strategic alliances with strategic collaborators and government-sponsored and private organizations to discover, develop, and commercialize potential mRNA medicines.

The following is a summary of revenue recognized for the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018 (in thousands):

<table>
<thead>
<tr>
<th></th>
<th>Year Ended December 31,</th>
<th>Nine Months Ended September 30,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td>Collaboration revenue</td>
<td>$ 101,536</td>
<td>$ 176,974</td>
</tr>
<tr>
<td>Grant revenue</td>
<td>6,860</td>
<td>28,851</td>
</tr>
<tr>
<td>Total revenue</td>
<td>$ 108,396</td>
<td>$ 205,825</td>
</tr>
</tbody>
</table>

(1) Includes collaboration revenue from an affiliate.

Total revenue for the years ended December 31, 2016 and 2017 was $108.4 million and $205.8 million, respectively, and for the nine months ended September 30, 2017 and 2018 was $113.9 million and $99.6 million, respectively. Cash received from strategic alliances was $324.2 million and $43.1 million for the years ended December 31, 2016 and 2017, respectively, and was $34.8 million and $51.4 million for the nine months ended September 30, 2017 and 2018, respectively.
The timing of revenue recognition is not directly correlated to the timing of cash receipts. Total deferred revenue related to our strategic alliances as of December 31, 2016 and 2017 and September 30, 2018, was $502.0 million, $339.7 million and $302.6 million, respectively.

The following table summarizes collaboration revenue for the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018 (in thousands):

<table>
<thead>
<tr>
<th></th>
<th>Year Ended December 31,</th>
<th>Nine Months Ended September 30,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td>Collaboration revenue:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AstraZeneca</td>
<td>$32,427</td>
<td>$30,021</td>
</tr>
<tr>
<td>Merck</td>
<td>47,708</td>
<td>62,895</td>
</tr>
<tr>
<td>Vertex</td>
<td>3,456</td>
<td>9,138</td>
</tr>
<tr>
<td>Alexion</td>
<td>17,191</td>
<td>74,365</td>
</tr>
<tr>
<td>Other</td>
<td>754</td>
<td>555</td>
</tr>
<tr>
<td>Total collaboration revenue</td>
<td>$101,536</td>
<td>$176,974</td>
</tr>
</tbody>
</table>

Collaboration revenue for the years ended December 31, 2016 and 2017 was generated primarily from our strategic alliances with AstraZeneca, Merck, Vertex and Alexion. Our arrangements with Alexion were terminated in October 2017 and all rights to mRNA researched, developed, or supplied as part of the programs with Alexion reverted back to us.

Grant revenue is generated primarily from contracts with DARPA, BARDA, and the Bill & Melinda Gates Foundation, to develop novel mRNA medicines.

For further information on our revenue recognition policies, see “Critical accounting policies and significant judgments and estimates—Revenue recognition.”

Our ability to generate revenue from sales of mRNA medicines and become profitable depends upon our ability to successfully commercialize mRNA medicines. For the foreseeable future, we do not expect revenue from product sales. To the extent that existing or potential future strategic alliances generate revenue, our revenue may vary due to many uncertainties in the development of our mRNA medicines and other factors. We expect to incur losses for the foreseeable future, and we expect these losses to increase as we continue our research and development efforts. We expect our programs to mature and advance to later stage clinical development we expect expenses to increase and seek regulatory approvals for our investigational medicines and begin to commercialize any approved mRNA medicines.

Research and development expenses

The nature of our business and primary focus of our activities generate a significant amount of research and development costs. Research and development expenses represent costs incurred by us for the following:

- cost to develop our platform;
- discovery efforts leading to development candidates;
- clinical development costs for our programs;
- cost to develop our manufacturing technology and infrastructure; and
- digital infrastructure costs.
The costs above comprise the following categories:

- personnel-related expenses, including salaries, benefits, and stock-based compensation expense;
- expenses incurred under agreements with third parties, such as consultants, investigative sites, contract research organizations, or CROs, that conduct our preclinical and clinical studies, and in-licensing arrangements;
- costs of acquiring, developing, and manufacturing materials for preclinical and clinical studies, including both internal manufacturing and third-party contract manufacturing organizations, or CMOs;
- expenses incurred for the procurement of materials, laboratory supplies, and non-capital equipment used in the research and development process; and
- facilities, depreciation, and amortization, and other direct and allocated expenses incurred as a result of research and development activities.

We use our employee and infrastructure resources for the advancement of our platform, and for discovering and developing programs. Due to the number of ongoing programs and our ability to use resources across several projects, indirect or shared operating costs incurred for our research and development programs are not recorded or maintained on a program- or modality-specific basis.

The following table reflects our research and development expenses, including direct program specific expenses summarized by modality and indirect or shared operating costs summarized under other research and development expenses during the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018 (in thousands):

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prophylactic vaccines</td>
<td>$20,374</td>
<td>67,888</td>
</tr>
<tr>
<td>Cancer vaccines</td>
<td>4,135</td>
<td>31,818</td>
</tr>
<tr>
<td>Intratumoral immuno- oncology</td>
<td>8,022</td>
<td>20,340</td>
</tr>
<tr>
<td>Localized regenerative therapeutics</td>
<td>193</td>
<td>1,684</td>
</tr>
<tr>
<td>Systemic secreted therapeutics</td>
<td>—</td>
<td>7,175</td>
</tr>
<tr>
<td>Systemic intracellular therapeutics</td>
<td>—</td>
<td>3,093</td>
</tr>
<tr>
<td>Total program-specific expenses by modality(1)</td>
<td>32,724</td>
<td>131,998</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other research and development expenses</th>
<th>Year Ended December 31, 2016</th>
<th>Nine Months Ended September 30, 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discovery programs</td>
<td>52,360</td>
<td>40,190</td>
</tr>
<tr>
<td>Platform research</td>
<td>83,414</td>
<td>86,473</td>
</tr>
<tr>
<td>Technical development and unallocated manufacturing expenses</td>
<td>36,016</td>
<td>29,606</td>
</tr>
<tr>
<td>Shared discovery and development expenses</td>
<td>49,516</td>
<td>47,513</td>
</tr>
<tr>
<td>Stock-based compensation</td>
<td>20,687</td>
<td>21,679</td>
</tr>
<tr>
<td>Other expenses(2)</td>
<td>—</td>
<td>53,000</td>
</tr>
<tr>
<td>Total research and development expenses</td>
<td>$274,717</td>
<td>$410,459</td>
</tr>
</tbody>
</table>

(1) Includes a total of 12, 18 and 21 development candidates at December 31, 2016 and 2017 and September 30, 2018, respectively. Program-specific expenses include external costs and allocated manufacturing costs of mRNA supply and consumables, and reflect these expenses beginning in the period the program was internally advanced to development.

(2) Relates to in-licensing agreements entered into in June 2017 with Cellscript, LLC and its affiliate mRNA RiboTherapeutics, Inc. to sublicense certain patent rights.
A “modality” refers to a group of programs with common product features and the associated combination of enabling mRNA technologies, delivery technologies, and manufacturing processes. The program-specific expenses by modality summarized in the table above include expenses we directly attribute to our programs, which consist primarily of external costs, such as fees paid to outside consultants, central laboratories, investigative sites, and CROs in connection with our preclinical and clinical studies, and allocated manufacturing costs of mRNA supply and consumables. Costs to acquire and manufacture mRNA supply for preclinical and clinical studies are recognized and included in unallocated manufacturing expenses when incurred, and subsequently allocated to program-specific manufacturing costs after completion of the program-specific production. The timing of allocating manufacturing costs to program-specific costs varies depending on the program development and production schedule. We do not allocate personnel-related costs, including stock-based compensation, costs associated with our general platform research, technical development, and other shared costs on a program-specific basis. These costs were therefore excluded from the summary of program-specific expenses summary by modality.

Discovery program expenses are costs associated with research activities for our programs in the preclinical discovery stage, and primarily consist of external costs for CROs and lab services, and allocated manufacturing cost of preclinical mRNA supply and consumables.

Platform research expenses are mainly costs to develop technical advances in mRNA science, delivery science, and manufacturing process design. These costs include personnel-related costs, computer equipment, facilities, preclinical mRNA supply and consumables, and other administrative costs to support our platform research. Technology development and unallocated manufacturing expenses are primarily related to non-program-specific manufacturing process development and manufacturing costs. Shared discovery and development expenses are research and development costs such as personnel-related costs and other costs, which are not otherwise included in development programs, discovery programs, platform research, technical development and unallocated manufacturing expenses, stock-based compensation, and other expenses.

We have developed six modalities. As of October 31, 2018, we had 10 programs in clinical trials and a total of 21 development candidates, summarized by modality as follows:

- **Prophylactic vaccines** included nine development candidates: RSV vaccine (mRNA-1777), CMV vaccine (mRNA-1647), hMPV+PIV3 vaccine (mRNA-1653), VZV vaccine (mRNA-1278), H10N8 vaccine (mRNA-1440), H7N9 vaccine (mRNA-1851), Zika vaccine (mRNA-1325 and mRNA-1388), and Chikungunya vaccine (mRNA-1388). We currently have seven programs for which the Phase 1 trial is either ongoing or has been completed;

- **Cancer vaccines** included two development candidates: Personalized cancer vaccine, or PCV, (mRNA-4157) and KRAS vaccine (mRNA-5671). We are collaborating with Merck on both programs. PCV is in a Phase 1 clinical trial and the KRAS vaccine has an open IND;

- **Intratumoral immuno-oncology** included three development candidates: OX40L (mRNA-2416), OX40L+IL23+IL36γ (mRNA-2752), and IL12 (MEDI1191). The OX40L program is currently in a Phase 1 clinical trial, the OX40L+IL23+IL36γ program has an open IND, and IL12 is in preclinical development;

- **Localized regenerative therapeutics** included one development candidate, VEGF-A (AZD8601). The program is being led by AstraZeneca through clinical development and advanced to a Phase 2 clinical trial in 2018;

- **Systemic secreted therapeutics** included three development candidates: antibody against Chikungunya virus (mRNA-1944), Relaxin (AZD7970), and Fabry disease (mRNA-3630). The antibody against Chikungunya virus development candidate is in collaboration with DARPA and the program has an open IND. The Relaxin program in collaboration with AstraZeneca and the Fabry disease program are both in preclinical development; and
Systemic intracellular therapeutics included three development candidates: MMA (mRNA-3704), PA (mRNA-3927), and PKU (mRNA-3283). These development candidates are in preclinical development.

The largest component of our total operating expenses has historically been our investment in research and development activities, including development of our platform, mRNA technologies, and manufacturing technologies. We expense research and development costs as incurred and cannot reasonably estimate the nature, timing, and estimated costs required to complete the development of the investigational medicines we are currently developing or may develop in the future. There are numerous risks and uncertainties associated with the research and development of such investigational medicines, including, but not limited to:

- scope, progress, and expense of developing ongoing and future investigational medicines;
- entry in and completion of related preclinical studies;
- enrollment in and completion of subsequent clinical trials;
- safety and efficacy of investigational medicines resulting from these clinical trials;
- changes in laws or regulations relevant to the investigational medicines in development;
- receipt of the required regulatory approvals; and
- commercialization, including establishing manufacturing and marketing capabilities.

A change in expectations or outcomes of any of the known or unknown risks and uncertainties may materially impact our expected research and development expenditures. Continued research and development is central to the ongoing activities of our business. Investigational medicines in later stages of clinical development generally have higher development costs than those in earlier stages of clinical development, primarily due to the increased size and duration of later-stage clinical trials. We expect these costs to continue to increase in the future as investigational medicines progress through the development phases and as we identify and develop additional programs. However, we do not believe that it is possible at this time to accurately project total program-specific expenses through commercialization. There are numerous factors associated with the successful commercialization of any of our investigational medicines, including future trial design and various regulatory requirements, many of which cannot be determined with accuracy at this time based on our stage of development. Additionally, future commercial and regulatory factors beyond our control will impact our clinical development programs and plans.

General and administrative expenses

General and administrative expenses consist primarily of personnel-related costs, including stock-based compensation, for executives, finance, legal, human resources, business development and other administrative and operational functions, professional fees, accounting and legal services, information technology and facility-related costs, and expenses associated with obtaining and maintaining IP. These costs relate to the operation of the business, unrelated to the research and development function, or any individual program.

We anticipate general and administrative expenses will increase as research and development expands. These increases will likely relate to additional personnel and increased costs related to finance, legal and IP-related matters along with increased expenses related to operating as a publicly traded company, such as fees related to audit, legal, and tax services, regulatory compliance programs and investor relations. In addition, if we obtain regulatory approval for any of our investigational medicines and do not enter into a third-party commercialization collaboration, we expect to incur significant expenses related to building a sales and marketing team to support medicine sales, marketing, and distribution activities.

We have a broad IP portfolio covering our development and commercialization of mRNA vaccine and therapeutic programs, including those related to mRNA design, formulation, and manufacturing platform technologies. We regularly file patent applications to protect innovations arising from our research and development, and have filed over 1,500 patent applications (including pending and expired applications) around the world. We also hold trademarks and trademark applications in the United States and foreign jurisdictions. Costs to secure and defend our IP are expensed as incurred, and are classified as general and administrative expenses.
General and administrative expenses, including IP-related expenses, totaled $57.5 million and $64.7 million for the years ended December 31, 2016 and 2017, respectively, and totaled $48.8 million and $56.2 million for the nine months ended September 30, 2017 and 2018, respectively. IP-related expenses, including our internal personnel-related costs, were $10.9 million and $10.7 million, for the years ended December 31, 2016 and 2017, respectively, and were $7.3 million and $8.6 million for the nine months ended September 30, 2017 and 2018, respectively. We did not incur litigation expenses related to our IP during the years ended December 31, 2016 and 2017, or for the nine months ended September 30, 2017 and 2018.

Other income (expense), net

Interest income

Interest income consists of interest generated from our investments in cash and cash equivalents, money market funds, and high-quality fixed income securities.

Other income (expense)

Other income (expense), net consists of gains (losses) from the sale of investments in marketable securities, interest expense, and other miscellaneous income and expense unrelated to our core operations.

Critical accounting policies and significant judgments and estimates

Our management’s discussion and analysis of our financial condition and results of operations is based on our consolidated financial statements, which have been prepared in accordance with U.S. generally accepted accounting principles. The preparation of these consolidated financial statements requires us to make judgments and estimates that affect the reported amounts of assets, liabilities, revenues, and expenses and the disclosure of contingent assets and liabilities in our consolidated financial statements. We base our estimates on historical experience, known trends and events, and various other factors that we believe to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions. On an ongoing basis, we evaluate our judgments and estimates in light of changes in circumstances, facts, and experience. The effects of material revisions in estimates, if any, are reflected in the consolidated financial statements prospectively from the date of change in estimates.

While our significant accounting policies are described in more detail in the notes to our consolidated financial statements appearing elsewhere in this prospectus, we believe the following accounting policies used in the preparation of our consolidated financial statements require the most significant judgments and estimates.

Revenue recognition

We have primarily generated revenue from our strategic alliances. Our strategic alliances with strategic collaborators typically contain multiple elements, including research and other licenses, options to obtain development and commercialization rights, research and development services, obligations to develop and manufacture preclinical and clinical material, and options to obtain additional research and development services and preclinical and clinical material. Such arrangements provide for various types of payments to us, including upfront fees, funding of research and development services and preclinical and clinical material, technical, development, regulatory, and commercial milestone payments, licensing fees, option exercise fees, and royalty and earnout payments on product sales. Such payments are often not commensurate with the timing of revenue recognition and therefore result in deferral of revenue recognition.

We analyze our strategic alliance arrangements to assess whether they are within the scope of Financial Standards Accounting Board, or FASB, Accounting Standards Codification, or ASC, Topic 808, Collaborative Arrangements, or ASC 808 to determine whether such arrangements involve joint operating activities performed by parties that are both active participants in the activities and exposed to significant risks and rewards that are
dependent on the commercial success of such activities. This assessment is performed throughout the life of the arrangement based on changes in the responsibilities of all parties in the arrangement. For strategic alliance arrangements that are deemed to be within the scope of ASC 808, we assess which elements of the arrangement are deemed to be within the scope of ASC 808, and we recognize our allocation of shared costs incurred with respect to the jointly conducted activities as a component of the related expense in the period incurred.

We also consider the guidance in FASB ASC Topic 605-45, Revenue Recognition—Principal Agent Considerations, or ASC 605-45 in determining the appropriate treatment for the transactions between us and our strategic collaborators, including the accounting treatment for arrangements in which we are reimbursed for research services performed by a third-party. Generally, transactions under our strategic alliance arrangements are recorded on either a gross or net basis based on the nature and contractual terms of the arrangement along with an evaluation of the indicators to identify the principal participant of the arrangement which could require significant judgment.

For those elements of the arrangement that are accounted for pursuant to ASC 605, revenue is recognized for each unit of accounting when all of the following criteria are met:

- persuasive evidence of an arrangement;
- delivery has occurred or services have been rendered;
- the seller’s price to the buyer is fixed or determinable; and
- collectability is reasonably assured.

Further, we analyze multiple element arrangements in accordance with FASB ASC Topic 605-25, Revenue Recognition—Multiple Element Arrangements, ASC 605-25. The evaluation involves subjective determinations and requires management to make judgments about individual deliverables and whether such deliverables represent separate units of accounting, or whether they must be accounted for as a single unit of accounting. Deliverables are considered separate units of accounting provided that: (i) the delivered item(s) has value to the customer on a standalone basis, and (ii) if the arrangement includes a general right of return relative to the delivered item(s), delivery or performance of the undelivered item(s) is considered probable and substantially controlled by us. In assessing whether an item has standalone value, we consider factors such as the research, manufacturing, and commercialization capabilities of the strategic collaborator, and the availability of the associated expertise in the general marketplace. In addition, we consider whether the strategic collaborator can use the other deliverable(s) for their intended purpose without the receipt of the remaining element(s), whether the value of the deliverable is dependent on the undelivered item(s), and whether there are other vendors that can provide the undelivered element(s).

Arrangement consideration that is fixed or determinable is allocated among the separate units of accounting based on the relative selling price method and the applicable revenue recognition criteria in ASC 605-25 are applied to determine the appropriate period and pattern of recognition. We determine the selling price of a unit of accounting following the hierarchy of evidence prescribed by ASC 605-25. Accordingly, we determine the estimated selling price for units of accounting within each arrangement using vendor-specific objective evidence, or VSOE of selling price, if available, third-party evidence, or TPE, of selling price if VSOE is not available, or best estimate of selling price, or BESP, if neither VSOE nor TPE is available. We typically use BESP to estimate the selling price, since we generally do not have VSOE or TPE of selling price for our units of accounting. Determining the BESP for a unit of accounting requires significant judgment. In developing the BESP for a unit of accounting, we consider applicable market conditions and relevant entity-specific factors, including factors that were contemplated in negotiating the agreement with the strategic collaborator and estimated costs. We validate the BESP for units of accounting by evaluating whether changes in the key assumptions used to determine the BESP will have a significant effect on the allocation of arrangement consideration between multiple units of accounting.
Our strategic alliance arrangements may include options for our strategic collaborators to acquire development and commercialization rights to mRNA therapeutics or with respect to specific targets or options to receive research and development services or preclinical and clinical material from us. Such options must be evaluated to determine if they represent substantive options which requires significant judgment by management. In determining if an option is substantive, we consider the overall objective of the arrangement, the benefit the strategic collaborator may obtain from the arrangement without exercising the option, the likelihood of option exercise, and whether the strategic collaborator is required or compelled through significant incentive to exercise the option. If an option in an arrangement is considered substantive, the rights obtained upon exercise of the option are excluded from the identification of deliverables for allocation of total arrangement consideration, assuming the option is not priced at a significant and incremental discount. Conversely, when an option is not considered substantive, we would consider the option, including other deliverables contingent upon the exercise of the option, to be a deliverable at the inception of the arrangement and a corresponding amount would be included in allocable arrangement consideration. In addition, if the price of the option includes a significant incremental discount, the discount would be included as a deliverable at the inception of the arrangement.

We recognize arrangement consideration allocated to each unit of accounting when all of the revenue recognition criteria under ASC 605-25 are satisfied for that particular unit of accounting. We will recognize revenue associated with licenses, options, or the discount related to an option upon (i) delivery of the license or (ii) the earlier of exercise or expiration of the option, if the underlying license has standalone value from the other deliverables to be provided after delivering that license. If the license does not have standalone value, the amounts allocated to the license will be combined with the related undelivered items as a single unit of accounting and recognized over the estimated period of performance or delivery of the combined unit of accounting.

Revenue related to the units of accounting that contain several deliverables is recognized as the last to be delivered element is provided, which is generally over the period that research services are provided. If there is no discernable pattern of performance or objectively measurable performance measures do not exist, we recognize revenue on a straight-line basis over the expected period of performance. Conversely, if the pattern of performance can be determined and objectively measurable performance measures exist, then we recognize revenue under the arrangement using the proportional performance method. Revenue recognized is limited to the lesser of the cumulative amount of payments received or the cumulative revenue earned determined using the straight-line method or proportional performance, as applicable, as of the period end date.

Our third-party arrangements may include options for our strategic collaborators to acquire development and commercialization rights to our mRNA programs or, with respect to specific targets or options, to receive research and development services or pre-clinical or clinical materials from us. Options are considered substantive if, at the inception of the arrangement, we are at risk as to whether the strategic collaborator will choose to exercise the option. The evaluation of whether an option is substantive requires significant judgment. In determining if the option is substantive, we consider the overall objective of the arrangement, the benefit the third-party might obtain from the arrangement without exercising the option, the likelihood that the option will be exercised, or if the third party is required or compelled through significant incentive to exercise the option. When an option is considered substantive, we do not consider the option or item underlying the option to be a deliverable at inception of the arrangement and the associated option fee is not included in the allocable arrangement consideration, assuming the option is not priced at a significant and incremental discount. Conversely, if we determine that an option is not substantive, we will consider the item underlying the option to be a deliverable at the inception of the arrangement and the associated option exercise fee is included in the allocable arrangement consideration. In addition, if the price of the option includes a significant and incremental discount, then the option is not considered substantive.

Our arrangements may include additional payments that are subject to achievement of milestone events, including specific technical, development, regulatory, and commercial milestones. At the inception of an arrangement that includes milestone payments, we evaluate whether each milestone is substantive and at risk to
both parties on the basis of the contingent nature of the milestone. This evaluation includes an assessment of whether: (i) the consideration is commensurate with either our performance to achieve the milestone or the enhancement of the value of the delivered item(s) as a result of a specific outcome resulting from our performance to achieve the milestone, (ii) the consideration relates solely to past performance, and (iii) the consideration is reasonably relative to all of the deliverables and payment terms within the arrangement. We evaluate factors such as scientific, clinical, regulatory, commercial, and other risks that must be overcome to achieve the respective milestones and the level of effort and investment required to achieve the respective milestones in making this assessment. There is considerable judgment involved in determining whether a milestone satisfies all of the criteria required to conclude that a milestone is substantive. In accordance with FASB ASC Topic 605-28, Revenue Recognition—Milestone Method, or ASC 605-28, a technical, development, or regulatory milestone that is considered substantive will be recognized as revenue in its entirety upon successful accomplishment of the milestone. Amounts received from milestones that are not considered substantive would be considered additional arrangement consideration and allocated to the identified units of accounting. Revenue from commercial milestone payments will be accounted for as royalties and recorded as revenue upon achievement of the milestone, assuming all other revenue recognition criteria are met.

We will recognize royalty revenue in the period of sale of the related medicine(s), based on the underlying contract terms, provided that the reported sales are reliably measurable, we have no remaining undelivered elements, and assuming all other revenue recognition criteria are met.

Our contracts with DARPA, BARDA, and the Bill & Melinda Gates Foundation provide for reimbursed costs, which may include overhead and general and administrative costs as well as a related profit margin. We recognize revenue from these contracts as we perform services under the arrangements so long as an agreement has been executed and the fees for the services are fixed or determinable, legally billable, and reasonably assured of collection. Recognized amounts reflect our performance under the agreements. We do not recognize revenue under these agreements for amounts related to contract periods where funding is not yet committed, as fees above committed funding thresholds would not be considered fixed or determinable, or reasonably assured of collection. Revenues and related expenses are presented gross in the consolidated statements of operations as we have determined we are the primary obligor under the arrangements relative to the research and development services we perform as lead technical expert.

Research and development costs

As part of the process of preparing our financial statements, we are required to estimate our accrued research and development expenses, a significant portion of which are clinical study expenses conducted by third-party service providers. This process involves reviewing open contracts and purchase orders, communicating with our personnel to identify services that have been performed on our behalf, and estimating the level of service performed and the associated cost incurred for the service when we have not yet been invoiced or otherwise notified of the actual cost. The majority of our service providers invoice us in arrears for services performed or when contractual milestones are met. Examples of estimated accrued research and development expenses include fees paid to:

- CROs to conduct our clinical studies;
- investigative sites in connection with clinical studies;
- vendors for laboratory services, supplies, and distribution of materials in connection with clinical studies; and
- vendors in connection with preclinical development activities.

We base our expenses related to clinical studies on our estimates of the services received and efforts expended pursuant to contracts with CROs that conduct and manage clinical studies on our behalf. The financial terms of these agreements are subject to negotiation, vary from contract to contract and may result in uneven payment.
flows. There may be instances in which payments made to our vendors will exceed the level of services provided and result in a prepayment of the clinical expense. Payments under some of these contracts depend on factors such as the successful enrollment of subjects and the completion of clinical study milestones. In accruing service fees, we estimate the time period over which services will be performed and the level of effort to be expended in each period and adjust accordingly.

We make estimates of our research and development accrued expenses as of each balance sheet date in our financial statements based on facts and circumstances known to us at that time. We recognize costs for certain development activities based on an evaluation of the progress to completion of specific tasks using information and data provided to us by our vendors and our clinical sites, such as number of sites activated, number of patient enrollments and visits, and patient duration. We determine accrual estimates through financial models that take into account discussion with applicable personnel and service providers as to the progress or state of completion of trials. We periodically confirm the accuracy of these estimates with the service providers and make adjustments, if necessary. Upon settlement, these costs may differ materially from the amounts accrued in our consolidated financial statements. Our historical accrual estimates have not been materially different from our actual costs. However, due to the nature of estimates, we cannot provide assurance that we will not make changes to our estimates in the future as we become aware of additional information about the status or conduct of our clinical studies and other research activities.

Stock-based compensation

We issue stock-based awards to employees and non-employees, generally in the form of stock options, restricted stock or restricted stock units. Historically, we also granted unit options and incentive units to our employees and non-employees, which were exchanged into options and restricted stock awards in connection with the 2016 Reorganization. We measure and recognize compensation expense for our stock-based awards granted to our employees and non-employee directors based on the estimated grant date fair value in accordance with FASB ASC Topic 718, Compensation—Stock Compensation, or ASC 718. We account for stock-based awards to non-employees in accordance with FASB ASC Topic 505-50, Equity-Based Payments to Non-Employees, which requires the fair value of the unvested portion of the equity awards granted to non-employees to be re-measured as of each reporting date.

Our stock-based awards are subject to either service or performance-based vesting conditions. We recognize compensation expense related to awards to employees and directors with service-based vesting on a straight-line basis based on the grant date fair value over the requisite service period, which is generally the vesting period. Compensation expense related to awards to employees and non-employee directors with performance-based vesting conditions is recognized based on the grant date fair value over the requisite service period using an accelerated attribution method to the extent the achievement of the performance condition is probable. Compensation expense related to awards to non-employees with service-based vesting conditions is recognized on the then-current fair value at each reporting date prior to the measurement date over the requisite service period, which is generally the vesting period. Compensation expense related to awards to non-employees with performance-based vesting conditions is recognized based on the then-current grant date fair value at each reporting date prior to the measurement date over the requisite service period using an accelerated attribution method to the extent the achievement of the performance condition is probable. As of January 1, 2017, we made an accounting policy election to recognize forfeitures as they occur upon adoption of FASB ASU No. 2016-09, Compensation—Stock Compensation.

We classify stock-based compensation expense in our consolidated statements of operations in the same manner in which the award recipient’s salary and related costs are classified or in which the award recipient’s service payments are classified. In future periods, we expect stock-based compensation expense to increase, due in part to our existing unrecognized stock-based compensation expense and as we grant additional stock-based awards to continue to attract and retain our employees.
Fair value of stock-based awards

We determine the fair value of restricted stock and restricted stock units, based on the fair value of our common stock. We estimate the fair value of our stock options and, prior to the 2016 Reorganization, unit options and incentive units using the Black-Scholes option pricing model, which requires inputs of subjective assumptions, including: (i) the expected volatility of our stock (or, prior to the 2016 Reorganization, units); (ii) the expected term of the award; (iii) the risk-free interest rate; (iv) expected dividends; and (v) the fair value of common stock (or, prior to the 2016 Reorganization, units). Due to the lack of company specific historical and implied volatility data, we based our estimate of expected volatility on the estimate and expected volatilities of a guideline group of publicly traded companies. For these analyses, we select companies with comparable characteristics to ours including enterprise value, risk profiles, and with historical share price information sufficient to meet the expected life of the stock-based awards. We compute the historical volatility data using the daily closing prices for the selected companies’ shares during the equivalent period of the calculated expected term of our stock-based awards. We will continue to apply this process until a sufficient amount of historical information regarding the volatility of our own stock price becomes available. We estimate the expected term of our stock options granted to employees and non-employee directors using the simplified method, whereby, the expected term equals the average of the vesting term and the original contractual term of the option. We utilize this method as we do not have sufficient historical exercise data to provide a reasonable basis upon which to estimate the expected term. For stock options granted to non-employees, we utilize the contractual term of the option as the basis for the expected term assumption. For the determination of the risk-free interest rates we utilize the U.S. Treasury yield curve for instruments in effect at the time of measurement with a term commensurate with the expected term assumption. The expected dividend yield is assumed to be zero as we have never paid dividends and do not have current plans to pay any dividends on our common stock. Historically, for periods prior to this initial public offering, the fair value of our equity instruments underlying our stock-based awards were determined on each grant date by our board of directors based on valuation estimates from management considering our most recently available independent third-party valuation of our equity instruments. Our board of directors also assessed and considered, with input from management, additional objective and subjective factors that we believed were relevant and which may have changed from the date of the most recent valuation through the grant date.

The following table sets forth by grant date and type of award, the number of equity awards granted, the per share exercise price and per share fair value of stock awards granted from January 1, 2017 through October 31, 2018.

<table>
<thead>
<tr>
<th>Date of Issuance</th>
<th>Type of Award</th>
<th>Number of Shares</th>
<th>Exercise Price of Award Per Share(1)</th>
<th>Fair Value of Common Stock(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/22/2017</td>
<td>Options</td>
<td>3,179,500</td>
<td>$3.60</td>
<td>$5.47</td>
</tr>
<tr>
<td>2/23/2017</td>
<td>Options</td>
<td>4,736,000</td>
<td>$3.60</td>
<td>$5.47</td>
</tr>
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<td>4/18/2017</td>
<td>Options</td>
<td>630,000</td>
<td>$3.60</td>
<td>$5.47</td>
</tr>
<tr>
<td>6/14/2017</td>
<td>Restricted Stock Units</td>
<td>1,500,000</td>
<td>—</td>
<td>$5.47</td>
</tr>
<tr>
<td>8/29/2017</td>
<td>Options</td>
<td>3,915,000</td>
<td>$3.60</td>
<td>$6.00</td>
</tr>
<tr>
<td>8/30/2017</td>
<td>Options</td>
<td>92,000</td>
<td>$3.47</td>
<td>$6.00</td>
</tr>
<tr>
<td>10/3/2017</td>
<td>Options</td>
<td>10,465,671</td>
<td>$3.60</td>
<td>$6.08</td>
</tr>
<tr>
<td>10/10/2017</td>
<td>Options</td>
<td>92,000</td>
<td>$3.47</td>
<td>$6.08</td>
</tr>
<tr>
<td>2/28/2018</td>
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</tr>
<tr>
<td>4/4/2018</td>
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</tr>
<tr>
<td>6/26/2018</td>
<td>Options</td>
<td>2,528,521</td>
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<td>7/13/2018</td>
<td>Options</td>
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<tr>
<td>8/16/2018</td>
<td>Options</td>
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<tr>
<td>10/2/2018</td>
<td>Options</td>
<td>3,978,273</td>
<td>$8.02</td>
<td>$8.02</td>
</tr>
</tbody>
</table>

(1) Prior to 2018, independent third-party valuations of our equity instruments were performed annually in December and these were considered by the board of directors in determining the exercise price for stock-
based awards. We granted options with an exercise price equal to or above the fair value of the common stock based on the most recent independent third-party valuation, at discretion of the board of directors. Therefore, the exercise price may not equal to our subsequently determined fair value of the underlying equity instruments, taking into consideration both contemporaneous and retrospective valuations. Commencing in 2018, independent third-party valuations were performed contemporaneously and were considered by the board of directors in determining the exercise price for stock-based awards.

(2) The fair value of common stock in the table above represents the fair value of our common stock as determined by our board of directors based on our most recently available contemporaneous and retrospective independent third-party valuations, taking into consideration various objective and subjective factors. We performed retrospective valuations as of August 29, 2017 and October 3, 2017.

**Determination of the fair value of common stock and common units**

For periods prior to this initial public offering, the fair values of the shares of common stock and common units underlying our stock-based awards were determined on each grant date by our board of directors based on valuation estimates from management considering our most recently available independent third-party valuation of our equity instruments. Our board of directors also assessed and considered, with input from management, additional objective and subjective factors that we believed were relevant and which may have changed from the date of the most recently available valuation through the grant date. Historically, these independent third-party valuations of our equity instruments were performed annually in December, and beginning in 2018, these valuations were performed, contemporaneously with each grant date. As such, we performed retrospective valuations as of August 29, 2017 and October 3, 2017 to determine the fair value of equity instruments on those respective grant dates for financial reporting purposes.

The independent third-party valuations were prepared in accordance with the guidance outlined in the American Institute of Certified Public Accountants’ Technical Practice Aid, *Valuation of Privately-Held-Company Equity Securities Issued as Compensation*, or the Practice Aid. The Practice Aid identifies various available methods for allocating enterprise value across classes and series of capital stock to determine the estimated fair value of common stock at each valuation date. In accordance with the Practice Aid, the Probability-Weighted Expected Return Method, or PWERM, and the Option-Pricing Method, or OPM, were the most appropriate methods for determining the fair value of our common units or common stock, based on our stage of development and other relevant factors. Our valuations prior to May 2018 were based on a hybrid method of the PWERM and the OPM and subsequent valuations were based on the PWERM. This change was necessary in order to reflect variations, depending on the circumstances, in the conversion ratio of our Series H preferred stock issued in May 2018. The PWERM is a scenario-based analysis that estimates value per share based on the probability-weighted present value of expected future investment returns, considering each of the possible outcomes available to us, as well as the economic and control rights of each share class. Under the OPM, each class of stock is modeled as a call option with a distinct claim on the enterprise value of the Company. Under this method, the common stock has value only if the enterprise value exceeds the total liquidation preference of the preferred stock at the time of the liquidity event, such as a strategic sale or a merger. The hybrid method is a hybrid between the PWERM and OPM estimating the probability-weighted value across multiple scenarios but using the OPM to estimate the allocation of value within at least one of these scenarios.

In addition to considering the results of these third-party valuations, management considered various objective and subjective factors to determine the fair value of our equity instruments as of each grant date, which may be later than the most recently available third-party valuation date, including:

- the lack of liquidity of our equity as a private company;
- the prices of our preferred securities sold to or exchanged between outside investors in arm’s length transactions, and the rights, preferences, and privileges of our preferred securities as compared to those of our common units, incentive units, or common stock, including the liquidation preferences of our preferred securities;
The progress of our research and development efforts, including the status of preclinical studies and planned clinical trials for our investigational medicines;

our stage of development and business strategy and the material risks related to our business and industry;

the achievement of enterprise milestones, including entering into strategic alliance and license agreements;

the valuation of publicly traded companies in the life sciences and biotechnology sectors, as well as recently completed mergers and acquisitions of peer companies;

any external market conditions affecting the biotechnology industry, and trends within the biotechnology industry;

the likelihood of achieving a liquidity event, such as an initial public offering, or IPO, or a sale of our Company, given prevailing market conditions; and

the analysis of IPOs and the market performance of similar companies in the biopharmaceutical industry.

The assumptions underlying these valuations represent management’s best estimates, which involve inherent uncertainties and the application of management judgment. As a result, if factors or expected outcomes change and we use significantly different assumptions or estimates, our stock-based compensation expense could be materially different. Following the completion of this initial public offering, the fair value of our common stock will be determined based on the quoted market price of our common stock.

Contemporaneous valuation for December 31, 2016

We determined the fair value of our common stock to be $5.47 per share as of December 31, 2016. We used a hybrid of the PWERM and OPM. We estimated the value of our common stock relative to the price of $8.78 per Series F preferred stock, which was established in our August 10, 2016 Series F preferred stock financing. We considered three scenarios: an IPO in September 2018, an IPO in September 2019, and a remain-private scenario. Each IPO scenario assumes the conversion of preferred shares to common shares. For the remain-private scenario, we allocated equity value using the OPM. We estimated our per share value in an IPO as a step-up, or appreciation in value, from the Series F preferred issuance stock price. For the remain-private scenario, we estimated our equity value by using the OPM to backsolve to the Series F preferred issuance stock price, after adjusting for the value of Series F preferred stock in IPO scenarios. We assigned a weight of 27.5% to the September 2018 IPO scenario, a weight of 27.5% to the September 2019 scenario, and a weight of 45.0% to the remain-private scenario. We estimated our per share value in an IPO using the discounted cash flow method and applied an appropriate risk-adjusted discount rate to a forecast of cash flows, which were probability-weighted to reflect success rates in clinical trials. We assigned a weighting of 60% to the IPO scenario and a weighting of 40% to the remain-private scenario.

Retrospective valuations for August 29, 2017 and October 3, 2017

We determined the fair value of our common stock to be $6.00 and $6.08 per share as of August 29, 2017 and October 3, 2017, respectively. We used a hybrid of the PWERM and OPM. We considered two scenarios: an IPO and a remain-private scenario. The IPO scenario assumed the conversion of preferred shares to common shares. For the remain-private scenario, we estimated our equity value using the OPM. We estimated our per share value in an IPO using the discounted cash flow method and applied an appropriate risk-adjusted discount rate to a forecast of cash flows, which were probability-weighted to reflect success rates in clinical trials. For the remain-private scenario, we estimated our equity value using the discounted cash flow method and applied an appropriate risk-adjusted discount rate to a forecast of cash flows, which were probability-weighted to reflect success rates in clinical trials. We estimated our equity value using the discounted cash flow method and applied an appropriate risk-adjusted discount rate to a forecast of cash flows, which were probability-weighted to reflect success rates in clinical trials.
scenario. We applied a DLOM to the values indicated for our common stock in each scenario. A discount is appropriate because our common stock is unregistered, and the holder of a minority interest in the common stock may not influence the timing of a liquidity event for Moderna. Our estimate of the appropriate DLOM took into consideration put option methodologies.

Contemporaneous valuations for February 15, 2018 and March 31, 2018

We determined the fair value of our common stock to be $6.52 and $6.67 per share as of February 15, 2018 and March 31, 2018, respectively. We used a hybrid of the PWERM and OPM. We considered two scenarios: an IPO and a remain-private scenario. The IPO scenario assumed the conversion of preferred shares to common shares. For the remain-private scenario, we allocated equity value using the OPM. We estimated our per share value in an IPO using the discounted cash flow method and applied an appropriate risk-adjusted discount rate to a forecast of cash flows, which were probability-weighted to reflect success rates in clinical trials. For the remain-private scenario, we estimated our equity value by using the OPM to backsolve to the Series G preferred stock issuance price, after adjusting for the value of the Series G preferred stock in the IPO scenario. In an OPM framework, the backsolve method for inferring the equity value implied by a recent financing transaction involves making assumptions for the expected time to liquidity, volatility, and risk-free rate and then solving for the value of equity such that value for the most recent financing equals the amount paid. This method was selected as management concluded that the contemporaneous financing transaction was an arm’s length transaction. We assigned a weighting of 65% to the IPO scenario and a weighting of 35% to the remain-private scenario. We applied a DLOM to the values indicated for our common stock in each scenario. A discount is appropriate because our common stock is unregistered, and the holder of a minority interest in the common stock may not influence the timing of a liquidity event for Moderna. Our estimate of the appropriate DLOM took into consideration put option methodologies.

Contemporaneous valuation for May 7, 2018

We determined the fair value of our common stock to be $6.81 per share as of May 7, 2018. We used the PWERM. We considered three scenarios: an IPO, a strategic sale, and a distress sale. The IPO scenario assumes the conversion of preferred shares to common shares. For the strategic sale and distress sale scenarios, value is allocated according to the rights of each equity class relative to the assumed sale value. We estimated our per share value in an IPO using the discounted cash flow method and applied an appropriate risk-adjusted discount rate to a forecast of cash flows, which were probability-weighted to reflect success rates in clinical trials. For our strategic sale scenario, we assumed an acquisition premium to the value assumed for the IPO scenario. For the distress sale scenario, we assumed a sale value at a discount to the total liquidation preference on our preferred shares. We assigned a weighting of 65% to the IPO scenario, a weighting of 5% to the strategic sale scenario, and a weighting of 30% to the distress sale scenario. We applied a DLOM to the values indicated for our common stock in each scenario. A discount is appropriate because our common stock is unregistered, and the holder of a minority interest in the common stock may not influence the timing of a liquidity event for Moderna. Our estimate of the appropriate DLOM took into consideration put option methodologies.

Contemporaneous valuations for June 30, 2018, July 31, 2018 and September 15, 2018

We determined the fair value of our common stock to be $7.55, $7.92 and $8.02 per share as of June 30, 2018, July 31, 2018, and September 15, 2018, respectively. We used the PWERM. We considered three scenarios: an IPO, a strategic sale, and a distress sale. The IPO scenario assumes the conversion of preferred shares to common shares. For the strategic sale and distress sale scenarios, value is allocated according to the rights of each equity class relative to the assumed sale value. We estimated our per share value in an IPO using the discounted cash flow method and applied an appropriate risk-adjusted discount rate to a forecast of cash flows, which were probability-weighted to reflect success rates in clinical trials. For our strategic sale scenario, we assumed an acquisition premium to the value assumed for the IPO scenario. For the distress sale scenario, we assumed a sale value at a discount to the total liquidation preference on our preferred shares. We assigned a weighting of 68% to
the IPO scenario, a weighting of 4% to the strategic sale scenario, and a weighting of 28% to the distress sale scenario. We applied a DLOM to the values indicated for our common stock in each scenario. A discount is appropriate because our common stock is unregistered, and the holder of a minority interest in the common stock may not influence the timing of a liquidity event for Moderna. Our estimate of the appropriate DLOM took into consideration put option methodologies.

Income taxes
We account for income taxes based on an asset and liability approach. We recognize deferred tax assets and liabilities for the expected future tax consequences of events that have been included in the financial statements or tax returns. We determine our deferred tax assets and liabilities based on differences between financial reporting and tax bases of assets and liabilities, which are measured using the enacted tax rates and laws that will be in effect when the differences are expected to reverse.

Realization of our deferred tax assets is dependent upon the generation of future taxable income, the amount and timing of which are uncertain. Valuation allowances are provided, if, based upon the weight of available evidence, it is more likely than not that some or all of the deferred tax assets will not be realized. As of December 31, 2017, we continued to maintain a full valuation allowance against all of our deferred tax assets based on management’s evaluation of all available evidence.

We may become subject to income tax audits and adjustments by local tax authorities. The nature of uncertain tax positions is subject to significant judgment by management and subject to change, which may be substantial. We develop our assessment of uncertain tax positions, and the associated cumulative probabilities, using internal expertise and assistance from third-party experts. As additional information becomes available, estimates are revised and refined. Differences between estimates and final settlement may occur resulting in additional tax expense.

We record reserves for potential tax payments to various tax authorities related to uncertain tax positions. These reserves are based on a determination of whether and how much of a tax benefit taken by us in our tax filings or positions is more likely than not to be realized following resolution of any potential contingencies present related to the tax benefit. Potential interest and penalties associated with such uncertain tax positions is recorded as a component of income tax expense. To date, no amount has been recorded for uncertain tax positions.

On December 22, 2017, the TCJA was enacted, among other things, contains significant changes to corporate taxation, including reduction of the corporate tax rate from a top marginal rate of 35% to a flat rate of 21%, limitation of the tax deduction for interest expense to 30% of adjusted earnings (except for certain small businesses), limitation of the deduction for net operating losses to 80% of current year taxable income and elimination of net operating loss carrybacks, one time taxation of offshore earnings at reduced rates regardless of whether they are repatriated, elimination of U.S. tax on foreign earnings (subject to certain important exceptions), immediate deductions for certain new investments instead of deductions for depreciation expense over time, and modifying or repealing many business deductions and credits.

Concurrent with the passing of the Act, the SEC issued guidance under Staff Accounting Bulletin No. 118, Income Tax Accounting Implications of the Tax Cuts and Jobs Act directing taxpayers to consider the impact of the U.S. legislation as “provisional” when it does not have the necessary information available, prepared or analyzed (including computations) in reasonable detail to complete its accounting for the change in tax law.

We recognize changes in tax law, including the TCJA, in the period in which the law is enacted. Accordingly, the effects of the Act have been recognized in the financial statements for the year ended December 31, 2017. Items for which we were unable to determine a reasonable estimate, and thus are considered provisional, resulted in a $64.1 million reduction to deferred tax assets and a corresponding reduction in our valuation allowance. This preliminary estimate of the effects of the TCJA is subject to the finalization of management’s analysis related to certain matters, including developing interpretations of the provisions of the TCJA and the filing of our tax
returns. Final determination of the effects of the TCJA will be completed within one year of filing of the TCJA during which time management will continue to revise and refine its calculations, the result of which may be substantial.

Recently issued accounting pronouncements
We have reviewed all recently issued standards and have determined that, other than as disclosed in Note 2 to our consolidated financial statements appearing elsewhere in this prospectus, such standards will not have a material impact on our financial statements or do not otherwise apply to our operations.

Results of operations

The following table summarizes our consolidated statements of operations for each period presented (in thousands):

<table>
<thead>
<tr>
<th></th>
<th>Year Ended December 31,</th>
<th>Nine Months Ended September 30,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td>Revenue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration revenue</td>
<td>$101,536</td>
<td>$176,974</td>
</tr>
<tr>
<td>Grant revenue</td>
<td>6,860</td>
<td>28,851</td>
</tr>
<tr>
<td>Total revenue</td>
<td>108,396</td>
<td>205,825</td>
</tr>
<tr>
<td>Operating Expenses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research and development</td>
<td>274,717</td>
<td>410,459</td>
</tr>
<tr>
<td>General and administrative</td>
<td>57,450</td>
<td>64,722</td>
</tr>
<tr>
<td>Total operating expenses</td>
<td>332,167</td>
<td>475,181</td>
</tr>
<tr>
<td>Loss before provision for (benefit from) income taxes</td>
<td>(215,168)</td>
<td>(255,996)</td>
</tr>
<tr>
<td>Provision for (benefit from) income taxes</td>
<td>1,043</td>
<td>(80)</td>
</tr>
<tr>
<td>Net loss</td>
<td>$ (216,211)</td>
<td>$ (255,916)</td>
</tr>
</tbody>
</table>

Comparison of the nine months ended September 30, 2017 and 2018

Revenue

The following table summarizes our revenue by source for each period presented (in thousands):

<table>
<thead>
<tr>
<th></th>
<th>Nine Months Ended September 30,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2017</td>
</tr>
<tr>
<td>Collaboration revenue</td>
<td>$88,558</td>
</tr>
<tr>
<td>Grant revenue</td>
<td>25,363</td>
</tr>
<tr>
<td>Total revenue</td>
<td>113,921</td>
</tr>
</tbody>
</table>

Total revenue decreased by $14.3 million, or 13%, to $99.6 million for the nine months ended September 30, 2018 compared to $113.9 million for the nine months ended September 30, 2017. Collaboration revenue increased by $1.1 million, or 1%, to $89.7 million for the nine months ended September 30, 2018 compared to $88.6 million for the nine months ended September 30, 2017, mainly driven by increases in collaboration revenue from AstraZeneca and Vertex, partially offset by the termination of the Alexion strategic alliance arrangement in October 2017. Grant revenue decreased by $15.4 million, or 61%, to $10.0 million for the nine months ended September 30, 2018 compared to $25.4 million for the nine months ended September 30, 2017. The decrease was primarily attributable to a decrease in revenue of $12.7 million from the BARDA contract, primarily due to revisions to the Zika program.
Operating expenses

The following table summarizes our operating expenses for each period presented (in thousands):

<table>
<thead>
<tr>
<th></th>
<th>Nine Months Ended September 30,</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2017</td>
<td>2018</td>
</tr>
<tr>
<td>Research and development</td>
<td>$292,632</td>
<td>$303,653</td>
</tr>
<tr>
<td>General and administrative</td>
<td>48,817</td>
<td>56,229</td>
</tr>
<tr>
<td>Total operating expenses</td>
<td>$341,449</td>
<td>$360,882</td>
</tr>
</tbody>
</table>

Research and development expenses

Research and development expenses increased by $11.0 million, or 4%, to $303.7 million for the nine months ended September 30, 2018 compared to $292.6 million for the nine months ended September 30, 2017. The increase was primarily attributable to an increase in personnel related costs of $18.5 million, an increase in stock-based compensation of $9.4 million, an increase in facility and equipment related costs of $8.3 million and an increase in consulting and outside services of $6.7 million. The increases in personnel related costs and stock-based compensation were largely driven by an increase in the number of employees supporting our research and development programs. These increases were partially offset by a decrease of $29.4 million in costs related to in-licensing agreements executed in 2017 with Cellscript, LLC and its affiliate mRNA RiboTherapeutics, Inc. to sublicense certain patent rights.

General and administrative expenses

General and administrative expenses increased by $7.4 million, or 15%, to $56.2 million for the nine months ended September 30, 2018 compared to $48.8 million for the nine months ended September 30, 2017. The increase was primarily due to an increase in stock-based compensation of $2.5 million, an increase of personnel related costs of $2.0 million, and an increase in consulting and outside services of $1.7 million. The increases in stock-based compensation and personnel related costs were primarily driven by an increase in the number of employees supporting our business operations.

Other income, net

The following table summarizes other income, net for each period presented (in thousands):

|                                | Nine Months Ended September 30, | Change |
|                                | 2017                            | 2018   | $      | %     |
| Interest income                | $11,452                         | $18,129| $6,677 | 58%   |
| (Loss) gain on investment      | (1,175)                         | 1,362  | 2,537  | (216)%|
| Interest expense               | (102)                           | (1,571)| (1,469)| 1,440%|
| Other income (expense), net    | (528)                           | (835)  | (307)  | 58%   |
| Total other income, net        | $9,647                          | $17,085| $7,438 | 77%   |

Other income, net increased by $7.4 million, or 77%, to $17.1 million for the nine months ended September 30, 2018 compared to $9.6 million for the nine months ended September 30, 2017. The increase was primarily due to an increase of $6.7 million in interest income from our investments in marketable securities, driven by an overall higher market interest rate and a higher weighted average balance of cash and investments during the nine months ended September 30, 2018, compared to the nine months ended September 30, 2017, and an increase of $2.5 million in gain from the sale and maturity of our investments in marketable securities for the nine months ended September 30, 2018, compared to the nine months ended September 30, 2017. These increases were partially offset by higher interest expense of $1.5 million related to our Norwood construction financing obligation. We began recording interest expense upon the completion of the Norwood building in July 2018. Please see Note 7 to the consolidated financial statements appearing elsewhere in this prospectus.


**Comparison of the years ended December 31, 2016 and 2017**

**Revenue**

The following table summarizes our revenue by source for each period presented (in thousands):

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
<th>Change $</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaboration revenue</td>
<td>101,536</td>
<td>176,974</td>
<td>75,438</td>
<td>74%</td>
</tr>
<tr>
<td>Grant revenue</td>
<td>6,860</td>
<td>28,851</td>
<td>21,991</td>
<td>321%</td>
</tr>
<tr>
<td><strong>Total revenue</strong></td>
<td>$108,396</td>
<td>$205,825</td>
<td>$97,429</td>
<td>90%</td>
</tr>
</tbody>
</table>

Total revenue increased by $97.4 million, or 90%, to $205.8 million in 2017 compared to $108.4 million in 2016, due to increases in both collaboration revenue and grant revenue recognized in 2017. Collaboration revenue increased by $75.4 million, or 74%, to $177.0 million in 2017 compared to $101.6 million in 2016, mainly driven by $70.3 million of revenue recognized as a result of the termination of the Alexion strategic alliance arrangements. Grant revenue increased by $22.0 million, or 321%, to $28.9 million in 2017 compared to $6.9 million in 2016. The increase was largely attributable to having a full year revenue recognized from the BARDA contract, which was entered in the second half of 2016 in support of the development of a mRNA vaccine for Zika.

**Operating expenses**

The following table summarizes our operating expenses for each period presented (in thousands):

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
<th>Change $</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research and development</td>
<td>274,717</td>
<td>410,459</td>
<td>135,742</td>
<td>49%</td>
</tr>
<tr>
<td>General and administrative</td>
<td>57,450</td>
<td>64,722</td>
<td>7,272</td>
<td>13%</td>
</tr>
<tr>
<td><strong>Total operating expenses</strong></td>
<td>$332,167</td>
<td>$475,181</td>
<td>$143,014</td>
<td>43%</td>
</tr>
</tbody>
</table>

Research and development expenses

Research and development expenses increased by $135.7 million, or 49%, to $410.5 million in 2017 compared to $274.7 million in 2016. The increase was primarily attributable to $53.0 million in costs related to in-licensing agreements executed in 2017 with Cellscript, LLC and its affiliate mRNA RiboTherapeutics, Inc. to sublicense certain patent rights, an increase in clinical trial and manufacturing costs of $45.1 million for our preclinical and clinical studies, and an increase in personnel related costs of $36.5 million due to an increase in the number of employees supporting our research and development programs.

General and administrative expenses

General and administrative expenses increased by $7.3 million, or 13%, to $64.7 million in 2017 compared to $57.5 million in 2016. The increase was mainly due to an increase in personnel related costs of $6.7 million driven by an increase in the number of employees.
### Other income, net

The following table summarizes other income, net for each period presented (in thousands):

<table>
<thead>
<tr>
<th>Year Ended December 31</th>
<th>2016</th>
<th>2017</th>
<th>$</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest income</td>
<td>11,312</td>
<td>15,235</td>
<td>$3,923</td>
<td>35%</td>
</tr>
<tr>
<td>Loss on investment</td>
<td>(2,399)</td>
<td>(1,085)</td>
<td>1,314</td>
<td>(55)%</td>
</tr>
<tr>
<td>Interest expense and other income (expense), net</td>
<td>(310)</td>
<td>(790)</td>
<td>(480)</td>
<td>155%</td>
</tr>
<tr>
<td>Total other income, net</td>
<td>$ 8,603</td>
<td>$ 13,360</td>
<td>$4,757</td>
<td>55%</td>
</tr>
</tbody>
</table>

Other income, net increased by $4.8 million, or 55%, to $13.4 million in 2017 compared to $8.6 million in 2016. The increase was primarily due to an increase of $3.9 million in interest income from our investment in marketable securities, driven by an overall higher market interest rate and a higher weighted average balance of cash and investments during 2017 compared to 2016, and a decrease of $1.3 million in loss from the sale of our investments in marketable securities in 2017 compared to 2016.

### Liquidity and capital resources

We have historically funded our operations primarily from the sale of preferred equity instruments and from proceeds from certain strategic alliance arrangements and grant agreements. From inception through September 30, 2018, we have raised an aggregate of $1.8 billion of proceeds through the issuance of equity and $0.8 billion from upfront payments, milestone payments, and option exercise fees related to our strategic alliances. As of September 30, 2018, we had cash, cash equivalents, restricted cash, and investments of $1.2 billion. Cash and cash equivalents and investments are invested in accordance with our investment policy, primarily with a view to liquidity and capital preservation. Investments, consisting primarily of government and corporate debt securities are stated at fair value. As of September 30, 2018, we had current and non-current investments of approximately $905.1 million and $150.4 million, respectively.

We began construction of Norwood in the second half of 2016. Our capital expenditures related to Norwood were $18.2 million and $59.9 million for the years ended December 31, 2016 and 2017, respectively, and $27.8 million and $75.3 million for the nine months ended September 30, 2017 and 2018, respectively. Cash disbursements related to Norwood were $3.1 million and $41.2 million for the years ended December 31, 2016 and 2017, respectively, and $18.3 million and $83.2 million for the nine months ended September 30, 2017 and 2018, respectively. Norwood officially opened in July 2018.

On January 30, 2018 and February 12, 2018, we issued Series G preferred stock for total gross proceeds of $560.0 million. On May 7, 2018, we issued Series H preferred stock for gross proceeds of $125.0 million of which $13.0 million is determined to be a premium, and recorded to deferred revenue as part of the Merck PCV/SAV agreement executed contemporaneously. Please see Note 3 to our consolidated financial statements appearing elsewhere in this prospectus.
Cash flow

The following table summarizes the primary sources and uses of cash for each period presented (in thousands):

<table>
<thead>
<tr>
<th>Year Ended December 31,</th>
<th>Nine Months Ended September 30,</th>
<th>(unaudited)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td>Operating activities</td>
<td>$66,734</td>
<td>$ (331,484)</td>
</tr>
<tr>
<td>Investing activities</td>
<td>(648,607)</td>
<td>416,095</td>
</tr>
<tr>
<td>Financing activities</td>
<td>472,910</td>
<td>168</td>
</tr>
<tr>
<td>Net (decrease) increase in cash and cash equivalents</td>
<td>$(108,963)</td>
<td>$84,779</td>
</tr>
</tbody>
</table>

Operating activities

We derive cash flows from operations primarily from cash collected from certain strategic alliances. Our cash flows from operating activities are significantly influenced by our use of cash for operating expenses and working capital to support the business. We have historically experienced negative cash flows from operating activities as we have invested early in our mRNA technologies, digital infrastructure, manufacturing technology, and infrastructure.

Net cash used in operating activities for the nine months ended September 30, 2018 was $239.8 million and consisted of net loss of $243.3 million less non-cash adjustments of $57.3 million, plus net change in assets and liabilities of $53.9 million. Non-cash items primarily included stock-based compensation expense of $40.9 million and depreciation and amortization of $17.5 million. The net change in assets and liabilities was primarily due to a decrease in deferred revenue of $37.1 million, a decrease in accrued liabilities of $17.2 million and an increase in prepaid expenses and other assets of $5.2 million.

Net cash used in operating activities for the nine months ended September 30, 2017 was $228.6 million and consisted of net loss of $218.0 million less non-cash adjustments of $45.0 million, plus net change in assets and liabilities of $55.6 million. Non-cash items primarily included stock-based compensation expense of $29.0 million and depreciation and amortization of $14.6 million. The net change in assets and liabilities was mainly driven by a decrease in deferred revenue of $77.0 million and a decrease in accounts payable of $9.9 million, partially offset by an increase in accrued liabilities of $28.7 million.

Net cash used in operating activities in 2017 was $331.5 million and consisted of net loss of $255.9 million less non-cash adjustments of $61.7 million, plus net change in assets and liabilities of $137.2 million. Non-cash items primarily included stock-based compensation expense of $40.1 million and depreciation and amortization of $20.5 million. The net change in assets and liabilities in 2017 was primarily due to a decrease in deferred revenue of $162.3 million mainly driven by revenue recognition of $70.3 million resulting from termination of Alexion strategic alliance arrangements, a decrease in accounts payable of $12.8 million, partially offset by an increase in accrued liabilities of $34.4 million including a $25.0 million in-license payment accrual.

Net cash provided by operating activities in 2016 was $66.7 million and consisted of net loss of $216.2 million less non-cash adjustments of $57.0 million, plus net change in assets and liabilities of $226.0 million. Non-cash items primarily included stock-based compensation expense of $39.4 million and depreciation and amortization of $15.1 million. The net change in assets and liabilities in 2016 was mainly driven by an increase in deferred revenue of $164.1 million largely attributable to the upfront payments of $200.0 million and $20.0 million received in 2016 under the strategic alliance arrangements with Merck and Vertex, respectively, a decrease in accounts receivable of $52.3 million mainly attributable to the collection of $60.0 million milestone payment in 2016 under the AstraZeneca strategic alliance arrangements, an increase in accounts payable of $5.9 million, and an increase in accrued liabilities of $5.3 million.
Investing activities

Our primary investing activities consist of purchases, sales, and maturities of our investments and capital expenditures for manufacturing, laboratory, computer equipment, and software.

Net cash used in investing activities for the nine months ended September 30, 2018 was $378.9 million, which included purchases of marketable securities of $951.2 million and capital expenditures of $92.1 million, partially offset by proceeds from maturities of marketable securities of $493.5 million and proceeds from sales of marketable securities of $170.5 million.

Net cash provided by investing activities for the nine months ended September 30, 2017 was $303.3 million, which included proceeds from maturities of marketable securities of $667.3 million and proceeds from sales of marketable securities of $199.8 million, partially offset by purchases of marketable securities of $517.4 million and capital expenditures of $46.4 million.

Net cash provided by investing activities in 2017 was $416.1 million, which included proceeds from maturities of marketable securities of $800.4 million, proceeds from sales of marketable securities of $402.5 million, partially offset by purchases of marketable securities of $727.2 million, and capital expenditures of $58.4 million.

Net cash used in investing activities in 2016 was $648.6 million, which included purchases of marketable securities of $1,415.5 million, capital expenditures of $33.1 million, and an increase in restricted cash of $8.9 million, partially offset by proceeds from maturities of marketable securities of $675.2 million, and proceeds from sales of marketable securities of $133.7 million.

Financing activities

We generated cash from financing activities of $650.9 million for the nine months ended September 30, 2018, primarily from net proceeds from the issuance of redeemable convertible preferred stock of $661.1 million, partially offset by repurchases of redeemable convertible preferred stock of $8.2 million.

We had insignificant financing activities in 2017.

We generated cash from financing activities of $472.9 million in 2016 primarily from net proceeds from the issuance of preferred stock of $473.5 million.

Operation and funding requirements

Since our inception, we have incurred significant losses and negative cash flows from operations due to our significant research and development expenses. We have an accumulated deficit of $621.9 million and $865.2 million as of December 31, 2017 and September 30, 2018, respectively. We expect to continue to incur significant losses in the foreseeable future and expect our expenses to increase in connection with our ongoing activities, particularly as we continue research and development of our development candidates and clinical activities for our investigational medicines. In addition, upon the closing of this offering, we expect to incur additional costs associated with operating as a public company. Our expenses will also increase if, and as, we:

- leverage our platform to expand our programs or advance our programs into preclinical and clinical development;
- further develop our current programs;
- seek to research and develop additional programs;
- seek to research and develop additional modalities of mRNA medicines;
- seek regulatory approvals for any investigational medicines that successfully complete clinical trials;
- increase manufacturing capacity and production volume;
• hire additional clinical, manufacturing, quality control, and scientific personnel, expand our operational, financial, and management systems, and increase personnel, including personnel to support our clinical development and manufacturing efforts and our operations as a public company;
• establish a sales, marketing, medical affairs, and distribution infrastructure to commercialize any investigational medicine for which we may obtain marketing approval and intend to commercialize on our own or jointly;
• maintain, expand, and protect our intellectual property portfolio; and
• acquire or in-license other programs and technologies.

We are subject to all the risks related to the development and commercialization of novel medicines, and we may encounter unforeseen expenses, difficulties, complications, delays, and other unknown factors that may adversely affect our business. Our forecast of the period of time through which our financial resources will be adequate to support our operations is a forward-looking statement and involves risks and uncertainties, and actual results could vary as a result of a number of factors. We have based this estimate on assumptions that may prove to be wrong, and we could utilize our available capital resources sooner than we currently expect. We believe that our cash, cash equivalents, and investments as of September 30, 2018, will be sufficient to enable us to fund our projected operations through at least the next 12 months.

Our future funding requirements will depend on many factors, including, but not limited to:
• the rate of progress in the development of our development candidates;
• the initiation, progress, timing, costs, and results of clinical trials for our investigational medicines and future investigational medicines;
• the number and characteristics of programs that we develop;
• the costs of development efforts for our programs that are not subject to reimbursement from our strategic collaborators;
• the costs of mRNA materials;
• the costs necessary to obtain regulatory approvals, if any, for our investigational medicines in the United States and other jurisdictions, and the costs of post-marketing studies that could be required by regulatory authorities in jurisdictions where approval is obtained;
• the continuation of our existing strategic alliances and entry into new collaborations;
• the cost and timing of completion of additional manufacturing facilities and activities, including potential commercial-scale manufacturing;
• the costs we incur in maintaining business operations;
• the costs associated with being a public company;
• the revenue from any future sales of any approved mRNA medicines for which we are entitled to a profit share, royalties and milestones;
• the time and unreimbursed costs necessary to commercialize mRNA medicines in territories in which our investigational medicines are approved for sale;
• the effect of competing technological and market developments; and
• the costs we incur in the filing, prosecution, maintenance, and defense of our extensive patent portfolio and other intellectual property rights.
Until we can generate a sufficient amount of revenue from our programs, we expect to finance future cash needs through public or private equity or debt offerings and potential future strategic alliances from which we receive upfront fees, milestone payments, and other forms of consideration. Additional capital may not be available on reasonable terms, if at all. If we are unable to raise additional capital in sufficient amounts or on terms acceptable to us, we may have to significantly delay, scale back, or discontinue the development or commercialization of one or more of our investigational medicines, or slow down or cease work on one or more of our programs. If we raise additional funds through the issuance of additional equity or debt securities, it could result in dilution to our existing stockholders or increased fixed payment obligations, and any such securities may have rights senior to those of our common stock. If we incur indebtedness, we could become subject to covenants that would restrict our operations and potentially impair our competitiveness, such as limitations on our ability to incur additional debt, limitations on our ability to acquire, sell or license intellectual property rights and other operating restrictions that could adversely impact our ability to conduct our business. If we raise funds through strategic alliances or marketing, distribution, or licensing arrangements with third parties, we may have to relinquish valuable rights to our technologies, future revenue streams, research programs, or investigational medicines or grant licenses on terms that may not be favorable to us. Any of these events could significantly harm our business, financial condition, and prospects.

Off balance sheet arrangements
As of December 31, 2017, we did not have any off-balance sheet arrangements, as defined in Item 303(a)(4)(ii) of SEC Regulation S-K.

Contractual obligations and commitments
The following table summarizes our contractual obligations as of December 31, 2017 and the effects that such obligations are expected to have on our liquidity and cash flows in future periods:

<table>
<thead>
<tr>
<th>Payments Due by Period</th>
<th>Total</th>
<th>Less than 1 year</th>
<th>1 - 3 years</th>
<th>3 - 5 years</th>
<th>More than 5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norwood leases(1)</td>
<td>$109,509</td>
<td>$6,232</td>
<td>$12,935</td>
<td>$13,590</td>
<td>$76,752</td>
</tr>
<tr>
<td>Operating leases, excluding Norwood leases(2)</td>
<td>122,470</td>
<td>13,670</td>
<td>27,914</td>
<td>27,465</td>
<td>53,421</td>
</tr>
<tr>
<td>Purchase obligations(3)</td>
<td>20,308</td>
<td>20,308</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>License agreement obligations(4)</td>
<td>47,000</td>
<td>25,000</td>
<td>22,000</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Total contractual cash obligations</td>
<td>$299,287</td>
<td>$65,210</td>
<td>$62,849</td>
<td>$41,055</td>
<td>$130,173</td>
</tr>
</tbody>
</table>

(1) We lease land and a building located in Norwood, MA. The Norwood leases for the building facilities, land, and adjacent land, will each expire in September 2032 with options to extend each of the terms for two extension periods of ten years each at then market-based rent. The amounts in the table above represent the fixed contractual lease obligations, and do not include the optional extensions. Please refer to Note 7 to our consolidated financial statements appearing elsewhere in this prospectus.

(2) We have various lease agreements for office and laboratory space in Cambridge, MA, expiring at various times through December 2027.

(3) The amounts represent non-cancellable fixed payment obligations under certain manufacturing service agreements.

(4) We have license agreements with non-cancellable fixed payment obligations with Cellscript, LLC and its affiliate mRNA RiboTherapeutics, Inc. We do not include variable and contingent payments including annual license maintenance fees and potential milestone payments, and royalty payments because these amounts are not fixed and estimable. Cellscript, LLC and its affiliate mRNA RiboTherapeutics, Inc. are, however, eligible to receive, on a product-by-product basis, milestone payments upon the achievement of development, regulatory and commercial milestones totaling up to $25.5 million for therapeutic and prophylactic products and $0.5 million for diagnostic products. Additionally, we have other in-license agreements with third parties which require us to make future development, regulatory and commercial...
milestone payments for specified products associated with the agreements. The achievement of these milestones has not occurred and such milestone payments are immaterial.

Under our strategic collaboration agreements, we are committed to perform certain research, development, and manufacturing activities. Please refer to Note 3 to the consolidated financial statements appearing elsewhere in this prospectus. As part of our personalized mRNA cancer vaccines, or PCV, collaboration and license agreement with Merck, we are committed to perform certain research, development, and manufacturing activities related to PCV products through an initial Phase 2 clinical trial up to a budgeted amount of $200.0 million as of December 31, 2017. In April 2018, we amended the PCV agreement with Merck and the budgeted commitment increased to $243.0 million. Please see Note 15 to the consolidated financial statement appearing elsewhere in this prospectus. The expenses we expect to incur as part of our commitments under the PCV and other collaboration agreements were not included in the above table as we are not able to determine the timing and amounts of such expenses.

We have agreements with certain vendors for various services, including services related to clinical operations and support, for which we are not contractually able to terminate for convenience and avoid any and all future obligations to the vendors. Certain agreements provide for termination rights subject to termination fees or wind down costs. Under such agreements, we are contractually obligated to make certain payments to vendors, mainly, to reimburse them for their unrecoverable outlays incurred prior to cancellation. The exact amounts of such obligations are dependent on the timing of termination, and the exact terms of the relevant agreement and cannot be reasonably estimated. At December 31, 2017, we had cancellable open purchase orders of $44.4 million in total under such agreements for our significant clinical operations and support. These amounts represent only our estimate of those items for which we had a contractual commitment to pay as December 31, 2017, assuming we would not cancel these agreements. The actual amounts we pay in the future to the vendors under such agreements may differ from the cancellable open purchase order amounts of $44.4 million.

In addition to the above obligations, we enter into a variety of agreements and financial commitments in the normal course of business. The terms generally allow us the option to cancel, reschedule, and adjust our requirements based on our business needs, prior to the delivery of goods or performance of services. It is not possible to predict the maximum potential amount of future payments under these agreements due to the conditional nature of our obligations and the unique facts and circumstances involved in each particular agreement.

**JOBS Act and emerging growth company status**

In April 2012, the JOBS Act was enacted. As an EGC under the JOBS Act, we may delay the adoption of certain accounting standards until such time as those standards apply to private companies. Other exemptions and reduced reporting requirements under the JOBS Act for EGCs include presentation of only two years of audited financial statements in a registration statement for an initial public offering, an exemption from the requirement to provide an auditor’s report on internal controls over financial reporting pursuant to Section 404(b) of the Sarbanes-Oxley Act of 2002, an exemption from any requirement that may be adopted by the Public Company Accounting Oversight Board regarding mandatory audit firm rotation, and less extensive disclosure about our executive compensation arrangements. Additionally, the JOBS Act provides that an EGC can take advantage of an extended transition period for complying with new or revised accounting standards. This allows an emerging growth company to delay the adoption of certain accounting standards until those standards would otherwise apply to private companies. We have elected to avail ourselves of this exemption and, therefore, while we are an emerging growth company we will not be subject to new or revised accounting standards at the same time that they become applicable to other public companies that are not emerging growth companies.

We will remain classified as an EGC until the earlier of (i) the last day of our first fiscal year in which we have total annual gross revenues of $1.07 billion or more, (ii) the last day of the fiscal year following the fifth
anniversary of completion of this offering, (iii) the date on which we have issued more than $1.0 billion of non-convertible debt instruments during the previous three fiscal years, or (iv) the date on which we are deemed a “large accelerated filer” under the rules of the SEC with at least $700.0 million of outstanding equity securities held by non-affiliates.

Quantitative and qualitative disclosures about market risk
Our primary exposure to market risk relates to changes in interest rates. As of December 31, 2016 and 2017 and September 30, 2018, we had cash, cash equivalents, restricted cash, and investments in marketable securities of $1.3 billion, $914.6 million and $1.2 billion, respectively. Our investment portfolio is comprised of money market funds and marketable debt securities (including U.S. Treasury securities, debt securities of U.S. government agencies and corporate entities, and commercial paper). Our primary investment objectives are the preservation of capital and the maintenance of liquidity and our investment policy defines allowable investments based on quality of the institutions and financial instruments designed to minimize risk exposure. Our exposure to interest rate sensitivity is affected by changes in the general level of U.S. interest rates. Our available for sale securities are subject to interest rate risk and will fall in value if market interest rates increase.

We generally hold investments in marketable debt securities to maturity to limit our exposure to interest rate risk. Due to the short-term maturities and low risk profiles of our investments, we do not anticipate a significant exposure to interest rate risk. If market interest rates were to increase immediately and uniformly by 100 basis points, or one percentage point, from levels at December 31, 2017 and September 30, 2018, the net fair value of our interest sensitive marketable securities would not experience a material change in fair market value.

We currently do not have significant exposure to foreign currencies as we hold no foreign exchange contracts, option contracts, or other foreign hedging arrangements. Further, our operations and revenue generating activities are denominated in U.S. dollars. Our operations may be subject to fluctuations in foreign currency exchange rates in the future.

Inflation generally affects us by increasing our cost of labor. We do not believe that inflation had a material effect on our business, financial condition or results of operations during the years ended December 31, 2016 and 2017 or the nine months ended September 30, 2017 and 2018.
mRNA, the software of life

Messenger RNA, or mRNA, transfers the information stored in our genes to the cellular machinery that makes all the proteins required for life. Our genes are stored as sequences of DNA which contain the instructions to make specific proteins. DNA serves as a hard drive, safely storing these instructions in the nucleus until they are needed by the cell.

When a cell needs to produce a protein, the instructions to make that protein are copied from the DNA to mRNA, which serves as the template for protein production. Each mRNA molecule contains the instructions to produce a specific protein with a distinct function in the body. mRNA transmits those instructions to cellular machinery, called ribosomes, that make copies of the required protein.

We see mRNA functioning as the “software of life.” Every cell uses mRNA to provide real time instructions to make the proteins necessary to drive all aspects of biology, including in human health and disease. This was codified as the central dogma of molecular biology over 50 years ago, and is exemplified in the schematic below.

mRNA is used to make every type of protein, including secreted, membrane, and intracellular proteins, in varying quantities over time, in different locations, and in various combinations. This is shown in the figure below.
Given its essential role, we believe mRNA could be used to create a new category of medicines with significant potential to improve the lives of patients. Over the last 40 years, the biotechnology industry has created a new category of drugs based on recombinant protein technology. These drugs rely on secreted proteins, including antibodies and protein replacements, to treat a wide range of diseases. Today this category of drugs accounts for over $200 billion in annual worldwide sales. However, intracellular and membrane proteins represent as much as two-thirds of the proteins in humans, and are largely beyond the reach of recombinant protein technology. Based on the ability of mRNA to produce these proteins directly in cells, we believe that mRNA-based medicines have the potential to help patients in ways that could equal or exceed the impact of recombinant protein-based drugs.

The structure of mRNA

Messenger RNA is a linear polymer comprising four monomers called nucleotides: adenosine (A), guanosine (G), cytosine (C), and uridine (U). Within the region of the molecule that codes for a protein, or the coding region, the sequence of these four nucleotides forms a language made up of three-letter words called codons. The first codon, or start codon (AUG), signals where the ribosome should start protein synthesis. To know what protein to make, the ribosome then progresses along the mRNA one codon at a time, appending the appropriate amino acid to the growing protein. To end protein synthesis, three different codons (UAA, UAG, and UGA) serve as stop signals, telling the ribosome where to terminate protein synthesis. In total, there are 64 potential codons, but only 20 amino acids that are used to build proteins; therefore multiple codons can encode for the same amino acid.

The process of protein production is called translation because the ribosome is reading in one language (a sequence of codons) and outputting in another language (a sequence of amino acids). As shown in the figure below, the coding region is analogous to a sentence in English. Much like a start codon, a capitalized word can indicate the start of a sentence. Codons within the coding region resemble groups of letters representing words. The end of the sentence is signaled by a period in English, or a stop codon for mRNA.
The intrinsic advantages of using mRNA as a medicine

We believe mRNA possesses inherent characteristics that could serve as the foundation for a new category of medicines. These characteristics include:

1. **mRNA is used by every cell to produce all proteins:** Cells in the human body use mRNA to make all types of proteins, including secreted, membrane, and intracellular proteins. mRNA is used by cells to vary the quantities of protein produced over time, in different locations, and in various combinations. Given the universal role of mRNA in protein production, we believe that mRNA medicines could have broad applicability across human disease.

2. **Making proteins inside one’s own cells mimics human biology:** Using a person’s own cells to produce protein therapeutics or vaccine antigens could create advantages over existing technologies such as recombinant proteins, which are manufactured using processes that are foreign to the human body. These advantages include the ability to:
   - use multiple mRNAs to produce multiple proteins;
   - reduce or eliminate immunogenicity;
   - create multi-protein complexes;
   - produce therapeutic or vaccine proteins locally;
   - harness native protein folding and glycosylation; and
   - make proteins that are unstable outside the body.

3. **mRNA has a simple and flexible chemical structure:** Each mRNA molecule comprises four chemically similar nucleotides to encode proteins made from up to 20 chemically different amino acids. To make the full diversity of possible proteins, only simple sequence changes are required in mRNA. A vast number of potential mRNA medicines can be developed, therefore, with only minor changes to the underlying chemical structure of the molecule or manufacturing processes, a significant advantage over small molecule or protein therapeutics.

4. **mRNA has the potential for classic pharmacologic features:** The intrinsic properties of mRNA translate into attractive pharmacologic features, including:
   - each mRNA encodes for a specific protein and no other protein;
   - each mRNA molecule can produce many copies of a protein in the cell before being degraded;
   - increasing mRNA levels in a cell generally leads to increasing protein levels; and
   - the effects of mRNA in a cell can be transient and limits risk of irreversible changes to the cell’s DNA.

As a result, mRNA could have many of the attractive pharmacologic features of most modern medicines, including reproducible activity, predictable potency, and well-behaved dose dependency; and the ability to adjust dosing based on an individual patient’s needs, including stopping or lowering the dose, to seek to ensure safety and tolerability.

**mRNA as a new category of medicines**

Based on these and other features, we have developed four core beliefs about the value drivers of mRNA as a new category of medicines:

1. **mRNA has the potential to create an unprecedented abundance and diversity of medicines.** mRNA medicines could be used to provide patients or healthy individuals with any therapeutic protein or vaccine, including those targeting intracellular and membrane proteins. This breadth of applicability has the potential to create an extraordinary number of new mRNA-based medicines that are currently beyond the reach of recombinant protein technology.
Advances in the development of our mRNA medicines can reduce risks across our portfolio. mRNA medicines share fundamental features that can be used to learn quickly across a portfolio. We believe that once safety and proof of protein production has been established in one program, the technology and biology risks of related programs that use similar mRNA technologies, delivery technologies, and manufacturing processes will decrease significantly.

mRNA technology can accelerate discovery and development. The software-like features of mRNA enable rapid in silico design and the use of automated high-throughput synthesis processes that permit discovery to proceed in parallel rather than sequentially. We believe these mRNA features can also accelerate drug development by allowing the use of shared manufacturing processes and infrastructure.

The ability to leverage shared processes and infrastructure can drive significant capital efficiency over time. We believe the manufacturing requirements of different mRNA medicines are dramatically more similar than traditional recombinant protein-based drugs across a similarly diverse pipeline. When manufacturing at commercial scale, we believe mRNA medicines will benefit from shared capital expenditures, resulting in lower program-specific capital needs and an advantageous variable cost profile.

Recombinant protein-based drugs significantly advanced patient care and transformed the biopharmaceutical industry. We believe that the development of mRNA as a new category of medicines could represent another breakthrough for patients and our industry.

OUR STRATEGIC PRINCIPLES AND APPROACH TO MANAGING RISK

Our strategy is designed to deliver on the full scope of the mRNA opportunity over the long-term. Reaching patients with mRNA medicines requires us to make complex choices, including: how much capital we devote to technology creation, drug discovery, drug development, and infrastructure; which programs we advance and how; whether we advance programs alone or with strategic collaborators; and which capabilities we build internally versus outsource.

To navigate these choices, we established five strategic principles that guide our approach to creating long-term value for patients and investors. No single strategic principle dominates our choices. Embedded in every decision we make is also our assessment of the most important risks inherent in our business. We believe these risks fall into four categories: technology, biology, execution, and financing.

To increase our chances of success, we often find it necessary to balance our near-to-mid-term risks against the strategic principles that guide our approach to long-term value creation.

Our strategic principles

1. **We seek to discover and develop a large pipeline in parallel.** Our goal is to address or prevent as many human diseases as our technology, talent, capital, and other resources permit. We do so as rapidly as we can, understanding both the urgency for patients and the need to be disciplined in our approach. We have generated a diverse pipeline of 21 development candidates to date, 10 of which have advanced into clinical trials, and many of which have the potential to be first-in-class or best-in-class medicines.

2. **We undertake sustained, long-term investment in technology creation.** We aim to improve the performance of mRNA medicines in our current modalities, and to unlock new modalities, through investments within basic and applied science. We are committed to remaining at the forefront of mRNA science, which we believe will take many more years to fully mature.

3. **We focus on the pace and scale of our learning.** We believe that time is a critical resource. We seek to accelerate our progress by solving numerous technical problems in parallel rather than in sequence. Our scientists pursue experiments based on how much we can learn from the results, not just the probability of a positive outcome. We believe negative information is valuable and we can learn from our setbacks. We
make significant investments in digital assets and research infrastructure to accelerate the pace and scale of our learning.

4. **We integrate across the most critical parts of our value chain.** mRNA is a complex multicomponent system and we believe it demands integration. We believe that we must be directly engaged in research, drug discovery, drug development, process and analytical development, and manufacturing to accelerate our learning, reduce our risk, and protect our critical know-how. Where appropriate, we seek out strategic collaborators that can augment our capabilities or expand our capacity in specific therapeutic areas, while being careful to resist the fragmentation of our core technology.

5. **We forward invest in core enabling capabilities and infrastructure.** To execute across a broad pipeline, we need to invest at risk before we have all the answers. Our forward investments focus on areas where lead times are long and where early investments can reduce execution risk and accelerate future progress. In 2016, we proactively decided to invest in a dedicated manufacturing facility in Norwood, MA, to support the anticipated growth of our pipeline.

Our approach to managing risk

In conjunction with the strategic principles that guide our approach to long-term value creation, we actively manage the risks inherent in our business. At present, these categories of risk include: technology, biology, execution, and financing. We summarize our approach to managing these risks below:

1. **Technology risk** encompasses the challenges of developing the product features of mRNA medicines, including delivery, controlling interactions with the immune system, optimizing therapeutic index, and manufacturing. We believe the best way to mitigate technology risk is to sustain long-term investments in our platform. In addition, we diversify our technology risk by compartmentalizing our pipeline into groups of programs with shared product features, which we call modalities. Lastly, we stage program development within a modality, leveraging the first program, whether successful or not, to generate insights that accelerate and reduce the risk of subsequent programs within the modality.

2. **Biology risk** entails the risk unique to each program based on its mechanism of action and of clinical development in the target patient population. We believe the best way to manage biology risk is to diversify it by pursuing multiple programs in parallel. In addition, within a modality we seek to initially pursue programs with well-understood biology. Lastly, we may seek strategic collaborators to share risk and upside in disease areas with high inherent biology risk, such as cancer and heart disease.

3. **Execution risk** refers to the challenge of executing against the scale of our mission. We solve for this risk by seeking to hire the right people, the best talent in the industry. We seek to foster a culture of execution with a focus on quick review cycles and high velocity decision-making. We make forward investments in infrastructure, including manufacturing. Lastly, we have created a digital backbone to track all aspects of our programs and anticipate challenges before they arise.

4. **Financing risk** refers to our ability to access the capital required to fund the current breadth of our endeavor, as well as new opportunities. We manage this risk by attempting to maintain a strong balance sheet with several years of cash runway. As of September 30, 2018, we had cash, cash equivalents, and investments of $1.2 billion. Total operating expenses were approximately $475 million in 2017. We seek equity investors who share our long-term vision and we are committed to building these relationships over time. Lastly, we pursue strategic alliances, which provide resources and another source of funding.

There is no single strategic principle nor single category of risk that dominates our decision-making, and universal rules do not exist across our portfolio. Our trade-offs generally involve balancing near-term risks and long-term value creation. Because development cycles are long, our choices are complex. We expect the weighting and types of risk we face will evolve as our business matures. We believe that disciplined capital allocation across near- and long-term choices must be a core competency if we are to maximize the opportunity for patient impact and shareholder value creation.
Our progress

We are encouraged by our results to date. Across the six modalities that we have established, we have moved 21 programs into development, and manufactured more than 50 drug substance lots for use in IND-enabling Good Laboratory Practice, or GLP, toxicology studies. “IND-enabling” refers to studies required for Investigational New Drug Application, or IND, or equivalent non-U.S. regulatory filings, such as a Clinical Trial Application, or CTA. We and our strategic collaborators have completed IND-enabling GLP toxicology programs to support open INDs for 13 of our development candidates, manufactured more than 45 current good manufacturing practice, or cGMP, batches of clinical trial materials, filed 13 INDs or CTAs to initiate clinical trials, and have 10 programs in clinical trials and another 3 with open INDs. More than 755 subjects in clinical trials have been dosed with our mRNA vaccines or therapeutics. To fund these activities, we have raised over $2.6 billion as of September 30, 2018, including $1.8 billion from equity issuances and $0.8 billion in upfront payments, milestone payments, and option exercise fees from strategic collaborators.
OUR PLATFORM
Overview of our platform

Our “platform” refers to our accumulated knowledge and capabilities in basic and applied sciences across mRNA, the delivery of mRNA to target tissues, and the manufacturing processes for making potential mRNA medicines. We invest in basic science to discover foundational mechanistic insights, and we invest in applied sciences to invent technology that harnesses those insights. We use our platform to identify and develop new mRNA medicines. When we identify a combination of platform technologies or programs across mRNA technologies, delivery technologies, and manufacturing processes that can enable shared product features across multiple potential mRNA medicines, we group those programs as a modality. The primary goal of our platform is to identify new modalities and to expand the utility of our existing modalities. We are committed to advancing the technological frontier of mRNA medicines over the long term.

We define success in our platform as achieving the following pharmacologic properties:

- predictable dose response;
- reproducible pharmacology, including upon repeat dosing;
- therapeutic potency, through achieving the intended pharmacologic activity in the target tissue;
- safety and tolerability; and
- scalability for development.

Achieving any of these pharmacologic properties requires many, often interdependent, technological solutions. We organize our efforts into three core scientific areas: mRNA, delivery, and manufacturing process as shown in the figure below.

We pursue mRNA science both to minimize undesirable activation of the immune system by mRNA and to maximize the mRNA potency of mRNA once inside target cells. We pursue delivery science to protect mRNA from extracellular enzymes that would degrade it, to avoid counterproductive interactions of our delivery vehicles with the immune system, deliver mRNA to desired tissues, and facilitate mRNA transport across cell membranes to the translational machinery within cells. Finally, we have learned that the methods for producing mRNA and lipid nanoparticle, or LNP, delivery systems can have profound positive and negative effects on pharmacology. We pursue process science to optimize these features for our future medicines and to develop technical capabilities to scale our potential mRNA medicines for clinical development.

Through September 30, 2018, we have incurred approximately $480 million of expense to advance our platform technology and our intellectual property. This investment has underpinned the creation of all six of our existing modalities and helped us to establish fundamental intellectual property. We intend to sustain our investment in our platform in the future because we believe we can establish new modalities and continue to make meaningful improvements in the performance of our current modalities.

The success of our current platform and the current pipeline of 21 programs that it underpins depends on hundreds of small advances in our three core scientific areas. Examples of many critical advances that we have made are described below. These advances demonstrate our significant progress to date, and exemplify our approach to tackling hundreds of smaller scientific problems and organizing them into technological solutions.
Messenger RNA is a linear polymer comprised of four monomers called nucleotides: adenosine (A), guanosine (G), cytosine (C), and uridine (U). Within the region of the mRNA molecule that serves as instructions for protein synthesis, the coding region, the exact sequence of these four nucleotides forms a language made up of three-letter words called codons. One codon, the start codon (AUG), serves to signal where the ribosome should start protein synthesis. To know what protein to make, the ribosome then progresses along the mRNA one codon at a time, appending the appropriate amino acid to the growing protein chain. Because the ribosome is reading in one language (a sequence of codons) and outputting in another language (a sequence of amino acids), this process is called translation. Finally, three different codons (UAA, UAG, and UGA) can serve as stop signals, telling the ribosome where to terminate protein synthesis. The production of proteins from mRNA sequences is called translation and is used to make all human proteins. The production of mRNA from DNA is called transcription.

As shown in the figure below, the coding region in an mRNA molecule is analogous to a sentence in English. The start codon indicates the start of the protein, much like a capitalized word can indicate the start of a sentence. Codons within the coding region resemble groups of letters representing words. The end of the sentence is signaled by a period in English, or a stop codon for mRNA.

In every cell, hundreds of thousands of mRNAs make hundreds of millions of proteins every day. A typical protein contains 200-600 amino acids; therefore a typical mRNA coding region ranges from 600-1,800 nucleotides.

In addition to the coding region, mRNAs contain four other key features: (1) the 5’ untranslated region or 5’-UTR; (2) the 3’ untranslated region or 3’-UTR; (3) the 5’ cap; and (4) a 3’ polyadenosine, or poly-A, tail. The sequence of nucleotides in the 5’-UTR influences how efficiently the ribosome initiates protein synthesis, whereas the sequence of nucleotides in the 3’-UTR contains information about which cell types should translate that mRNA and how long the mRNA should last. The 5’ cap and 3’ poly-A tail enhance ribosome engagement and protect the mRNA from attack by intracellular enzymes that digest mRNA from its ends.

As a result of this biology, mRNA has several key features. First, mRNA is exquisitely specific. There is a one-to-one correspondence between an mRNA molecule and the protein dictated by the coding sequence. Second, the biological effects of mRNA are amplified. Because each mRNA copy can be translated thousands of times, we believe that in some cases, a small number of mRNA copies per cell may be sufficient to induce a pharmacologic...
Decades of academic investigation have uncovered the basic mechanisms of mRNA translation. Parallel efforts have uncovered how the innate immune system determines self-mRNA versus foreign RNA from RNA-based viruses. We are grateful for the deep scientific foundation established by these pioneers. Yet as we seek to develop mRNA into medicines we often find ourselves at the frontiers of current understanding. Therefore, we invest in both applied and basic research, seeking to advance both the state of our technology and the state of the scientific community’s understanding of mRNA.

Examples of advances in mRNA science that combine nucleotide chemistry, sequence engineering, and targeting elements are described below.

mRNA chemistry: Modified nucleotides to mitigate immune system activation

The innate immune system has evolved to protect cells from foreign RNA, such as viral RNA, by inducing inflammation and suppressing mRNA translation once detected. Many cells surveil their environment through sensors called toll-like-receptors, or TLRs. These include types that are activated by the presence of double-stranded RNA (TLR3) or uridine containing RNA fragments (TLR7, TLR8). Additionally, all cells have cytosolic double-stranded RNA, or dsRNA, sensors, including retinoic acid inducible gene-I, or RIG-I that are sensitive to foreign RNA inside the cell.

The immune and cellular response to mRNA is complex, context specific, and often linked to the sensing of uridine. To minimize undesired immune responses to our potential mRNA medicines, our platform employs chemically-modified uridine nucleotides to minimize recognition by both immune cell sensors such as TLR3/7/8, and broadly-distributed cytosolic receptors such as RIG-I. mRNA produced using our synthesis technologies and containing unmodified uridine results in significant upregulation of secreted cytokines such as IP-10, as shown in the figure below. Administration of monocyte-derived macrophages, or MDMs, with unmodified mRNA formulated in LNPs results in an increased ratio of IP-10 transcripts relative to a housekeeping gene, HPRT. By substituting unmodified uridine with a modified uridine, we can substantially reduce immune cell activation in this assay. The control contains only transfection agent and no mRNA. In multiple preclinical experiments we have demonstrated reduced immune cell activation, including of B cells, lower immunoglobulin secretion, and lower cytokine expression when administering mRNA made with modified uridine versus unmodified uridine. To date, when deploying these technologies we have yet to observe dose-limiting toxicity attributable to the mRNA encoding proteins from our drug substance even at the exaggerated doses in IND-enabling GLP toxicology programs. Importantly, in preclinical testing, our chemically-modified uridine has not significantly affected the ribosome’s ability to read and translate the mRNA sequence.

Nucleotide chemistry of mRNA reduces immune activation in vitro (in MDMs)
mRNA sequence engineering: Maximizing protein expression

mRNA exists transiently in the cytoplasm, during which time it can be translated into thousands of proteins before eventually being degraded. Our platform applies bioinformatic, biochemical, and biological screening capabilities, most of which have been invented internally that aim to optimize the amount of protein produced per mRNA. We have identified proprietary sequences for the 5'-UTR that have been observed to increase the likelihood that a ribosome bound to the 5'-end of the mRNA transcript will find the desired start codon and reliably initiate translation of the coding region.

We additionally design the nucleotide sequence of the coding region to maximize its successful translation into protein. As previously described, there are often multiple codons that encode for a specific amino acid. The amount of protein produced by an mRNA sequence is known to be partly determined by the codons it uses, with certain codons being more or less common in endogenous mRNAs. We have found that the amount of protein produced is also determined by the secondary structure of mRNA, or the propensity of mRNA to fold on itself, with more structured mRNAs producing more protein. We designed a set of sequences which independently varied codon usage and structure of the mRNA. As shown in the figure below, protein expression in the Alpha mouse liver 12, or AML12, cell line is highest for sequences containing more commonly occurring codons and also more structured mRNA. Both codon usage and structure have an independent and additive effect on protein expression, shown as mean expression (solid line), as measured by fluorescence of the expressed protein, with 95% confidence interval in gray. The total expression area under the curve, or AUC, and standard error of the mean for AUC are shown for each quadrant, in relative fluorescence units per hour, or RFU/h. By optimizing translation initiation and efficiency, we have further increased the average number of full-length desired proteins expressed per molecule mRNA. This permits us to reduce the mRNA doses required to achieve the same therapeutic benefit.

Sequences with more structure and more common codons in mRNA maximize protein expression in vitro

Targeting elements: Enabling tissue-targeted translation

All nucleated cells in the body are capable of translating mRNA, resulting in pharmacologic activity in any cell in which mRNA is delivered and translated. To minimize or prevent potential off-target effects, our platform employs technologies that regulate mRNA translation in select cell types. Cells often contain short RNA sequences, called microRNAs or miRNAs, that bind to mRNA to regulate protein translation at the mRNA level. Different cell types have different concentrations of specific microRNAs, in effect giving cells a microRNA signature. microRNA binding directly to mRNA effectively silences or reduces mRNA translation and promotes mRNA degradation. We design microRNA binding sites into the 3'-UTR of our potential mRNA medicines so that if our mRNA is delivered to cells with such microRNAs, it will be minimally translated and rapidly degraded.
As an example, we have demonstrated by intratumoral administration in an animal model that an mRNA encoding a cytotoxic protein and containing a microRNA binding site can be used to selectively kill cancer cells, while protecting systemic tissues such as liver cells. In a mouse model of cancer (Hep3b subcutaneous xenograft mouse), liver enzyme levels and immunohistochemistry, or IHC, of cleaved caspase-3, or CC3, indicate production of an apoptosis-inducing protein encoded by mRNA in tumor cells but not healthy liver cells when the mRNA has multiple miR-122 target sites. This is denoted as 3x122ts in the figure below; miR-122 is more prevalent in non-cancerous liver cells, but absent in the cancerous liver cells. We published this work in Nucleic Acid Therapeutics in 2018.

**Tissue-targeted translation of mRNA encoding a pro-apoptotic protein and microRNA binding sites in mouse study**

Our platform: Delivery science

We focus on the delivery of our mRNA molecules to specific tissues. Our mRNA can, in specific instances, such as our VEGF therapeutic, be delivered by direct injection to a tissue in a simple saline formulation without lipid nanoparticles, or LNPs, to locally produce small amounts of pharmacologically active protein. However, the blood and interstitial fluids in humans contain significant RNA degrading enzymes that rapidly degrade any extracellular mRNA and prevent broader distribution without LNPs. Additionally, cell membranes tend to act as a significant barrier to entry of large, negatively-charged molecules such as mRNA. We have therefore invested
heavily in delivery science and have developed LNP technologies, as well as alternative nanoparticle approaches to enable delivery of larger quantities of mRNA to target tissues.

LNPs are generally composed of four components: an amino lipid, a phospholipid, cholesterol, and a pegylated-lipid, or PEG-lipid. Each component, as well as the overall composition, or mix of components, contributes to the properties of each LNP system. LNPs containing mRNA injected into the body rapidly bind proteins that can drive uptake of LNPs into cells. Once internalized in endosomes within cells, the LNPs are designed to escape the endosome and release their mRNA cargo into the cell cytoplasm, where the mRNA can be translated to make a protein and have the desired therapeutic effect. Any mRNA and LNP components that do not escape the endosome are typically delivered to lysosomes where they are degraded by the natural process of cellular digestion.

Examples of tools we developed by using our platform include proprietary LNP formulations that address the steps of mRNA delivery, including cell uptake, endosomal escape, and subsequent lipid metabolism, and for avoidance of counterproductive interactions with the immune system. Examples of delivery tools we have developed are described below.

**Chemistry: Novel lipid chemistry to potentially improve safety and tolerability**

We initially used LNP formulations that were based on known lipid systems, which we refer to as “legacy LNPs.” A recognized limitation of these legacy LNPs is the potential for inflammatory reactions upon single and repeat administration that can impact tolerability and therapeutic index. Our later-developed, proprietary LNP systems are therefore designed to be highly tolerated and minimize any LNP vehicle-related toxicities with repeat administration *in vivo*. The changes we made have included engineering amino lipids to avoid the immune system and to be rapidly biodegradable relative to prior lipids as shown in the figure below. Administered intravenously in non-human primates, at 0.2 mg/kg, our proprietary LNPs demonstrate rapid clearance of the lipid from panel A (plasma) and B (various organs 12 hours post administration).

**Rapid clearance of lipid components of LNPs from plasma in non-human primate study (y-axis in log-scale)**

![Graph showing lipid clearance](image-url)
Even in the case of vaccines, where one might hypothesize that LNP-induced immune stimulation could potentially increase the effectiveness of the vaccine, we have demonstrated in preclinical studies that we can maintain the desired immune response to the vaccine while reducing undesired local immune reaction, or reactogenicity, to the LNP as shown in the figure below. Representative histology sections in the muscle stained with hematoxalin and eosin two days after a single intramuscular administration in rats demonstrated less inflammation and muscle cell necrosis with our proprietary LNPs vs. legacy LNPs containing 0.1 mg of our mRNA. As exemplified in the box with the legacy LNP in panel A, necrosis and degeneration of muscle cells and inflammation were observed (dotted box). With our proprietary LNPs, inflammation (dotted box) and muscle cell necrosis were less extensive. Serum cytokine levels shown in panel B, are lower with our proprietary LNPs vs. legacy LNPs.

**Vaccines with our proprietary LNPs demonstrate less inflammation and muscle cell necrosis compared to legacy LNPs in rat study**

Panel (B)

Panel (A)
**Composition: Proprietary LNPs enhance delivery efficiency**

Our platform includes extensive in-house expertise in medicinal chemistry, which we have applied to design large libraries of novel lipids. Using these libraries in combination with our discovery biology capabilities, we have conducted high throughput screens for desired LNP properties and believe that we have made fundamental discoveries in preclinical studies about the relationships between structural motifs of lipids and LNP performance for protein expression. By screening for components and compositions that enhance the amount of mRNA delivered per cell and protein expression, we have demonstrated with intravenous administration up to a six-fold improvement in protein production over the prior state of the art for LNPs as shown in the figure below (n=3 rats, 95% CI shown).

**Surface properties: Novel LNP design to avoid immune recognition**

We have designed our proprietary LNP systems for sustained pharmacology upon repeat dosing by eliminating or altering features that activate the immune system. These are based on insights into the surface properties of LNPs. Upon repeated dosing, surface features on traditional LNPs such as amino lipids, phospholipids, and PEG-lipids, can be recognized by the immune system, leading to rapid clearance from the bloodstream, a decrease in potency upon repeat dosing, and an increase in inflammation.
Based on our insights into these mechanisms, we have engineered our LNP systems to reduce or eliminate undesirable surface features. In preclinical studies in non-human primates for our systemic therapeutic development candidates that use our novel LNP systems, we have been able to repeat dose with negligible or undetectable loss in potency, liver damage, and immune system activation.

**Our platform: Manufacturing process science**

We invest significantly in manufacturing process science to impart more potent features to our mRNA and LNPs, and to invent the technological capabilities necessary to manufacture our potential mRNA medicines at scales ranging from micrograms to kilograms, as well as achieve pharmaceutical properties such as solubility and shelf life. We view developing these goals of manufacturing and pharmaceutical properties as stage appropriate for each program. In some cases, this includes inventing novel analytical technologies that make it possible to connect analytical characterization of mRNA and LNPs to biological performance.

**mRNA manufacturing process: Improving pharmacology**

Our platform creates mRNA using a cell-free approach called *in vitro* transcription in which an RNA polymerase enzyme binds to and transcribes a DNA template, adding the nucleotides encoded by the DNA to the growing RNA strand. Following transcription, we employ proprietary purification techniques to ensure that our mRNA is free from undesired synthesis components and impurities that could activate the immune system in an indiscriminate manner. Applying our understanding of the basic science underlying each step in the manufacturing process, we have designed proprietary manufacturing processes to impart desirable pharmacologic features, for example increasing potency in a vaccine. Using a model antigen injected intramuscularly in mice at a 3 µg mRNA dose, the figure below shows the significant improvement in CD8 T cell response we have achieved through mRNA manufacturing process science and engineering as evidenced by Process B.

![Manufacturing process changes to tune immune response in mouse study](image)

**LNP manufacturing process: Improving pharmacology**

Our platform technology includes synthetic processes to produce LNPs. Traditionally LNPs are assembled by dissolving the four molecular components, amino lipid, phospholipid, cholesterol, and PEG-lipid, in ethanol and then mixing this with mRNA in an aqueous buffer. The resulting mixture is then purified to isolate LNPs from impurities. Such impurities include molecular components that have not been incorporated into particles, un-encapsulated mRNA that could activate the immune system, and particles outside of the desired size range.

Going beyond optimization of traditional manufacturing processes, we have invested in understanding and measuring the various biochemical and physical interactions during LNP assembly and purification. We have additionally developed state-of-the-art analytical techniques necessary to characterize our LNPs and biological properties.
systems to analyze their *in vitro* and *in vivo* performance. With these insights, we have identified manufacturing process parameters that drive LNP performance, for example, the potency in a secreted therapeutic setting. These insights have allowed us to make significant improvements in the potency of our LNPs, as exemplified in the figure below. For example, expression of a secreted protein in our Relaxin program (AZD7970) demonstrates an approximate eight-fold increase in area under the curve, or AUC, and approximate six-fold increase in maximum concentration for manufacturing process Y versus manufacturing process X in rats dosed intravenously with 0.5 mg/kg mRNA.

**Manufacturing process changes to enhance relaxin protein production by mRNA in rat study**

![Graph showing manufacturing process changes](image)
Our platform progress to date

Over the last seven years, we have solved numerous interdependent problems related to the pharmacologic features of our potential mRNA medicines. These features are detailed and exemplified below.

Dose-dependent protein expression at clinically relevant levels

We have demonstrated in preclinical studies the ability to generate consistent dose-dependent levels of protein, which is particularly important for therapeutics. A recent example is from our IND-enabling non-human primate study for our antibody against Chikungunya virus program (mRNA-1944). We demonstrated linear dose-dependence, meaning three- and ten-fold increases in the dose of mRNA led to three- and ten-fold increases in antibody as shown in the figure below. At the top dose, antibody levels reached 16.2 ± 4.6 µg/mL (SD) following first dose (0 hours), and effectively doubled to 28.8 ± 10.0 µg/mL upon second dose (168 hours). This dose regimen also maintained antibody trough levels above 2 µg/mL for 100 days in non-human primates, a level consistent with clinically efficacious levels of many approved antibodies. All doses (0.3, 1, and 3 mg/kg) tested in non-human primates showed no dose-limiting toxicities related to mRNA-1944, and all other observations were generally reversible.

Expression of antibody against Chikungunya virus with repeat dosing of mRNA-1944 in non-human primate study
Reproducible pharmacology, including upon repeated dosing

By combining advances in mRNA, delivery, and manufacturing process science, we have demonstrated in preclinical studies sustained and reproducible pharmacology. The figure below shows a recent example in a mouse model that recapitulates metabolic defects in propionic acidemia, or PA. In this rare disease, a defect in one or both of two different subunits (PCCA and PCCB) of the mitochondrial enzyme propionyl-CoA carboxylase results in accumulation of toxic metabolites such as 2-methylcitrate, or 2MC. In mice hypomorphic for the PCCA subunit, monthly IV administration of mRNAs encoding PCCA and PCCB formulated in our proprietary LNP (mRNA-3927) resulted in a significant and sustained lowering of 2MC throughout the duration of the 6-month study compared to control (luciferase) mRNA (1 mg/kg, n=6/group).

Plasma 2-methylcitrate levels with repeat dosing of PCCA+PCCB mRNA in PA mouse study
Decreased immune activation upon repeat dosing in non-human primates

We have observed decreased immune activation with repeat dosing in non-human primates, as shown in the figure below. Panel A indicates serum concentration of human erythropoietin, or hEPO, with repeat dosing of mRNA encoding hEPO in our proprietary LNPs with weekly intravenous, or IV, administration at 0.2 mg/kg in non-human primates. Panels B and C demonstrate comparable serum concentrations of MCP-1 (promoting immune cell recruitment to sites of inflammation) and C5b9 (indicative of innate immune activation via the complement system) with our proprietary LNP at 0.2 mg/kg weekly IV infusion in non-human primates vs. legacy LNP.

Repeat dosing with mRNA encoding for hEPO in our proprietary LNP in non-human primate study

In addition to this example we have completed multiple IND-enabling toxicology studies under GLP for our two systemic therapeutics modalities. For many such programs the no adverse event level was the top dose tested, generally 2 mg/kg or higher. We believe that by combining proprietary mRNA technologies, delivery technologies, and manufacturing process technologies we have significantly advanced the potential therapeutic index of our potential mRNA-based therapeutics.
Pharmacologic activity in the target tissue and cell

While some of our modalities, such as systemic secreted therapeutics, can leverage many different cell types to make therapeutic proteins, others such as systemic intracellular therapeutics, may require delivery of our mRNA into specific tissues, for instance hepatocytes in certain liver metabolic diseases. Combining our proprietary mRNA, delivery, and manufacturing process technologies we have observed on-target pharmacologic activity in hepatocytes in non-human primates. The on-target potency of this approach contrasts with traditional delivery technologies. In the figure below, our proprietary LNP and process result in mRNA delivery to and protein expression in liver hepatocytes in non-human primates as demonstrated with a reporter mRNA detected by in situ hybridization and a reporter protein detected by immunohistochemistry at 12 hours after IV infusion at 0.5 mg/kg.

mRNA delivery to and protein expression in hepatocytes with our proprietary LNPs in non-human primate study

Our platform’s future: Improving and expanding our modalities

We are committed to sustaining investment in our platform, both in basic science to elucidate new mechanistic insights, and in applied science to discover new technologies that harness these insights. Our platform investments have enabled six modalities to date, most of which have already led to multiple development candidates and investigational medicines in our pipeline. We believe that sustaining our investment in platform research and development will enable further improvements in the current modalities and will lead to the creation of new modalities, both of which will benefit our clinical pipeline in the years ahead.
CREATING MODALITIES WITH SHARED PRODUCT FEATURES

Our approach to developing modalities

Within our platform, we develop technologies that enable the development of mRNA medicines for diverse applications. When we identify technologies that we believe could enable a new group of potential mRNA medicines with shared product features, we call that group a “modality.” While the programs within a modality may target diverse diseases, they share similar mRNA technologies, delivery technologies and manufacturing processes to achieve shared product features. The programs within a modality will also generally share similar pharmacology profiles, including the desired dose response, the expected dosing regimen, the target tissue for protein expression, safety and tolerability goals, as well as pharmaceutical properties. Programs within a modality often have correlated technology risk, but because they pursue diverse diseases they often have uncorrelated biology risk. We have created six modalities to date:

- prophylactic vaccines;
- cancer vaccines;
- intratumoral immuno-oncology;
- localized regenerative therapeutics;
- systemic secreted therapeutics; and
- systemic intracellular therapeutics.

The figure below summarizes our progress advancing our pipeline of mRNA medicines across our current portfolio of six modalities.

<table>
<thead>
<tr>
<th>Protein expression in non-human primates</th>
<th>Cancer vaccines</th>
<th>Intratumoral immuno-oncology</th>
<th>Localized regenerative therapeutics</th>
<th>Systemic secreted therapeutics</th>
<th>Systemic intracellular therapeutics</th>
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</thead>
<tbody>
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<tr>
<td>Protein expression in the clinic</td>
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<tr>
<td>Clinical trials ongoing</td>
<td></td>
<td>Clinical trials</td>
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<td>Evidence of activity in the clinic at tolerated dose</td>
<td></td>
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<tr>
<td>Clinical trials ongoing</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of programs</th>
<th>9</th>
<th>2</th>
<th>3</th>
<th>1</th>
<th>3</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic collaborators</td>
<td>Merck</td>
<td>Merck</td>
<td>AstraZeneca</td>
<td>AstraZeneca</td>
<td>Bill &amp; Melinda Gates Foundation</td>
<td>DARPA</td>
</tr>
<tr>
<td>First program</td>
<td>H10N8</td>
<td>Personalized cancer vaccines</td>
<td>OX40L</td>
<td>VEGF-A</td>
<td>Antibody against Chikungunya virus</td>
<td>MMA</td>
</tr>
</tbody>
</table>
When entering into a new modality, our approach is consistent with our strategic principles and perspectives on risk management discussed previously. The tenets of our approach are summarized below.

- We identify a first program (or programs) through which we seek to discover and develop solutions for any modality-specific technological challenges. We then leverage the learnings from this first program to the benefit of all subsequent programs in the modality.
- We seek to diversify biology risks within the modality by advancing multiple programs in parallel, against multiple diseases, following the first program.
- When we believe a strategic collaborator could significantly de-risk our early efforts in a new modality, we seek a strategic collaborator to share the risks and benefits on a specific set of early programs.
- After experience with the first program (or programs) in a modality, we seek to rapidly expand our pipeline within that modality to take full advantage of the opportunity.

Illustrating our approach: From our first modality to today

We started with prophylactic vaccines as our first modality because we believed this modality faced lower technical hurdles, relative to other areas. Our early formulations of mRNA tended to stimulate the immune system, which would present a challenge to therapeutics but was a desired feature for vaccines. In addition, many potential prophylactic vaccine antigens are well-characterized, allowing us to reduce biology risk. Lastly, the dosing regimens for vaccines require as few as one or two administrations, and generally involve relatively low doses.

For our first programs in this modality we chose our H10N8 and H7N9 pandemic influenza vaccines, each requiring expression of a single membrane protein. We chose to pursue two programs in two separate, but parallel, clinical trials to establish the flexibility of our platform.

When both programs met our goals for safety, tolerability, and pharmacology, we accelerated and expanded our vaccine pipeline to include multiple commercially meaningful and increasingly complex vaccines. These included a combination vaccine, designed to protect against two unrelated respiratory viruses, hMPV and PIV3, and a vaccine that combines six different mRNAs, our CMV vaccine, to express a complex pentameric antigen. We also sought strategic alliances with Defense Advanced Research Projects, or DARPA, Biomedical Advanced Research Development Authority, or BARDA, and Merck & Co., or Merck, to allow us to rapidly expand our pipeline and complement our capabilities with their expertise.

Over time, we have taken on more challenging applications and technological hurdles with each successive modality, but we have also tried to build upon our prior experiences to manage risk. For example, in our cancer vaccines modality, we are now applying our technology to elicit T cell responses to potentially recognize and eradicate cancer as a logical extension of our prophylactic vaccines modality. Having demonstrated local expression of protein in our vaccines, we expanded into local therapeutic applications. For example, in our intra-tumoral immuno-oncology modality, we are seeking to use local expression to drive anti-cancer T cell responses by transforming tumor microenvironments. We can also use local expression to drive regenerative processes as in our VEGF-A program. Most recently, we have expanded into two new modalities that use systemic delivery of mRNA to encode secreted or intracellular proteins. We have moved multiple programs in these areas into development for the treatment of diseases as varied as rare genetic disorders, preventing viral infections, or treating heart failure.
How modalities build our pipeline

We believe our portfolio of modalities—each with distinct technological and biological risk profiles—allows us to maximize long-term value for patients and investors. We see our six current modalities as six distinct multi-product pipelines that represent different risk profiles and benefit from common infrastructure and a shared platform technology. We believe the high technology correlation within a modality allows us to rapidly accelerate the expansion of the pipeline in that modality based on learnings from the initial programs. We believe the lower technology correlation between modalities allows us to compartmentalize the technology risks.

We believe our ongoing investments in our platform will lead to the identification of additional new modalities in the future, and will expand the diversity of our pipeline.
EXECUTING ON OUR BROAD PIPELINE

In order to capitalize on the breadth of the mRNA opportunity, we built a set of capabilities across the drug development value chain to enable us to efficiently execute on many pipeline programs in parallel.

mRNAs encode proteins across diverse biology using the same chemical building blocks arranged into different sequences. This lends itself to common rules when designing a new mRNA medicine and common processes for manufacturing. We have invested in scalable infrastructure, built on a digital backbone and enabled by automation to advance a large pipeline of mRNA programs in parallel.

Our capabilities and infrastructure are grouped into three basic units, or engines, that are applied at different stages of the drug development value chain, as shown in the following figure:

![Diagram of drug development value chain with Research Engine, Early Development Engine, Late Stage Development and Commercial Engine stages]

Our current pipeline programs utilize our Research Engine and Early Development Engine. We are starting to build the Late Stage Development and Commercial Engine to handle the further advancement of our programs. Each of these engines integrates critical internal capabilities with outsourced, flexible capacity.

Our **Research Engine** enables us to advance new product ideas into development candidates via our drug discovery efforts, and includes infrastructure to enable rapid supply of thousands of preclinical mRNAs for research involving *in vitro* and *in vivo* experiments in order to accelerate programs from idea to development candidate designation.

Our **Early Development Engine** enables progression of preclinical development candidates to investigational medicines upon IND filing or its equivalent, through early clinical trials that seek to demonstrate human proof of concept, or hPOC. This includes internal and outsourced infrastructure for IND-enabling GLP toxicology studies, the scale up and cGMP manufacture of the investigational medicine, initial regulatory submissions, and the execution of clinical trials.

Our **Late Stage Development and Commercial Engine** is envisioned to enable progress of our investigational medicines from hPOC through late-stage development to approval and eventual commercialization. This is expected to include internal and outsourced infrastructure for cGMP manufacture for late stage development and commercial supply of products, regulatory submissions, and capabilities to execute later stage clinical trials.

All of these engines are supported and enabled by our integrated digital investments, our focus on highly talented and motivated team members, and our deep capital base.

Our **digital infrastructure** facilitates efficient integration and control of virtually every aspect of what we do. We design and implement digital operations to control or support complex workflows, accelerate learnings across our enterprise real-time, and provide deeper insights through analytical tools, artificial intelligence, and custom automation.

Our **talented employees** drive our mission across this value chain for patients and investors. Our culture also plays an invaluable role in our execution at all levels in our organization. An example of our commitment to the
development of our employees is our investment in Moderna University, our extensive program of internal and external course offerings curated to meet the learning and development needs of our people.

Our capital from our investors and strategic collaborators enables the scale required to execute on our pipeline. We sought, and continue to seek, diverse funding sources. Of approximately $2.6 billion in cash we have received through September 30, 2018, $0.8 billion has been in the form of upfront payments, milestone payments, and option exercise payments from strategic collaborators, such as AstraZeneca and Merck, and over $1.8 billion has been from the issuance of equity in the private markets from a diverse set of global investors. As of September 30, 2018, we had cash, cash equivalents, and investments of $1.2 billion.

Examples of our proprietary infrastructure

Our Drug Design Studio enables rapid design of multiple mRNAs

As our scientists create new mRNA concepts, they can design mRNAs for research and testing, within days, using our proprietary systems. We utilize the software-like property of mRNA in our proprietary, web-based Drug Design Studio. Our scientists request mRNAs for a specific protein, and the protein target is automatically converted to an initial optimized mRNA sequence. Using our Sequence Designer module, they can tailor entire mRNAs from the 5’-UTR to the coding region to the 3’-UTR based on our ever-improving proprietary learnings. The mRNA sequence is then further optimized using our proprietary bioinformatics algorithms. Our digital ordering then ensures rapid and accurate transmission of sequences to our modular synthesis robotics.

Our high throughput systems facilitate rapid synthesis of research grade mRNA

Once our scientists design mRNAs, we make them at a small scale to test them in cells or in animal models to see if our ideas will work. We integrated the Drug Design Studio mRNA sequence into a modular synthesis system comprised of custom high-throughput automation for making up to 1,000 orders of unique mRNA sequences and formulations per month with a turnaround time of a few weeks at 1-10 mg per lot, the amounts required for testing in cells or animal models. This has accelerated our learnings by allowing us to test many different mRNAs in parallel.

Our Norwood manufacturing site provides modular and automated capacity that can scale with our pipeline

Manufacturing is strategically important to us, and we believe we need to control a significant portion of our manufacturing supply chain. We initially used an outsourced global supply chain to make our multi-component mRNA products. However, we believe that managing quality, supply, and timing in such a supply chain for cGMP material could increase our overall business risk. Accordingly, we elected in 2016 to build our own manufacturing facility. We opened our newly constructed 200,000 square foot Norwood manufacturing facility in July 2018, and brought multiple cGMP suites online, thereby providing integration of our supply chain from raw materials to filled vials at a single site. We can make mRNA, lipids, and LNPs at this site to control quality and supply, while also potentially creating new manufacturing intellectual property. We can readily flex the capacity at our Norwood facility via its modular systems to produce up to 100 cGMP lots per year. This capacity will support our current pipeline, will enable significant future pipeline expansion, and, under certain scenarios, could serve some commercial supply needs.
At Moderna, we define a modality as a group of potential mRNA medicines that share similar mRNA technologies, delivery technologies, and manufacturing processes to achieve shared product features. Typically, programs within a modality will also share similar pharmacology profiles, including the desired dose response, the expected dosing regimen, the target tissue for protein expression, safety and tolerability goals, and their pharmaceutical properties. We have created six modalities to date:

- Prophylactic vaccines;
- Cancer vaccines;
- Intratumoral immuno-oncology;
- Localized regenerative therapeutics;
- Systemic secreted therapeutics; and
- Systemic intracellular therapeutics.

We believe our portfolio of modalities, each with distinct technological and biological risk profiles, allows us to maximize long-term value for patients and investors. We see our six current modalities as six distinct multi-product pipelines that represent different risk profiles and benefit from common infrastructure and a shared technology platform. We believe the risk correlation within a modality allows us to rapidly accelerate the expansion of the pipeline in that modality based on learnings from the initial programs. We believe the lower risk correlation between modalities allows us to mitigate the risks of expanding into new areas. The illustration below depicts the diversity of the biology of our pipeline across our six modalities.
I. PROPHYLACTIC VACCINES MODALITY OVERVIEW

We designed our prophylactic vaccines modality to prevent or control infectious diseases. Since we nominated our first program in late 2014, this modality has grown to include nine programs, all of which are vaccines against viruses. The goal of any vaccine is to safely pre-expose the immune system to a small quantity of a protein from a pathogen, called an antigen, so that the immune system is prepared to fight the pathogen if exposed in the future, and prevent infection or disease.

Within this modality, our portfolio includes programs for both commercial and global health uses. We have strategic alliances with Merck on select commercial vaccines, and BARDA and DARPA on global health vaccine programs.

Our prophylactic vaccines pipeline is shown below.

* Life-cycle to mRNA-1893
  1 See section of the prospectus titled “Business—Third-Party Strategic Alliances” for funding arrangements on clinical development

Abbreviations: CMV, cytomegalovirus; hMPV, human metapneumovirus; PIV3, human parainfluenza virus 3; RSV, respiratory syncytial virus; VZV, varicella zoster virus.

Prophylactic vaccines: Opportunity

Vaccines to prevent infectious diseases are one of the great innovations of modern medicine. In the United States alone, the Centers for Disease Control and Prevention, or CDC, estimates that childhood vaccinations given in the past two decades will in total prevent 322 million Americans from falling ill, 21 million hospitalizations, 732,000 deaths, $295 billion of direct costs, and $1.3 trillion in social costs. The commercial opportunity for vaccines is significant, with more than $35 billion in annual worldwide sales of vaccines, and with 16 different vaccine franchises each generating more than $500 million in annual worldwide sales in 2017. More innovative vaccines have been able to achieve pricing per regimen generally ranging from 5 to 20 times that of seasonal flu vaccines.
Prophylactic vaccines: Product features

We believe mRNA-based vaccines offer several advantages, including:

- **Ability to mimic many aspects of natural viral infections.** mRNA enters cells and is used to produce viral antigen proteins from within the cell that include natural, post-translational modifications. This mimics the process by which natural viral infections occur, where information from viral genomes is used to produce viral proteins from within a cell. This can potentially enhance the immune response, including improved B and T cell responses.

- **Multiplexing of mRNA for more compelling product profiles.** Multiple mRNAs encoding for multiple viral proteins can be included in a single vaccine, permitting production of complex multimeric antigens that are much more difficult to achieve with traditional technologies. As an example, our CMV vaccine (mRNA-1647) contains six mRNAs, five of which encode five different proteins that combine to form a pentameric protein complex that is a potentially critical antigen for immune protection against CMV.

- **Rapid discovery and advancement of mRNA programs into the clinic.** Many viral antigens are known. However, with traditional vaccines, the target pathogens or antigens have to be produced in dedicated cell-cultures and/or fermentation-based manufacturing production processes in order to initiate testing of potential vaccine constructs. Our ability to design our antigens in silico allows us to rapidly produce and test antigens in preclinical models, which can dramatically accelerate our vaccine selection.

- **Capital efficiency and speed from shared manufacturing processes and infrastructure.** Traditional vaccines require product-dedicated production processes, facilities, and operators. Our mRNA vaccines are produced in a manufacturing process that is sufficiently consistent across our pipeline to allow us to use a single facility to produce all of our mRNA vaccines.

Prophylactic vaccines: Status and next steps

Our prophylactic vaccines modality currently includes nine programs, seven of which have entered into clinical trials. Of those seven, four of our programs, based on the data observed, have demonstrated desired pharmacology, in the form of immunogenicity, in their Phase 1 clinical trials: H1N8 vaccine (mRNA-1440), H7N9 vaccine (mRNA-1851), RSV vaccine (mRNA-1777), and Chikungunya vaccine (mRNA-1388). For the Zika vaccine (mRNA-1325), although the Phase 1 safety and tolerability data generated would permit additional dose escalation of mRNA-1325, our current development efforts are focused on our next-generation vaccine, mRNA-1893, which has been shown to be 20 times more potent in non-human primate Zika challenge studies. The remaining clinical stage programs, CMV vaccine (mRNA-1647), and hMPV+PIV3 vaccine (mRNA-1653), are in ongoing Phase 1 trials. The next program in this modality, a VZV vaccine (mRNA-1278), is in preclinical development with an IND-enabling GLP toxicology study in progress.
On the basis of the Phase 1 results for the RSV vaccine (mRNA-1777), Merck has initiated planning for a Phase 2a clinical trial. We are working with Merck to identify and advance improvements to the RSV vaccine. Each of these programs is more fully described under “Program Descriptions.”

### Prophylactic Vaccines Data Summary

<table>
<thead>
<tr>
<th>Safety information</th>
<th>Immunogenicity information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preclinical</strong></td>
<td></td>
</tr>
<tr>
<td>Successfully completed IND-enabling GLP toxicology programs for seven of seven clinical stage vaccines that supported advancement into the clinic.</td>
<td>Dose dependent induction of neutralizing antibodies or measurement of T cell response in all programs listed in the pipeline for this modality; protection against viral challenge in six programs where challenge studies were performed including RSV vaccine (mRNA-1777), hMPV+PIV3 vaccine (mRNA-1653), H7N9 vaccine (mRNA-1851), Zika vaccine (mRNA-1325 and mRNA-1893), and Chikungunya vaccine (mRNA-1388).</td>
</tr>
<tr>
<td><strong>Clinical</strong></td>
<td></td>
</tr>
<tr>
<td>In Phase 1 studies describing safety and tolerability for RSV vaccine (mRNA-1777), H10N8 vaccine (mRNA-1440), H7N9 vaccine (mRNA-1851), Zika vaccine (mRNA-1325), and Chikungunya vaccine (mRNA-1388), we have generated sufficient data to support advancement to further clinical development. The Phase 1 trial for CMV vaccine (mRNA-1647) is ongoing and the dose-escalation phase A has completed dosing through the top dose level. Based on an unblinded review of safety data through seven days after all subjects had received the second dose in phase A, the safety monitoring committee approved continuation of the CMV vaccine trial. The dose-escalation phase B of mRNA-1647, including the top dose level, has completed dosing of the second dose. The hMPV+PIV3 vaccine Phase 1 trial is fully enrolled and based on unblinded evaluation of safety data from the dose-escalation phase by the safety monitoring committee, the three highest doses are being evaluated in the dose-selection phase. 675 subjects have received mRNA investigational medicines in these Phase 1 trials.</td>
<td>Based on data observed, four of our five Phase 1 trials demonstrated immunogenicity at sufficient levels to warrant further study. This includes persistence in seroresponse for the 100 µg dose in the H10N8 vaccine (mRNA-1440) Phase 1 trial, 25 µg dose in the H7N9 vaccine (mRNA-1851) Phase 1 trial, and for the 50 µg and 100 µg dose levels in the Chikungunya vaccine (mRNA-1388) Phase 1 trial. Our initial Zika program (mRNA-1325) did not demonstrate immunogenicity at the evaluated doses in the Phase 1 trial; our backup Zika program (mRNA-1893) has been shown to be 20 times more potent in non-human primate Zika challenge studies.</td>
</tr>
</tbody>
</table>

For our commercial vaccine programs, we expect the next series of milestones will involve the reporting of Phase 1 safety and immunogenicity data from our hMPV+PIV3 vaccine (mRNA-1653) and our CMV vaccine (mRNA-1647). Based on the data for the hMPV+PIV3 vaccine (mRNA-1653), we may consider a Phase 1b trial in pediatric subjects as we look to develop this vaccine to address hMPV and PIV3 childhood infections. For the programs being conducted by our strategic collaborator Merck, the next milestones will be the potential start of the Phase 2a trial for the RSV vaccine (mRNA-1777) and the continued development of the VZV vaccine (mRNA-1278) including completion of an IND-enabling GLP toxicology study. For our global health programs, we do not intend to advance our H10N8 vaccine (mRNA-1440), our H7N9 vaccine (mRNA-1851), or our Chikungunya vaccine (mRNA-1388) through further clinical development without government or other third-party funding.

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II. CANCER VACCINES MODALITY OVERVIEW

We designed our cancer vaccines modality to treat or cure cancer by enhancing immune responses to tumor neoantigens, defined below. This modality has two programs currently for neoantigen vaccines, a personalized cancer vaccine, or PCV, program and a vaccine against neoantigens related to a common oncogene called KRAS, both conducted in collaboration with Merck. The goal of a cancer vaccine is to safely expose the patient’s immune system to tumor related antigens, known as neoantigens, to enable the immune system to elicit a more effective antitumor response. Our cancer vaccines modality is focused on the use of mRNA to express neoantigens found in a particular tumor in order to elicit an immune response via T cells that recognize those neoantigens, and therefore the tumor. These neoantigens can either be unique to a patient, as in the case of our personalized cancer vaccine program, or can be related to a driver oncogene found across subsets of patients, as in the case of our KRAS vaccine program.

Our cancer vaccines pipeline is shown in the figure below.

Abbreviation: CRC, colorectal cancer; NSCLC, non-small cell lung cancer; PCV, personalized cancer vaccine

Cancer vaccines: Opportunity

More than 1.6 million new cancer cases and approximately 600,000 deaths due to cancer were predicted in the United States for 2017. Despite the recent success of checkpoint inhibitors, the majority of patients with the most common types of epithelial cancer still do not benefit from checkpoint inhibitors, as many patients still have incomplete or no response to currently available therapies. In addition, treatment resistance is thought to arise from a number of mechanisms, principally the local immunosuppressive effects of cancer cells, which prevent either access to or recognition by T cells.

Recent breakthroughs in cancer immunotherapy, such as checkpoint inhibitors and chimeric antigen receptor T cell therapies, have demonstrated that powerful antitumor responses can be achieved by activating antigen specific T cells. We believe one approach to improve the efficacy of checkpoint inhibitors is to develop vaccines that increase both the number and antitumor activity of a patient’s T cells that recognize tumor neoantigens.

Cancer vaccines: Product features

We believe that mRNA technology is an attractive approach for cancer vaccines for many reasons, including:

- mRNA vaccines can deliver multiple neoantigens concatenated in a single mRNA molecule. We currently encode up to 20 neoantigens in each personalized cancer vaccine (mRNA-4157 and NCI-4650) that we administer, and four KRAS mutations in our KRAS vaccine (mRNA-5671). Given that a T cell response against a single antigen has the potential to eradicate cancer cells, we believe that delivering multiple neoantigens could increase the probability of a successful treatment outcome for a patient.

- mRNA encoding for neoantigens is translated and processed by patients’ endogenous cellular mechanisms for presentation to the immune system. Neoantigen peptides are then potentially processed in multiple ways to give rise to different size peptides for presentation by the immune system. We believe this endogenous antigen production and presentation has the potential to drive a more effective immune response.
mRNA vaccines can be efficiently personalized. The shared features of mRNA, combined with our investments in automated manufacturing technology, enable us to manufacture individual cGMP batches of personalized cancer vaccines rapidly, in parallel.

mRNA vaccines can be delivered simultaneously with customized immuno-stimulators. In our KRAS vaccine mRNA-5671, mRNA encoding for KRAS neoantigens are delivered in conjunction with mRNA encoding for an activated innate immuno-stimulator. The use of such innate immune stimulants has been shown to improve the T cell response against antigens of interest.

Cancer vaccines: Status and next steps

We are currently developing two programs within our cancer vaccines modality. Our personalized cancer vaccine program includes two vaccines, mRNA-4157 and NCI-4650. mRNA-4157 is being developed in collaboration with Merck and is in a multiple-arm Phase 1 trial. NCI-4650 is being developed in collaboration with the National Cancer Institute, or NCI, and is in an investigator-initiated single-arm Phase 1 trial. The two vaccines differ in the neoantigen selection protocols used, but are otherwise substantially the same.

Our second program within this modality, mRNA-5671, is a KRAS vaccine that also contains an innate immuno-stimulator. Following successful preclinical development, the Investigational New Drug Application, or IND, for this program was transferred to Merck, who will sponsor the Phase 1 trial. Each of these programs is more fully described under “Program Descriptions.”

<table>
<thead>
<tr>
<th>Cancer Vaccines Data Summary</th>
<th>Safety information</th>
<th>Immunogenicity information</th>
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<tbody>
<tr>
<td><strong>Preclinical</strong></td>
<td>Successfully completed IND-enabling GLP toxicology programs for PCV and KRAS vaccine to support advancement into the clinic.</td>
<td>Elicitation of immune activation demonstrated against specific neoantigens in animal models for both programs.</td>
</tr>
<tr>
<td><strong>Clinical</strong></td>
<td>Based on the interim data as of October 2018, no dose-limiting toxicities or significant related toxicities have been observed in the first three dose levels (0.04 mg, 0.13 mg, 0.39 mg) of mRNA-4157 as a monotherapy or in combination with KEYTRUDA; as of October 2018, 23 patients have been dosed with mRNA-4157 in the PCV Phase 1 trial.</td>
<td>For the mRNA-4157 Phase 1 clinical trial, as of October 19, 2018, we have interim immunogenicity data for ten cancer patients. Among these ten patients, we have detected potential antigen specific T cell responses for the first patient with melanoma at the 0.13 mg dose level. This occurred after the fourth dose in the mRNA-4157 monotherapy part of the trial. In patients in which negative controls are below the limit of detection, we have detected immunogenicity in three additional patients at the 0.13 mg dose level after the fourth dose at levels above the lower limit of detection. Because these levels were below the lower limit of quantification of the assay, these data for these three patients are of uncertain significance. We have observed no signal indicating immunogenicity induced by vaccination in the remaining six patients of which four are at the 0.04 mg dose level and two are at the 0.13 mg dose level.</td>
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</table>

We expect the next steps for the PCV programs (mRNA-4157 and NCI-4650) to involve the reporting of immunogenicity data from the Phase 1 clinical trials in cancer patients. We have also triggered planning for a randomized Phase 2 trial for PCV (mRNA-4157) with Merck. The next steps for the KRAS vaccine (mRNA-5671) include the completion of cGMP manufacturing and initiating a Phase 1 trial in patients with certain KRAS mutations. Merck may choose to measure T cell responses in this Phase 1 trial for KRAS vaccine (mRNA-5671).
III. INTRATUMORAL IMMUNO-ONCOLOGY MODALITY OVERVIEW

We designed our intratumoral immuno-oncology modality to treat or cure cancer by transforming the tumor microenvironment to drive anti-cancer T cell responses against tumors. This modality currently has three programs. Our mRNA technology within this modality allows for the combination of multiple therapeutics that can be directly injected into a tumor with the goal of activating the tumor microenvironment to kill cancer cells in the injected tumor as well as in distal tumors, known as the abscopal effect. Intratumoral administration allows for localized effect of these therapeutics that could be toxic if administered systemically.

Our intratumoral immuno-oncology pipeline is shown in the figure below.

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Intratumoral immuno-oncology: Opportunity

More than 1.6 million new cancer cases and approximately 600,000 deaths due to cancer were predicted in the United States for 2017. There have been several advances in the treatment of cancer through immune-mediated therapies in recent years. However, the outlook for many patients with advanced cancer remains poor, especially in tumors that have little immune system engagement and are sometimes termed immunologically “cold.” We aim to activate the tumor microenvironment with our mRNA therapeutics, in conjunction with a checkpoint inhibitor, to activate the immune system against these otherwise immunologically cold tumors.

Intratumoral immuno-oncology: Product features

We believe our approach to immuno-oncology using our mRNA medicines could complement checkpoint inhibitors and has several advantages over recombinant protein-based drugs, including:

- **mRNA focuses and limits exposure of immune stimulatory proteins.** One of the intrinsic properties of mRNA is its transient nature. This allows for short exposure of the proteins encoded by the mRNA in the target tissue thereby enhancing tolerability.

- **mRNA can produce membrane associated immune stimulatory proteins.** In contrast to recombinant proteins, mRNA administered to a tumor site can lead to the production of either secreted or membrane proteins, depending on the mRNA sequence.

- **Multiplexing of mRNA allows access to multiple immune stimulatory pathways.** The ability to combine multiple mRNAs to express multiple proteins allows for activation of several immune pathways simultaneously. For example, OX40L+ IL23+IL36γ (mRNA-2752) encodes for two secreted cytokines (IL23 and IL36γ) and one membrane protein (OX40L).

- **mRNA sequences can be engineered to reduce off-target effects.** Our mRNA can be designed to minimize translation in off-target tissues. For immune-stimulatory proteins this can potentially prevent toxicities.

- **Local administration of mRNA can create a concentration gradient for encoded proteins.** mRNA administered intratumorally allows for the local production of encoded immune-stimulatory proteins, such
as cytokines. The mRNA and encoded protein are expected to form a concentration gradient that decreases as a function of the distance from the tumor, thereby potentially lowering undesirable systemic effects and increasing immune-stimulatory effects close to the tumor.

**Intratumoral immuno-oncology: Status and next steps**

We have three programs in this modality. The first program in this modality, OX40L (mRNA-2416), was designed to overcome technological challenges in advancing this modality, including engineering the mRNA sequence to minimize off-target effects, utilizing our proprietary LNPs to enhance safety and tolerability, and to demonstrate expression of a membrane protein in patients. OX40L (mRNA-2416), is currently being evaluated in an ongoing Phase 1 trial in the United States. As of October 2018, 26 patients have been dosed with mRNA-2416 in the Phase 1 trial and protein expression has been demonstrated in a number of patients. Our second program, OX40L+IL23+IL36γ (mRNA-2752) has completed preclinical development and the IND is open. Our third program, IL12 (MEDI1191) is being developed in collaboration with AstraZeneca. In collaboration with AstraZeneca, we are completing preclinical development for this program. Each of these programs is more fully described under “Program Descriptions.”

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<thead>
<tr>
<th>Safety information</th>
<th>Activity information</th>
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<tbody>
<tr>
<td><strong>Preclinical</strong></td>
<td>Successfully completed IND-enabling GLP toxicology programs for OX40L, OX40L+IL23+IL36γ, and IL12 to support advancement into the clinic.</td>
</tr>
<tr>
<td><strong>Clinical</strong></td>
<td>Of the 26 patients dosed with mRNA-2416 as of October 2018, the two patients with ovarian cancer have demonstrated clinical observations of regression in certain injected lesions and in an adjacent uninjected lesion. These clinical observations with ovarian cancer do not meet partial response criteria as per the response evaluation criteria in solid tumors, or RECIST, guidelines version 1.1. In one of these patients with ovarian cancer dosed at 2 mg, a reduction in an injected lesion was observed after the fourth dose. In addition, for the same patient, a reduction in an adjacent uninjected lesion was observed. For the second ovarian cancer patient dosed at 1 mg, a reduction in an injected lesion was observed after five doses and elevated levels of OX40L protein in the injected lesion have been observed after the first dose.</td>
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The Phase 1 trial for OX40L (mRNA-2416) is ongoing. We plan to collect Phase 1 clinical trial data including potential clinical responses for OX40L+IL23+IL36γ (mRNA-2752). AstraZeneca may progress IL12 (MEDI1191) into a Phase 1 clinical trial.
IV. LOCALIZED REGENERATIVE THERAPEUTICS MODALITY OVERVIEW

We designed our localized regenerative therapeutic modality to develop mRNA medicines to address injured or diseased tissues. Our mRNA technology in this modality allows for the local production of proteins that provide a therapeutic benefit in the targeted tissue. The development of our program in this modality, AZD8601, for the local production of VEGF-A, is being led by our strategic collaborator AstraZeneca. This program recently completed a Phase 1a/b clinical trial in which we observed dose-dependent protein production and a pharmacologic effect, as measured by changes in local blood flow. We believe this data provides clinical proof of mechanism for our mRNA technology outside of the vaccine setting.

Our localized regenerative therapeutic pipeline is shown below.

Abbreviation: AZ, AstraZeneca; VEGF-A, vascular endothelial growth factor A.

Localized regenerative therapeutics: Opportunity

There are multiple applications for tissue regeneration. With AstraZeneca, we have focused on ischemic heart failure for the first program. Coronary artery disease, the primary cause of ischemic heart failure, affects the arteries providing blood supply to the cardiac muscle. In 2015, coronary artery disease resulted in 366,000 deaths in the United States, and 8.9 million deaths globally.

Localized regenerative therapeutics: Product features

We believe our approach to localized regenerative therapeutics using mRNA has several advantages over alternative approaches, including:

• mRNA can be administered locally to produce the desired protein for an extended, but still limited, duration. Local exposure to the therapeutic protein encoded by our mRNA is sustained by the ongoing translation of the mRNA into protein, often from hours to days. This pharmacokinetic profile closely mimics the optimal tissue exposure profile for regenerative applications and cannot be achieved by injections of recombinant proteins that rapidly diffuse out of the tissue after injection.

• Local administration of mRNA allows for focused activity. mRNA administered to a specific tissue or organ should allow for local production of the encoded protein, which could lead to lower levels of encoded protein in distant or systemic locations. This could help to prevent potential toxicity from production of the encoded protein outside of the targeted tissue.

• mRNA allows for transient production of the encoded protein. mRNA therapies should also allow for dose titration and repeat dosing. This provides several advantages over gene therapy. Gene therapy typically results in a permanent change to cellular DNA that may result in uncontrolled or constant production of the desired protein in local tissue or in distant sites, which could cause local or systemic side effects. Further, some gene therapy delivery vehicles are associated with immune responses that limit the ability to repeat dose, preventing dose titration.

Localized regenerative therapeutics: status and next steps

Our localized VEGF-A program, AZD8601, which is being developed by AstraZeneca, has completed a Phase 1a/b trial to describe its safety, tolerability, protein production, and activity in diabetic patients. The study...
has met its primary objectives of describing safety and tolerability and secondary objectives of demonstrating protein production and changes in blood flow post AZD8601 administration. In this trial, AZD8601 was administered by intradermal injection in the forearm skin of patients for single ascending doses. These data are consistent with studies previously conducted in preclinical models. We believe these data provide clinical proof of mechanism for our mRNA technology outside of the vaccine setting. Each of these programs is more fully described under “Program Descriptions.”

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<tr>
<th>Safety information</th>
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<tr>
<td>Preclinical</td>
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<tr>
<td>Successfully completed IND-enabling GLP toxicology program for AZD8601 to support advancement into the clinic.</td>
<td>Improved cardiac function or survival in multiple animal models of ischemic heart failure.</td>
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<tr>
<td>Clinical</td>
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<tr>
<td>Demonstrated sufficient tolerability in the Phase 1a/b trial at all dose levels (33 patients received AZD8601 for the Phase 1 trial) to warrant advancement to a Phase 2a study.</td>
<td>Increase in VEGF-A and bioactivity of VEGF-A protein was observed by increase in blood flow at injection sites up to seven days following a single dose of AZD8601.</td>
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</table>

AstraZeneca has initiated a Phase 2a trial for AZD8601 in ischemic heart disease. The Phase 2a study in Finland is designed to provide initial safety and tolerability data in approximately 24 coronary artery bypass patients. As of October 2018, three patients have been enrolled as part of this Phase 2a trial.
V. SYSTEMIC SECRETED THERAPEUTICS MODALITY OVERVIEW

We designed our systemic secreted therapeutics modality to increase levels of desired secreted proteins in circulation or in contact with the extracellular environment, in order to achieve a therapeutic effect in one or more tissues or cell types. The goal of this modality is to provide secreted proteins, such as antibodies or enzyme replacement therapies across a wide range of diseases, such as heart failure, infectious diseases, and rare genetic diseases. This modality has benefitted from our strategic alliances with AstraZeneca, DARPA, and the Bill & Melinda Gates Foundation. This modality currently has three programs.

Our pipeline for systemic secreted therapeutics is shown in the figure below.

1 See section of the prospectus titled “Business—Third-Party Strategic Alliances” for funding arrangements on clinical development.

Abbreviations: AZ, AstraZeneca; α-GAL, alpha galactosidase.

Systemic secreted therapeutics: Opportunity

The ability to systemically deliver mRNA for a therapeutic effect would allow us to address a number of diseases of high unmet medical need. Systemically delivered, secreted therapeutics address conditions often treated with recombinant proteins that are typically administered to the blood stream. These current therapies include, for example:

• Enzyme replacement therapies, or ERTs, for rare diseases;
• Antibodies for membrane and extracellular soluble targets; and
• Circulating modulation factors for common and rare diseases such as growth factors and insulin.

Systemic secreted therapeutics: Product features

Systemically delivered, secreted therapeutics, we believe, would allow us to target areas of biology that cannot be addressed using recombinant proteins. Our potential advantages in these areas include:

• mRNA can produce hard-to-make or complex secreted proteins. Some proteins, due to their folding requirements or complexity, are challenging to make using recombinant technologies, but can potentially be produced by human cells using administered mRNA.
• Native post-translational modifications are possible through intracellular protein production using mRNA. mRNA administered to a human cell uses natural secretory pathways inside the cell to make and process the encoded protein. The resulting post-translational modifications, such as glycosylation, are human. With recombinant proteins, these post-translational modifications are native to the non-human cells used for manufacture. These non-human post-translational modifications in recombinant proteins may lead to sub-optimal therapeutic outcomes, side effects, and increased immunogenicity.
• mRNA can sustain production of proteins, which can increase exposure to proteins with short half-lives. mRNA can lead to protein production by cells that can last from hours to days depending on design. This feature could increase the levels of short half-life proteins for therapeutic benefit.
mRNA allows for desirable pharmacology in rare genetic diseases currently addressed by enzyme replacement therapies. Our mRNA technology potentially permits several differentiated pharmacologic features for treating rare genetic diseases currently addressed by enzyme replacement therapies, including the ability to repeat dose as needed, lower immunogenicity of the replacement protein, the ability to adjust dose levels in real-time based on individual patient needs, and the ability to stop dosing. Gene therapies may also prove to be useful for treating rare genetic diseases; however, mRNA is not limited by pre-existing immunity that may exist for certain gene therapies using viral vectors, and does not localize to the nucleus or require persistent changes to cellular DNA to have the desired effect.

Systemic secreted therapeutics: Status and next steps

We have three systemic secreted therapeutics development candidates in our pipeline. Our secreted programs include our antibody against Chikungunya virus (mRNA-1944), Relaxin (AZD7970) for the treatment of heart failure, and Fabry disease (mRNA-3630). All of these programs are currently in preclinical development. Each of these programs are more fully described under “Program Descriptions.”

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<tr>
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<th>Safety information</th>
<th>Activity information</th>
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<tbody>
<tr>
<td><strong>Preclinical</strong></td>
<td>Successfully completed IND-enabling GLP toxicology program</td>
<td>Repeat dosing of mRNA-1944 with pharmacologically relevant levels of antibody at doses tested in non-human primates.</td>
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<tr>
<td></td>
<td>for our antibody against Chikungunya virus (mRNA-1944) to support advancement into the clinic.</td>
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<tr>
<td><strong>Clinical</strong></td>
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We plan to take these three development candidates in this modality into the clinic for Phase 1 testing.
VI. SYSTEMIC INTRACELLULAR THERAPEUTICS MODALITY OVERVIEW

We designed our systemic intracellular therapeutics modality to increase levels of intracellular proteins, using cells in the human body to produce proteins located in the cytosol or specific organelles of the cell to achieve a therapeutic effect in one or more tissues or cell types. The goal of this modality is to provide intracellular proteins, such as intracellular enzymes and organelle-specific proteins, as safe, tolerable, and efficacious therapies. Our initial focus within this modality is on rare genetic diseases. This modality currently has three programs.

Our pipeline for systemic intracellular therapeutics is shown in the figure below.

Systemic intracellular therapeutics: Opportunity

Systemically delivered, intracellular therapeutics focus on areas currently not addressable with recombinant proteins, which are typically administered systemically and cannot reach the inside of the cell. Objectives for potential new therapies in this area include, for example, increasing the levels of:

- intracellular pathway proteins;
- soluble organelle-specific proteins; and
- organelle-specific membrane proteins.

Systemic intracellular therapeutics: Product features

Systemically delivered, intracellular therapeutics, we believe, would allow us to target areas of biology that cannot be addressed using recombinant proteins. Our potential advantages in these areas include:

- Using mRNA to encode for intracellular and organelle-specific proteins. Our modality permits the expression of intracellular proteins, including those that must be directly translated and moved into organelles such as mitochondria. The ability of mRNA to produce protein inside of the cell enables production of these protein types that we believe are beyond the reach of recombinant proteins.

- mRNA can produce hard-to-make or complex proteins. For example, some proteins, due to their folding requirements or complexity, are challenging to make using recombinant technologies, but can potentially be produced by human cells using administered mRNA.

- Native post-translational modifications are possible through intracellular protein production using mRNA. mRNA administered to a human cell uses natural secretory pathways inside the cell to make and process the encoded protein. The resulting post-translational modifications, such as glycosylation, are human as opposed to recombinant proteins where these post-translational modifications are native to the non-human cells used for manufacture. These non-human post-translational modifications in recombinant proteins may lead to sub-optimal therapeutic outcomes, side effects and increased immunogenicity.
mRNA can sustain production of proteins, which can increase exposure to proteins with short half-lives. mRNA can lead to protein production by cells that can last from hours to days depending on design. This feature could increase the levels of short half-life proteins for therapeutic benefit.

mRNA allows for desirable pharmacology in complex metabolic diseases. Our mRNA technology potentially permits several differentiated pharmacologic features for treating complex metabolic diseases, including the ability to repeat dose as needed, a rapid onset of action, the ability to adjust dose levels real-time based on individual patient needs, and the ability to stop dosing. Gene therapies may also prove to be useful for treating rare genetic diseases; however, mRNA is not limited by pre-existing immunity that may exist for certain gene therapies using viral vectors, and does not localize to the nucleus or require persistent changes to cellular DNA to have the desired effect.

Systemic intracellular therapeutics: Status and next steps

We have three systemic intracellular therapeutics development candidates in our pipeline. Our intracellular programs address methylmalonic acidemia, or MMA (mRNA-3704), propionic acidemia, or PA (mRNA-3927), and phenylketonuria, or PKU (mRNA-3283). All of these programs are currently in preclinical development. Each of these programs is more fully described under “Program Descriptions.”

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<th>Safety information</th>
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<tr>
<td>Preclinical</td>
<td>Successfully completed IND-enabling GLP toxicology program for MMA (mRNA-3704) to support advancement into the clinic; IND-enabling GLP toxicology program for PKU is ongoing (mRNA-3283).</td>
<td>Activity measured in animal models for MMA (mRNA-3704), PA (mRNA-3927), and PKU (mRNA-3283); data published for MMA (mRNA-3704).</td>
</tr>
<tr>
<td>Clinical</td>
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We plan to take the three development candidates in this modality into the clinic for Phase 1 testing.
OUR PIPELINE

This section describes the pipeline that has emerged thus far from the combination of our strategy, our platform, our infrastructure, and the resources we have amassed. Complete descriptions of our programs are found in the section of this prospectus titled “Business—Program Descriptions.”

In late 2014, we nominated our first development candidate and today, have brought forward 21 development candidates, with 10 now in clinical trials on three different continents. More than 755 subjects have been dosed with our mRNA investigational medicines in clinical trials since December 2015. Our diverse pipeline comprises programs across six modalities and a broad range of therapeutic areas. A modality is a group of potential mRNA medicines with shared product features, and the associated combination of mRNA technologies, delivery technologies, and manufacturing processes. Aspects of our pipeline have been supported through strategic alliances, including with AstraZeneca, Merck, and Vertex Pharmaceuticals, or Vertex, and government-sponsored organizations and private foundations focused on global health initiatives, including BARDA, DARPA, and the Bill & Melinda Gates Foundation.

Our selection process for advancing new development candidates reflects both program-specific considerations as well as portfolio-wide considerations. Program-specific criteria include, among other relevant factors, the severity of the unmet medical need, the biology risk of our chosen target or disease, the feasibility of clinical development, the costs of development, and the commercial opportunity. Portfolio-wide considerations include the ability to demonstrate technical success for our platform components within a modality, thereby increasing the probability of success and learnings for subsequent programs in the modality and in some cases in other modalities.

Our pipeline as of October 2018 is shown below in two formats, with a cell map illustrating the diversity of biology addressed by our mRNA pipeline programs, and a traditional format that shows the current stages of development of our pipeline programs. We believe the 21 programs in our pipeline represent only an initial wave of potential development candidates, and that our platform over time may yield both multiple new programs within our existing modalities and the potential for multiple programs in new modalities.
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#### Abbreviations:
- AZ: AstraZeneca
- α-GAL: α-galactosidase
- CMV: cytomegalovirus
- CRC: colorectal cancer
- hMPV: human metapneumovirus
- IL12: interleukin 12
- IL23: interleukin 23
- IL36γ: interleukin 36 gamma
- MUT: methylmalonyl-CoA mutase
- NSCLC: non-small cell lung cancer
- PAH: phenylalanine hydroxylase
- PCCA/PCCB: propionyl-CoA carboxylase subunit A/B
- PCV: personalized cancer vaccine
- PIV3: human parainfluenza virus 3
- RSV: respiratory syncytial virus
- VEGF-A: vascular endothelial growth factor A
- VZV: varicella zoster virus

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<th>Phase 1</th>
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</table>

*Life-cycle to mRNA-1893*

Abbreviations: AZ, AstraZeneca; α-GAL, α-galactosidase; CMV, cytomegalovirus; CRC, colorectal cancer; hMPV, human metapneumovirus; IL12, interleukin 2; IL23, interleukin 23; IL36γ, interleukin 36 gamma; MUT, methylmalonyl-CoA mutase; NSCLC, non-small cell lung cancer; PAH, phenylalanine hydroxylase; PCCA/PCCB, propionyl-CoA carboxylase subunit A/B; PCV, personalized cancer vaccine; PIV3, human parainfluenza virus 3; RSV, respiratory syncytial virus; VEGF-A, vascular endothelial growth factor A; VZV, varicella zoster virus.

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Portfolio-wide evidence in support of our platform and approach

We have generated significant learnings across our portfolio that we believe provide compelling support for our approach and pipeline across a broad array of human diseases.

We and our strategic collaborators AstraZeneca and Merck have completed IND-enabling GLP toxicology programs to support open INDs for 13 of our development candidates as of October 2018

With any new category of medicine, safety and tolerability is an important consideration for patients and healthy individuals, and helps to define the scope of application. As part of establishing our modalities and initial development pipeline, we conducted a large number of in vivo toxicology studies across a wide range of projects. We have sponsored more than 70 third-party or internally-conducted in vivo toxicology studies since our inception. This includes more than 35 IND-enabling GLP toxicology studies required for regulatory filings.

For our pipeline of 21 development candidates, 13 IND-enabling GLP toxicology programs have been completed and supported the opening of INDs by regulators for 13 of these development candidates to date. For the additional eight development candidates in our pipeline, we have completed two IND-enabling GLP toxicology programs for MMA (mRNA-3704) and IL12 (MEDI1191) that are yet to be submitted to regulators as part of an IND application and six IND-enabling GLP toxicology programs are ongoing or have yet to begin for VZV vaccine (mRNA-1278), Zika vaccine (mRNA-1893), Relaxin (AZD7970), Fabry disease (mRNA-3630), PA (mRNA-3927), and PKU (mRNA-3283).

Describing safety and tolerability — early stage clinical data from hundreds of subjects

The translation of preclinical safety and tolerability into the clinic is a key step for each of our programs and in totality supports the creation of a new category of medicines. We continue to generate safety and tolerability data across 10 investigational medicines with no observations that have prevented advancement of those programs to date. Of the remaining 11 development candidates, four have either completed IND-enabling GLP toxicology programs or have an open IND, and seven are either in preclinical testing or are yet to undergo IND-enabling GLP toxicology programs. The table below shows the number of subjects and patients that have been dosed with our pipeline candidates in clinical trials as of October 25, 2018:

<table>
<thead>
<tr>
<th>Modality (number of programs in clinical trials)</th>
<th>Subjects receiving an mRNA investigational medicine in clinical trials, as of October 25, 2018</th>
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<td>Prophylactic vaccines (7 programs)</td>
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<td>Cancer vaccines (1 program)</td>
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<td>Total</td>
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Diverse production of many types of proteins

Our scientists, in conjunction with scientists from Merck and AstraZeneca and other strategic collaborators, have tested over 12,000 unique mRNA sequences in *in vitro* and *in vivo* preclinical studies. This includes over 500 *in vivo* preclinical studies that were designed to show evidence of pharmacologic effect or the production of the desired protein. These studies included the following types of proteins:

- Extracellular soluble ligands (e.g., VEGF, IL12, Relaxin, and erythropoietin);
- Antibodies (e.g., immunoglobulins, which are composed of two light chain and two heavy chain proteins);
- Extracellular protein complexes (e.g., Chikungunya virus-like particles);
- Membrane proteins, in some cases as multimers (e.g., F protein, glycoprotein B, CMV pentamer, and OX40L);
- Intracellular soluble protein complexes (e.g., methylmalonic-CoA mutase homodimer and propionyl-CoA carboxylase heterododecamer);
- Intracellular membrane proteins with activating mutations (e.g., STING); and
- Neoantigens presented to the immune system as short peptides.

Direct and indirect clinical demonstration of protein production in humans across multiple modalities

Our pipeline includes 10 investigational medicines in clinical trials. After generating early stage safety and tolerability data, we aim to demonstrate that the mRNA administered makes the desired protein and creates the desired pharmacological effect. We have observed protein production or a resulting pharmacological effect across a number of programs:

- Phase 1 data for VEGF-A (a secreted ligand) demonstrated dose-dependent protein production directly quantified after intradermal administration of AZD8601. A pharmacological effect was also observed, as measured by changes in local blood flow (see “—Program Descriptions by Modality—Localized regenerative therapeutics”);
- Phase 1 data for OX40L (a membrane protein capable of T cell co-stimulation) protein production as measured by protein staining for OX40L in tumor tissue from patients after intratumoral administration of mRNA-2416 (see “—Program Descriptions by Modality—Intratumoral immuno-oncology”); and
- Four Phase 1 data sets that indirectly demonstrate protein production of different proteins by virtue of antibody responses to the pathogenic viral antigens coded by H10N8 vaccine (mRNA-1440), H7N9 vaccine (mRNA-1851), Chikungunya vaccine (mRNA-1388), and RSV vaccine (mRNA-1777) (see “—Program Descriptions by Modality—Prophylactic vaccines”).

Pharmacologic effect—immunological responses

In clinical data from our four most advanced prophylactic vaccine programs we have observed an ability to elicit neutralizing antibodies to viral antigens. For our two influenza vaccines, the RSV vaccine being developed in collaboration with Merck and the Chikungunya vaccine being developed in collaboration with DARPA, both the preclinical models and immune responses in humans showed increased antibody levels to pathogenic viral antigens. Preclinically, we have demonstrated the ability of our intratumoral immuno-oncology programs to transform immunologically cold tumor microenvironments in preclinical studies for our OX40L, OX40L+IL23+IL36γ, and IL12 programs. These responses include long-term T cell responses that eliminate tumors in animal models and makes them able to combat a second tumor challenge, indicating immunological memory. We also have preclinical evidence of immunological responses for programs in our cancer vaccines modality, including personalized cancer vaccines and KRAS vaccine.
Pharmacologic effect—enzyme-driven changes in metabolic phenotypes

We have tested our ability to impact metabolic phenotypes via the expression of over 24 different types of proteins. We have also progressed four development candidates, Methylmalonic acidemia, or MMA, propionic acidemia, or PA, and phenylketonuria, or PKU, and Fabry disease, through early preclinical development efforts. We have demonstrated the ability of our mRNA development candidates to drive metabolic change in animal models for MMA, PA, PKU, and Fabry disease.

Pharmacologic effect—via binding activity and/or signaling activity

We have demonstrated the ability of cells preclinically to make and secrete antibodies and soluble modulating factors that exert their pharmacologic activity by binding to targets and in some cases, having a signaling effect. For example, for our antibody against Chikungunya virus, we have demonstrated an ability to make an antibody against Chikungunya virus and its ability to drive passive immunity in animal models. For our Relaxin program, we have demonstrated an ability to make relaxin as a secreted and engineered protein, which can impact heart failure in preclinical models.

Pharmacologic effect from proteins encoded by mRNA—next wave of potential clinical data

We have several programs currently in or taking steps to enter Phase 1 clinical trials where we will measure the pharmacology of our expressed proteins, as well as direct or indirect evidence of protein production. These programs include:

- PCV (mRNA-4157) in the cancer vaccines modality to show specific T cells to one or many of the 20 encoded neoantigens;
- KRAS vaccine (mRNA-5671) in the cancer vaccines modality to show KRAS neoantigen specific T cells;
- OX40L+IL23+IL36γ (mRNA-2752) and IL12 (MEDI1191) (IL12) in the intratumoral immuno-oncology modality to show protein levels, although systemic levels may be limited due to the intratumoral nature of the injection;
- Antibody against Chikungunya virus (mRNA-1944), Relaxin (AZD7970), and Fabry disease (mRNA-3630) in the systemic secreted protein modality to show serum protein levels; and
- MMA (mRNA-3704), PA (mRNA-3927), and PKU (mRNA-3283) in the systemic intracellular protein modality, to show serum changes in metabolites resulting from active protein in these metabolic pathways.

Ten first-in-human trials from December 2015 to October 2018 and clinical material supply

We invest in capabilities and infrastructure that enable us to execute at scale. We first dosed a subject in a clinical trial occurred in December 2015. By October 2018, we or our strategic collaborators had achieved first-in-human for 10 different mRNA investigational medicines. Nine of those programs were run and sponsored by us.

Each first-in-human, or FIH, trial involved successful completion of one or more IND-enabling GLP toxicology studies, successful technical development, scale-up and cGMP manufacture of adequate quantities of mRNA drug product, IND or CTA regulatory filings and interactions with health authorities, and successful clinical operations start-up activities. We or our strategic collaborators have run clinical trials in the United States, Europe and Australia.

Conclusion

We believe that this body of preclinical and clinical data is indicative of our significant progress over the last four years, and provides a strong foundation for our ongoing mission to create a new category of medicines for patients.
PROGRAM DESCRIPTIONS

Using our platform, we have found solutions to many scientific and technical challenges in order to develop the desirable features of our potential mRNA medicines for different applications. A “modality” refers to a group of potential mRNA medicines with shared product features, and the associated combination of enabling mRNA technologies, delivery technologies, and manufacturing processes.

Each of our modalities is designed to overcome the challenges of delivering the right amount of mRNA to the right tissue at the right times across a variety of applications. In advancing our platform technologies and identifying new product features for novel mRNA medicines, we may designate additional modalities.

We started with prophylactic vaccines as our first modality as we believed there would be lower technical hurdles for vaccines compared to therapeutics. Early formulations of mRNA tended to stimulate the immune system, which is a desired feature for a vaccine, but not therapeutics. In addition, antigens for many viruses tend to be well-characterized and of lower biology risk. Also, dosing regimens for vaccines can require as few as one or two administrations.

I. PROGRAM DESCRIPTIONS IN OUR PROPHYLACTIC VACCINES MODALITY

We designed our prophylactic vaccines modality to prevent or control infectious diseases. Since we nominated our first program in late 2014, this modality has grown to include nine programs, all of which are vaccines against viruses. The goal of any vaccine is to safely pre-expose the immune system to a small quantity of a protein from a pathogen, called an antigen, so that the immune system is prepared to fight the pathogen if exposed in the future, and prevent infection or disease.

Within this modality, our portfolio includes programs for both commercial and global health uses. We have strategic alliances with Merck on select commercial vaccines, and with the Biomedical Advanced Research and Development Authority, or BARDA, and the Defense Advanced Research Projects Agency, or DARPA, on global health vaccine programs. Our prophylactic vaccines pipeline is shown below.
Opportunity

Vaccines to prevent infectious diseases are one of the great innovations of modern medicine. In the United States alone, the Centers for Disease Control and Prevention estimates that childhood vaccinations given in the past two decades will in total prevent 322 million Americans from falling ill, 21 million hospitalizations, 732,000 deaths, $295 billion of direct costs, and $1.3 trillion in social costs. The commercial opportunity for vaccines is significant, with more than $35 billion in annual worldwide sales, including 16 different vaccine products each generating more than $500 million in annual worldwide sales in 2017.

Our approach

Our vaccine research approach starts by identifying the antigens most likely to induce a protective immune response against a specific infectious disease. We test one or more antigens in vivo in multiple animal species. The immune response can be measured in multiple ways including:

- Generation of binding antibodies, where the antibodies generated by the vaccine bind to the pathogen antigens being targeted;
- Generation of neutralizing antibodies, where the antibodies generated by the vaccine are able to prevent the pathogen from infecting cells;
- Ability of the vaccine to protect vaccinated animals against a pathogen, as measured by reductions in detectable pathogen or by the survival of the challenged animal if the pathogen is lethal; and
- Generation of an antigen specific T cell response.

Clinical correlates of protection are levels of immune response that when achieved in response to vaccination are associated with protection against infection or disease. Influenza, for instance, has an established correlate of
protection based on the serum hemagglutination inhibition, or HAI, assay. HAI titers of 40 or above are associated with 50% to 70% protection against influenza. However, such correlates are generally only available for approved vaccines. As a result, new vaccines generally, but not always, have to demonstrate efficacy against clinical disease before being approved. Our first two programs in this modality are H10N8 and H7N9 vaccines for an established antigen with HAI clinical correlates.

Typically, subjects require only a limited number of administrations of a vaccine to confer long-lasting protection. Many of our mRNA vaccines are developed to be administered in two doses, one to prime the immune response and the second to boost it. In cases where populations have been exposed to the virus previously, such as with many respiratory viruses, a subject might be administered a single dose of an mRNA vaccine.

We believe that our potential mRNA vaccines will have a more standardized manufacturing process compared to traditional vaccines that would provide considerable advantages. Current approaches include attenuation and replication of live viruses and cell-culture methods to produce recombinant antigens. These approaches require considerable customization compared to the standardized process of producing mRNA vaccines.

We believe the inherent characteristics of mRNA, coupled with our strategy to execute at scale, will allow us to bring potential mRNA vaccines to the clinic in a relatively short period of time. We have chosen to be methodical for our early programs to understand the technology risks within the modality. If needed, as in the case of a pandemic, we could potentially exploit the scalability of mRNA medicines and our infrastructure to rapidly advance a potential mRNA vaccine to the clinic.

PROPHYLACTIC VACCINES MODALITY: COMMERCIAL PROGRAMS
RSV vaccine (mRNA-1777): Summary

Our RSV vaccine program completed dosing in a Phase 1 clinical trial and based on the interim data and other considerations, our strategic collaborator Merck has initiated Phase 2a planning

Respiratory syncytial virus, or RSV, is one of the most common causes of respiratory disease in infants and the elderly. More than 86,000 children and about 177,000 older adults are hospitalized due to RSV associated respiratory infections each year in the United States. To date, no effective vaccine to prevent RSV has been approved, and the only approved prophylaxis treatment is limited to the monoclonal antibody palivizumab, marketed as Synagis in the United States for pediatric patients at high risk for RSV infection. In collaboration with Merck, we designed mRNA-1777 to encode a membrane-anchored version of stabilized prefusion F protein, the main target of potently neutralizing and protective antibodies. This vaccine is administered as a single dose with no boost. The Phase 1 trial is currently ongoing in Australia, for which we are the sponsor. Merck has initiated plans for a Phase 2a trial, for which Merck will be the sponsor. In addition, we are working with Merck to identify and advance improvements to the RSV vaccine.

RSV vaccine (mRNA-1777): Disease overview

RSV impacts young children and older adults, and no approved vaccine exists today

RSV causes upper and lower respiratory tract illness worldwide and is transmitted primarily via aerosolized droplets from an infected person, or via contamination of environmental surfaces with infectious secretions. Following introduction of RSV into the nose or upper respiratory tract, the virus replicates primarily in the ciliated cells of the respiratory epithelium. Upper respiratory symptoms typically begin within several days of exposure. In healthy adults, the infection may remain confined to the upper respiratory tract. However, in those with compromised immune systems, such as premature infants, the elderly, or individuals with underlying respiratory disease, lower respiratory tract infections commonly occur and may manifest as wheezing, bronchiolitis, pneumonia, hospitalization or even death. Infections with RSV follow a seasonal pattern, occurring primarily in the Northern hemisphere between the months of November and April, and in the Southern hemisphere primarily between March and October.
More than 86,000 children are hospitalized due to RSV infection each year in the United States. About 177,000 older adults are hospitalized each year in the United States due to RSV-associated respiratory infections, with approximately 14,000 deaths as a result. RSV infection is common in adults over the age of 60 years, occurring in an average of 5.5% of older adults every season and resulting in physician’s visits for 17% of infected older adults. The cost of RSV disease to society can be considerable.

**RSV vaccine (mRNA-1777): Our product concept**

*Prevent RSV infections with an improved RSV antigen using a single vaccine dose*

Our RSV investigational medicine, mRNA-1777, includes an mRNA encoding an engineered form of the RSV fusion (F) glycoprotein stabilized in the prefusion conformation in an LNP. The F protein is present as a homotrimer on the surface of RSV. The prefusion conformation of the F protein interacts with a host cell membrane, and the conformational change from prefusion to postfusion drives virus fusion with a host cell. The majority of RSV-specific neutralizing antibodies in convalescent people are directed to epitopes present only on the prefusion conformation of the F protein. The prefusion state of the F protein elicits a superior neutralizing antibody response compared to the postfusion state in animal studies conducted by others. A schematic of the prefusion F protein on the surface of a host cell, with sites recognized by neutralizing antibodies, is depicted in the figure below; the inset on the left of the figure shows the intended design of the mRNA formulated in LNP, and the inset on the right shows the intended prefusion F protein on the surface of the cell. We believe that neutralizing antibodies elicited by mRNA-1777 may lead to an efficacious RSV vaccine.

**RSV vaccine (mRNA-1777): Preclinical information**

mRNA vaccines encoding different versions of the prefusion F protein have been evaluated in mice, cotton rats, and African green monkeys, or AGM. These studies demonstrate that mRNA vaccines encoding the prefusion F protein induce robust neutralizing antibody titers in preclinical species tested, do not lead to vaccine-enhanced respiratory disease (evaluated in cotton rats), and are protective against RSV challenge (evaluated in cotton rats and AGM). The data for a study in AGM are shown in the figure below. In this study, one group of AGM (4 per group) was vaccinated intramuscularly with vaccine, a second group was infected with 5.5 log10 plaque forming units, or pfu, of RSV strain A2 intranasally as a positive control, and a third group received no vaccine as a negative control, each on weeks 0, 4, and 8. Serum neutralizing antibody titers, or SN titers, were measured on the indicated weeks and are shown in panel A. All animals were challenged intranasally and intratracheally on study week 10. On multiple time points after the challenge, virus present in bronchoalveolar lavage, or BAL, fluid was quantified by plaque assay as shown in panel B. In this study, we observed an increase in serum neutralizing titers with each vaccine dose. The animals that received mRNA-1777 showed complete protection.
(no virus detected) in lungs, similar to the control group immunized with RSV A2. These results are shown in the figures below.

Serum neutralizing titers for mRNA-1777 in non-human primate study

Lung viremia detected post challenge in non-human primate study with mRNA-1777

RSV vaccine (mRNA-1777): Clinical data

The Phase 1 trial in Australia has generated safety and tolerability data and demonstrated immunogenicity through day 90; based on the interim data and other such considerations, Merck has initiated planning for a Phase 2a trial.

The Phase 1 trial for RSV vaccine has met its objectives of assessing the safety and tolerability profile of mRNA-1777 versus placebo including capturing solicited and unsolicited local and systemic adverse events. The Phase 1 trial for RSV vaccine has also demonstrated immunogenicity and we have observed a humoral immune response as measured by neutralizing antibody titers against RSV A for dose levels one, two, and three of mRNA-1777. Based on the interim data and other considerations, Merck has initiated planning for a Phase 2a trial.
The mRNA-1777 Phase 1 study is a randomized, partially double-blind, placebo-controlled, dose-escalation first-in-human study to describe the safety, tolerability, and immunogenicity in healthy adult subjects in Australia. We are the sponsor for this trial. The study evaluated three dose levels in healthy younger adults, and 4 dose levels in healthy older adults. All subjects were given a single intramuscular injection. The key objectives of the study included:

- assess the safety and tolerability of mRNA-1777 versus placebo; and
- determine the immunogenicity of mRNA-1777 by measuring serum neutralizing antibody titers against RSV.

The key endpoints for the study included safety and tolerability of mRNA-1777.

The study is being conducted in two parts. Part A evaluates healthy younger subjects (ages ≥18 and ≤49 years) and Part B evaluates healthy older subjects (ages ≥60 and ≤79 years). There are four dose levels, where the highest dose, or dose four, is twelve times the lowest dose, or dose one, and dose three, the second highest dose, is eight times the lowest dose. In Part A, dose levels one, two, and three are being evaluated. The safety data from the sentinel safety group for each dose level was reviewed before permitting enrollment of the expansion group within that dose level cohort. The safety data of each expansion group was reviewed before permitting dose escalation/enrollment of the sentinel safety group at the next dose level. In Part B, all four dose levels are being evaluated. The first sentinel dose cohort was triggered after review of the first sentinel dose level cohort in Part A. The safety data from the sentinel safety group for each dose level cohort was reviewed before permitting enrollment of the expansion group within that dose level cohort. The safety data of each expansion group was reviewed before permitting dose escalation/enrollment of the sentinel safety group at the next dose level. Part B includes the highest dose level, dose four, which was enrolled after review of the available safety and immunogenicity data of the preceding Part B dose level cohorts. Expansion groups in Part A and B were both randomized 3:1 mRNA-1777: placebo.
This 200-subject study is fully enrolled and all subjects have been dosed. As of April 2018, we have the majority of data through three months (90 days) post-vaccination for younger subjects in dose levels one and two, and for older subjects in doses one, two, and three. Based on the interim data as of April 2018, dose levels one, two, and three of mRNA-1777 were observed to elicit a humoral immune response as measured by neutralizing antibody titers against RSV A, neutralizing antibody titers against RSV B (dose level three only, dose levels one and two have yet to be assayed), absolute serum antibody titers to RSV prefusion F protein and RSV postfusion F protein, and competing antibody titers to RSV prefusion F protein in a dose-dependent manner up to dose level two in both younger and older subjects. The immune response measured by neutralizing antibody titers against RSV A in older adults that received dose level three of mRNA-1777 was not higher than that of the subjects that received dose level two. We have observed an increase in neutralizing antibody titers relative to placebo in younger adult subjects in panel A and older adult subjects in panel B who received our RSV vaccine, as shown in the figure below. At day ninety, between 10 and 19 healthy younger subjects and between 11 and 27 healthy older subjects were tested at each dose level. Based on the interim data and other considerations, Merck has initiated planning for a Phase 2a trial.

Neutralizing antibody titers in healthy younger subjects
[Ages 18 and ≤ 49 years] in Phase 1 trial for mRNA-1777 per protocol set
In addition, based on interim data as of April 2018, we observed an increase in T cell response relative to baseline at day 15 and day 60 in both healthy younger and healthy older adult subjects vaccinated with doses two and three of mRNA-1777.

Based on interim safety data as of April 2018, mRNA-1777 was well tolerated with no dose limiting toxicities at dose levels one, two, and three in both the younger and older adults. As of September 2018, the highest dose level, which was evaluated in older subjects only, dose level four, was not as well tolerated as the lower dose levels. However, across all treatment arms, there were no treatment-related serious adverse events, or SAEs, treatment emergent adverse events, or TEAEs, leading to withdrawals, adverse events, or AEs, of special interest, or new onset of chronic illnesses or autoimmune disorders in either of the age cohorts. There were no patterns in clinically significant laboratory abnormalities.

As of September 2018, we have observed 15 SAEs in nine subjects, all of which were deemed unrelated to study product. These SAEs occurred approximately one to ten months from receipt of study product and included aortic aneurysm repair, paralytic ileus, spinal decompression, death from pre-existing cardiomyopathy, hema, transient ischemic attack, peripheral vascular disorder, vasovagal syncope, diagnosis of non-small cell lung cancer, anterior cruciate ligament tear, left knee tendon tear, right knee tendon tear, left patella dislocation, right patella dislocation, and bilateral patella tendon repair.

The trial is ongoing and, consistent with the study protocol, we remain blinded to treatment at the individual subject level and continue to collect safety, tolerability, and immunogenicity data through day 365 of the study. Based on the interim safety, tolerability, and immunogenicity data, Merck has initiated plans for a Phase 2a trial for mRNA-1777.
CMV vaccine (mRNA-1647): Summary

Our CMV program targets congenital CMV infections to reduce or prevent birth defects

Congenital cytomegalovirus, or CMV, infection is the leading cause of birth defects in the United States. Despite several attempts, to date, there is no vaccine approved to prevent congenital transmission of CMV. We believe that in addition to the glycoprotein B, or gB, protein antigen, a successful CMV vaccine would need to include the Pentamer, a 5-protein membrane complex required for epithelial, endothelial, and myeloid cell infection by the virus. A CMV vaccine containing the Pentamer as a recombinant protein or a replication defective virus is complex to make and scale. We used our platform to generate a mRNA vaccine designed to make the Pentamer in its natural membrane-bound conformation. This investigational medicine is designed to prevent or control CMV infection and includes five mRNAs encoding for the Pentamer, as well as one mRNA encoding for CMV gB that has previously demonstrated partial clinical efficacy. Our program is currently being tested in a Phase 1 clinical trial in the United States.

CMV (mRNA-1647): Disease overview

CMV is a major cause of birth defects with no approved vaccine

Human CMV is a common human pathogen and member of the herpes virus family. Seropositivity, demonstrating prior exposure to virus, increases with age and is approximately 40-60% in women of child-bearing potential in the United States. However, general awareness of CMV is not high. Less than 10-20% of adults are aware of CMV and most healthy adults after initial (primary) CMV infection do not have symptoms. However, approximately 0.6-0.7% of newborns are congenitally infected by CMV annually in industrialized countries. Congenital CMV results from infected mothers transmitting the virus to their unborn child and it is the leading cause of birth defects, with approximately 25,000 newborns per year in the United States infected. Birth defects occur in approximately 20% of infected babies and include permanent neurodevelopmental disabilities, which can include hearing loss (often permanent), vision impairment, varying degrees of learning disability, decreased muscle strength and coordination, and even death. Some studies report approximately one-third of infants with severe congenital disease will die within the first year of life, and the survivors, their caregivers, and health systems bear significant long-term burdens.

There is currently no available vaccine for CMV, and many previous attempts at developing a vaccine to reduce or prevent congenital transmission have been missing a key antigen, the Pentamer. We believe the Pentamer is critical for the infection of epithelial, endothelial, and myeloid cells by the virus. We believe the Pentamer was not included in certain prior recombinant protein vaccine attempts due to the complexity of producing it as a multi-unit antigen complex. Prior vaccine studies demonstrated insufficient efficacy against CMV infection and limited durability of immune response. A vaccine that leads to durable immunity in women of child-bearing age would address a critical unmet need in the prevention of congenital CMV infection.

CMV vaccine (mRNA-1647): Our product concept

We are developing a single vaccine with complex antigens to prevent or control infection

Our ability to generate a multi-antigen vaccine enables us to combine a traditional target antigen (gB) with the Pentamer in order to specifically focus the immune system on these important antigens. We believe this gives us greater potential to produce neutralizing antibodies that can block CMV transmission from the mother to the fetus. Our approach to block transmission could either be:

- direct, by vaccinating adolescents or adults of child-bearing potential (female and male); or
- indirect, by vaccinating toddlers who could spread CMV to each other, their mothers, and their childcare workers.

Unlike a protein-based or live-attenuated vaccine, our mRNA instructs cells to specifically make predetermined antigens with a structure that mimics the one presented to the immune system by the virus, thus focusing the immune system on these important antigens.
mRNA-1647 comprises six mRNAs that encode for these known hard-to-make CMV antigens in a proprietary LNP:

- In CMV seropositive individuals, the majority of neutralizing antibodies target the Pentamer. The CMV Pentamer is made by five CMV glycoproteins that form a membrane-bound complex. The Pentamer is required for CMV entry into epithelial, endothelial, and myeloid cells. The mRNA-expressed Pentamer is displayed on the surface of the cell and stimulates the production of neutralizing antibodies that prevent the virus from entering the cells.

- gB is a trimeric CMV membrane glycoprotein that abundantly resides on the surface of the viral particles. Fusion between virus and host cells, and hence infection, requires gB. Antibodies to gB can prevent CMV infection. gB has been utilized in some earlier attempts at a CMV vaccine as the sole antigen which had resulted in partial efficacy but not at levels sufficient for approval.

An illustration of our proposed approach for CMV is shown in the figure below.

CMV vaccine (mRNA-1647): Preclinical information

We have published preclinical data for our CMV vaccine. We have demonstrated that the Pentamer and gB mRNAs can elicit potent and durable antibody titers against the antigens in mice and non-human primates, and have published these results in *Vaccine* in 2018. In one study, mice were immunized with the Pentamer and gB mRNAs encapsulated in our proprietary LNP. Serum samples were taken from the mice at specific timepoints post vaccination. Post-vaccination neutralizing titers were measured by admixing serial dilutions of each sample with CMV virus, incubating the mixture in a human primary epithelial cell culture, and counting the number of infected cells. We used CytoGam, an approved product for prevention of CMV in transplant patients, as a control in our experiment. CytoGam is cytomegalovirus immune globulin from pooled plasma of CMV seropositive donors. The table below shows the neutralization antibody titers in epithelial cells for escalating vaccine doses in mice, demonstrating our ability to generate neutralizing antibodies. We also observed that at the highest dose, our mRNA vaccine generated a response more than 75-fold higher than CytoGam at estimated clinical levels. In addition, we have also observed that the Pentamer and gB mRNAs can elicit strong T cell responses.
Neutralizing titers in human primary epithelial cells for escalating CMV mRNA vaccine doses in mouse study

<table>
<thead>
<tr>
<th>Dose for vaccine including the Pentamer and gB in our proprietary LNP</th>
<th>At 41 days</th>
<th>Neutralization titers in epithelial cell</th>
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<tbody>
<tr>
<td>1.2 µg</td>
<td></td>
<td>58,336</td>
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<tr>
<td>3.5 µg</td>
<td></td>
<td>682,989</td>
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<tr>
<td>10.5 µg</td>
<td></td>
<td>457,913</td>
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<tr>
<td>CytoGam comparator (used at maximum concentration of 2 mg/ml observed in human serum)</td>
<td></td>
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CMV vaccine (mRNA-1647): Clinical plan

We are currently conducting a Phase 1 trial in the United States

This Phase 1 trial is a randomized, observer-blinded, placebo-controlled, dose-ranging study to evaluate the safety and immunogenicity of mRNA-1647 in healthy adults in the United States. The study is designed to administer the vaccine as a 3-dose vaccination schedule (0, 2, and 6 months) at three dose levels (30, 90, and 180 µg) in both CMV-seronegative and CMV-seropositive subjects. Key objectives of the study include the evaluation of:

- safety and reactogenicity of different dose levels of mRNA-1647;
- neutralizing anti-CMV antibody responses against epithelial cell and fibroblast cell infection following vaccination;
- antigen-specific antibody responses against gB and the Pentamer following vaccination; and
- antigen-specific T cell responses to different dose levels of mRNA-1647.

Key endpoints for the study include safety, tolerability, and reactogenicity.

Subsequent to the initiation of our Phase 1 study for mRNA-1647, we developed a modified manufacturing process that demonstrated improved pharmaceutical properties in preclinical testing. We elected to introduce this modified process into mRNA-1647 under the same IND. Consequently, prior to our receipt of any immunogenicity data, we modified our trial design to test the original and modified manufacturing process for mRNA-1647.
The trial schematic is shown in the figure below. Our Phase 1 trial comprises dose-escalation and dose-selection phases A and B. Only CMV-seronegative subjects are enrolled into the dose-escalation phases, and both CMV-seronegative and -seropositive subjects are enrolled at a 1:1 ratio into the dose-selection phases. Dose-escalation phase A evaluated mRNA-1647 manufactured with the process originally filed in the IND, and dose-escalation phase B is now evaluating mRNA-1647 manufactured with a modified process. For each dose-escalation phase, there is sequential enrollment of subjects into three dose levels of study vaccine or placebo, starting at the lowest dose level. Internal safety review of all subjects at each dose level will permit enrollment of subjects into the next dose level. For each dose-escalation phase, the safety monitoring committee, or SMC, will review the safety data from all subjects after their second vaccination to permit enrollment into the corresponding dose-selection phase. Since dose-escalation phase A included the mRNA-1647 manufactured using the process originally filed in the IND and we prefer the modified manufacturing process, the drug product manufactured using the original manufacturing process is not being progressed to dose-selection.

As of November 2018, the dose-escalation phase A of mRNA-1647, including the top dose level, has completed dosing. Based on an unblinded review of safety data through seven days after all subjects had received the second dose in phase A, the SMC approved continuation of the trial. We opted to trigger dose-escalation phase B for mRNA-1647 which was manufactured using the modified manufacturing process. The dose-escalation phase B of mRNA-1647, including the top dose level has completed dosing of the second dose. Pending successful results from the Phase 1 trial, we plan to launch a Phase 2 trial for mRNA-1647.

**CMV vaccine (mRNA-1443): An additional antigen in a second development candidate to explore potential use of our CMV program in transplant recipients**

Every year in the United States, approximately 30,000 adults receive solid organ transplants. Transplant patients must take immunosuppressive medications to prevent transplant rejection, which places these patients at particular risk for both primary CMV infection or reactivation of latent CMV infection. Currently, there is no vaccine to prevent CMV infection and disease.

Given the unmet need, we believed that we could explore combination vaccines to combat CMV infections in the transplant setting by potentially combining the congenital CMV vaccine mRNA-1647 with a separate CMV
vaccine for a single CMV T cell antigen, phosphoprotein 65, encoded in mRNA-1443. Due to the exploratory nature of this product concept we have never listed mRNA-1443 in our pipeline chart.

Our ongoing, placebo-controlled, dose-ranging Phase 1 trial was designed to evaluate the safety and immunogenicity of mRNA-1443. mRNA-1443 was tested in conjunction with mRNA-1647 under a single IND in the same clinical trial but in separate arms. As of August 2018, the dose-escalation phase with mRNA-1443 had completed enrollment, at doses of 10, 40, and 80 µg. Based on an unblinded evaluation of safety data, the SMC approved continuation of the trial to dose-selection. In August 2018, we determined that the clinical material for mRNA-1443 did not meet our internal quality control specifications for visual inspection after one year of storage. Accordingly, we stopped further dosing of mRNA-1443 and notified the FDA, and the FDA subsequently placed a clinical hold on the IND. Within two business days, we reached agreement with the FDA to remove mRNA-1443 from the combined mRNA-1647/mRNA-1443 IND, lifting the clinical hold, and mRNA-1647 dosing has been uninterrupted by this matter. We will continue to monitor subjects who previously received mRNA-1443 pursuant to the protocol. Should we elect to continue development of mRNA-1443, we would submit a new, separate IND with new cGMP material for mRNA-1443.
We are developing a vaccine to address two viruses that are leading causes of respiratory infection

Human metapneumovirus, or hMPV, and human parainfluenza virus 3, or PIV3, are important causes of respiratory tract infections in children and have led to increasing rates of hospitalization over the past few years. Despite the substantial impact hMPV and PIV3 have on human health, attention and research on these viruses have lagged relative to RSV. To date, no vaccine to prevent hMPV or PIV3 infections has been approved. Our platform allows us to combine mRNAs encoding antigens for the two pathogens in one combination vaccine, enabling a single vaccine that could protect against both respiratory infections. In our approach, we utilize mRNA sequences encoding for the membrane F proteins for each of the viruses. We have developed experience with the related F protein from our RSV program with Merck. mRNA-1653 is currently being tested in a Phase 1 trial in the United States.

hMPV+PIV3 vaccine (mRNA-1653): Disease overview

hMPV and PIV3 have a substantial impact on human health yet have lagged in research and attention relative to RSV

There is no approved vaccine for hMPV although this RNA virus has been determined to be one of the more frequent causes of upper and lower respiratory tract infections. hMPV has been detected in 4% to 15% of patients with acute respiratory infections. hMPV causes disease primarily in young children but can also infect adults, the elderly, and immunocompromised individuals. Clinical signs of infection range from a mild upper respiratory tract infection to life-threatening severe bronchiolitis and pneumonia. Though PIV3 related infections were identified in the past, their burden to patients and hospitals has been elevated over the past few years.

There is no approved vaccine for PIV3 although this RNA virus is recognized as an important cause of respiratory tract infections in children. Infections from parainfluenza virus, or PIV, account for up to 7% of acute respiratory infections among children younger than 5 years. Of the four PIV types identified, PIV3 most frequently results in infections and leads to the more serious lower respiratory tract infections compared to the other three PIV types. hMPV was discovered in 2001 and identified as another leading cause of respiratory infection.

The majority of hMPV or PIV3-associated hospitalizations in children occur under the age of 2 years. Despite the substantial impact hMPV and PIV3 have on human health, attention and research on these viruses have lagged relative to RSV. Hospitalizations due to hMPV or PIV3 infections have risen, and we believe that a single vaccine intended for active immunization of infants and toddler against both hMPV and PIV3 would be valuable. Previous attempts at developing a vaccine have focused on only hMPV or PIV alone with no known attempts at a combination vaccine.
hMPV+PIV3 vaccine (mRNA-1653): Our product concept

Our approach is to develop a combination vaccine for all infants and toddlers

mRNA-1653 is a single investigational vaccine consisting of two distinct mRNA sequences that encode the membrane F proteins of hMPV and PIV3, co-formulated in our proprietary LNP as shown in the figure below.

hMPV+PIV3 vaccine (mRNA-1653): Preclinical information

Our mRNA vaccine is immunogenic in multiple species

We have evaluated multiple combinations for hMPV+PIV3 mRNA vaccines encoding full-length F proteins for hMPV and PIV3 viruses in mice, Sprague Dawley rats, cotton rats, and African green monkeys, or AGM, each following intramuscular, or IM, injection. These studies demonstrate that mRNA encoding for F proteins from these viruses induce robust neutralizing antibody titers in all species tested. For example, neutralizing antibody titers for mRNA encoding for F proteins of hMPV and PIV3 encapsulated in LNP in mice are shown in the figure below. C57Bl/6 mice were immunized with 0.33, 2, or 12 µg of formulated material intramuscularly on study days 1 and 29. Neutralizing antibody titers were measured in serum collected on day 43. Results are represented as geometric mean titers, or GMT, of seven mice per group. In the figure below, neutralizing antibody titers in mice after immunization with mRNA for hMPV and PIV3 in our proprietary LNP by hMPV (left panel) and PIV3 (right panel) are depicted along with the lower limit of quantification, or LLOQ, of the assay.
Neutralizing antibodies are thought to be important for protection against hMPV and PIV3. The titer of neutralizing antibodies induced by natural infection from hMPV or PIV3 can be used to benchmark the titers induced by our hMPV+PIV3 vaccine in preclinical models and in our clinical trial. We determined the geometric mean neutralizing antibody titer for 15 seropositive adult donors to be 3,807 (range 499 to 20,751) for hMPV, and 263 (range 47 to 1024) for PIV3. Our hMPV+PIV3 mRNA vaccine induces a similar neutralizing antibody titer in mice after 2 vaccinations of the dose levels evaluated as shown in the figure above, and we believe it has the potential to confer protection in humans.

We have demonstrated that our hMPV and PIV3 mRNA combination vaccine does not lead to vaccine-enhanced respiratory disease (evaluated in cotton rats) and is protective against hMPV or PIV3 viral challenge (evaluated in cotton rats and AGM).

**hMPV+PIV3 vaccine (mRNA-1653): Clinical plan**

*We are currently conducting a Phase 1 trial in the United States*

The mRNA-1653 Phase 1 study is a blinded, randomized, observer-blind, placebo-controlled, dose ranging first-in-human study to evaluate the safety and tolerability, reactogenicity, and immunogenicity of mRNA-1653 in healthy adult subjects in the United States. The study evaluates four dose levels of mRNA-1653 (25, 75, 150, and 300 µg) administered intramuscularly at day one and month one, with the one-month immunization randomized to be mRNA-1653 or placebo in the dose selection phase of the study.

The key objectives of the study include evaluating:

- safety and reactogenicity of mRNA-1653 through 28 days after the last vaccination;
- humoral immunogenicity of mRNA-1653 through 28 days after the last vaccination;
- optimal dose and vaccination schedule of mRNA-1653 for further clinical development; and
- safety of mRNA-1653 through 12 months after the second vaccination.

The key endpoints for the study include safety and tolerability of mRNA-1653.

The schematic of the trial is shown in the figure below. In the dose-escalation phase, there is sequential enrollment into one of the four dose levels of mRNA-1653 or placebo. Advancement to the next dose level is permitted after an internal safety review. In the dose-escalation phase, five subjects will be randomly assigned in a 4:1 ratio to receive mRNA-1653 or placebo. The safety monitoring committee, or SMC, reviews safety data after dose-escalation enrollment is completed to permit enrollment into the dose-selection phase at the three highest dose levels with acceptable safety profiles. In addition, the SMC periodically reviews safety data during the dose-selection phase.

As of October 2018, the study is fully enrolled with 124 subjects. Based on an unblinded evaluation of safety data from the dose-escalation phase by the SMC, the three highest dose levels (75, 150, and 300 µg) are being evaluated in the dose-selection phase. Pending successful results from the Phase 1 trial, we plan to further evaluate mRNA-1653 in the clinic, including a Phase 1b trial in pediatric subjects.
VZV vaccine (mRNA-1278): Summary

In collaboration with Merck, we aim to develop a varicella zoster virus vaccine with efficacy comparable to Shingrix with an attractive commercial profile.

Shingles is caused by reactivation of the virus that causes Chicken Pox, varicella zoster virus, or VZV. This painful infection causes a rash and can cause postherpetic neuralgia, a debilitating ongoing nerve pain. In addition, it is highly contagious. The most effective vaccine on the market is Shingrix by GlaxoSmithKline, for which two dose-series of the adjuvanted subunit vaccine is more than 90% effective at preventing shingles in adults 50 years and older. In collaboration with Merck, our goal is to develop a VZV vaccine with efficacy comparable to Shingrix and with an attractive commercial profile.

VZV vaccine (mRNA-1278): Our product concept

We are developing an mRNA vaccine formulated in lipid nanoparticle.

mRNA-1278 is an mRNA vaccine encoding a VZV antigen formulated in a proprietary LNP.

VZV vaccine (mRNA-1278): Preclinical information

In collaboration with Merck, we have observed an antibody response comparable to Shingrix and a T cell response.

mRNA-1278 has been evaluated in mice and non-human primates, or NHPs, following intramuscular injection and induces robust antigen-specific antibody and T cell responses. An IND-enabling GLP toxicology program for mRNA-1278 is ongoing.

VZV vaccine (mRNA-1278): Clinical plan

Merck may sponsor and conduct a Phase 1 trial.
PROPHYLACTIC VACCINES: GLOBAL HEALTH PROGRAMS

Our global health portfolio for prophylactic vaccines seeks to leverage our mRNA technology to address epidemic and pandemic diseases. We are currently working with strategic collaborators such as BARDA and DARPA to fund and support our programs within this area. The first programs in this portfolio, H10N8 vaccine and H7N9 vaccine, helped identify and overcome the technical challenges with mRNA vaccines and could eventually address pandemics for these viruses. We have also gone from mRNA sequence to a first-in-human trial for Zika vaccine in twelve months. We have leveraged our learnings to rapidly advance a potential mRNA vaccine for a Zika pandemic. As we continue to build infrastructure and capabilities in the Research Engine and Early Development Engine, we believe we can help address future pandemics rapidly.

H10N8 vaccine (mRNA-1440) and H7N9 vaccine (mRNA-1851): Summary

Our H10N8 and H7N9 investigational vaccines demonstrate the potential of our platform to respond to an influenza pandemic

Influenza is one of the most variable and deadly infectious diseases, ranging from 12,000-56,000 deaths per year in the United States alone. The antigens in circulating seasonal influenza strains change slightly, which is called antigenic drift, from one year to the next, necessitating a change in the vaccine to match the new strains. Potential pandemic influenza strains can arise very quickly from substantial changes in antigens, which is called antigenic shift, and because pre-existing immunity is nonexistent in some populations, they can be pathogenic. Addressing a potential pandemic requires the ability to produce an effective vaccine rapidly. We believe that our platform enables the rapid development of safe and effective vaccines. As a proof of concept, we developed vaccines for H10N8 and H7N9 avian influenza strains, where there is a quantitative correlate for protection in humans (hemagglutinin inhibition, or HAI, titer of $1:40$). We have observed tolerability and immunogenicity in Phase 1 clinical trials for both mRNA vaccines for H10N8 and H7N9 and have published the interim data in *Molecular Therapy* in 2017. We do not intend to progress these programs through clinical development on our own. We may advance these programs with government or other grant funding.

H10N8 vaccine (mRNA-1440) and H7N9 vaccine (mRNA-1851): Disease overview

Traditional vaccines cannot respond easily to a new influenza pandemic

Influenza A is an RNA virus, with a genome packed into eight individual gene segments that code for at least eleven functional proteins needed for infection, replication, and evasion of host antiviral responses. The two major glycoproteins expressed on the surface of the virion are hemagglutinin, or HA, and neuraminidase, or NA, both of which are crucial for infection. HA mediates viral entry into host cells by binding to sialic acid containing receptors on the host cell surface and causing fusion of viral and host endosomal membranes. NA mediates enzymatic cleavage of the viral receptor at late stages of infection, allowing for the release of progeny virions.

Influenza A viruses infect a variety of species, including birds, pigs, sea mammals, and humans. Wild aquatic birds serve as the reservoir of influenza A viruses infecting avian and mammalian species. Although many of these viruses are non-pathogenic in birds and most do not infect humans, in recent decades, some avian influenza viruses such as H10N8 and H7N9 have crossed the species barrier to cause human disease.

There have been five epidemics of human infection due to H7N9, totaling over 1,500 cases, with mortality rates of 34-47%. To date, there have been three reported cases of H10N8, of which two have been fatal. For both H10N8 and H7N9, severe or fatal infections are characterized by rapid progression to respiratory failure within days of initial symptoms.

There are efforts ongoing to develop a H7N9 vaccine and a universal flu vaccine that covers H10N8. However, we believe the use of traditional methods to produce these vaccines can lead to several shortcomings in the vaccine. These include:

- production of vaccines in eggs requires selection of vaccine-virus strains that can be grown in eggs and this strain may not always match the pandemic strain; and
growth of the virus in eggs has also been shown to induce structurally relevant mutations that can negatively impact vaccine potency.

H10N8 vaccine (mRNA-1440) and H7N9 vaccine (mRNA-1851): Our product concept

Our platform can bring mRNA encoding for influenza HA antigen to clinical testing rapidly

Our H10N8 and H7N9 influenza vaccine programs are each based on the mRNA sequence for the cell viral HA membrane protein in a legacy LNP. mRNA-1440 encodes for the HA protein of the H10N8 strain and mRNA-1851 encodes for the HA protein of the H7N9 strain.

We believe that mRNA technology offers several advantages to traditional approaches of producing these vaccines, including:

- short time period between strain selection and when the vaccine can be made available; this is enabled by intrinsic features of mRNA and the infrastructure we have built, allowing for shorter research and development and time to manufacture.
- potential improved vaccine efficacy by avoidance of egg-based manufacture; this prevents the antigenic mismatch due to egg-adapted strains.
- potential for improved efficacy by way of improved antigen presentation; an mRNA vaccine, upon administration to a cell, produces the antigen in its natural conformation; and
- combination of multiple antigens into a single vaccine, allowing one to target multiple strains if needed; one of the intrinsic features of mRNA is the ability to utilize multiple mRNA sequences so that the cell produces multiple antigens at the same time.

H10N8 vaccine (mRNA-1440) and H7N9 vaccine (mRNA-1851): Preclinical information

We have observed immunogenicity of our mRNA H10N8 vaccine in multiple species

The level of a vaccine’s protection against influenza infection is traditionally measured using the HAI assay. The European Medicines Agency, or EMA, and U.S. Food and Drug Administration, or FDA, have endorsed HAI titers of 1:40 to indicate an antibody level considered to be 50% protective against infection. This benchmark was based on data from inactivated vaccines and varies with age group and setting.

Proof-of-concept for the use of mRNA vaccines encoding the HA protein from H10N8 has been demonstrated in murine studies. After a single dose of H10N8 vaccine, mice exhibited antibody production sufficient to achieve HAI titers of 1:40 (HAI titer 1:40 is regarded as a quantitative correlate for protection from influenza). Supporting immunogenicity data in ferrets and cynomolgus monkeys for the H10N8 vaccine have also been published by us in Molecular Therapy in 2017.

We have also observed immunogenicity of our mRNA H7N9 vaccine in multiple species

Proof-of-concept for the use of mRNA vaccines encoding the HA protein from H7N9 influenza A virus has been demonstrated in murine studies. After vaccination with mRNA vaccines, mice exhibited antibody production sufficient to achieve HA inhibition titers of 1:40. Additionally, a single dose of H7N9 vaccine protected 100% of mice from a lethal challenge with H7N9 virus even 84 days after completion of immunization. In a ferret study where H7N9 vaccine was administered intradermally, a reduction in lung viral titers was observed when ferrets were challenged 7 days post immunization. Supporting immunogenicity data in cynomolgus monkeys have also been reported by us in Molecular Therapy in 2017.
H10N8 vaccine (mRNA-1440) and H7N9 vaccine (mRNA-1851): Clinical data

The Phase 1 clinical trial for H10N8 in Germany has ended and we have generated safety and tolerability data and demonstrated immunogenicity.

The Phase 1 trial for H10N8 vaccine has met its objectives of describing the safety and tolerability profile of mRNA-1440 vs. placebo including capturing solicited and unsolicited local and systemic adverse events. The Phase 1 trial for H10N8 vaccine has also demonstrated immunogenicity and we have observed 100% of the subjects demonstrating hemagglutinin inhibition, or HAI, titer \( \geq 1:40 \) at day 43 for the 100 µg dose where HAI \( \geq 1:40 \) is regarded as a quantitative correlate for protection from influenza. We believe the data provides support to advance the program in clinical development if we choose to with additional government or other funding. In this randomized, double-blind, placebo-controlled, dose-ranging study, we evaluated safety and immunogenicity of IM dose levels of 25, 50, 75, 100, and 400 µg on a two-dose vaccination schedule on Day 1 and Day 21. We also evaluated intradermal, or ID, dose levels of 25 and 50 µg on a two-dose vaccination schedule on Day 1 and Day 21. The study objectives were safety, tolerability, and immunogenicity by HAI, and microneutralization, or MN, assays. 201 subjects were enrolled in this study, of which 145 received IM vaccination and 56 received ID vaccination. Of the 145 subjects in the IM vaccination group, there were 30, 30, 24, 23, and 3 subjects in the 25, 50, 75, 100, and 400 µg dose level groups, respectively. 35 subjects received the placebo. The Phase 1 trial was conducted with the name of the intervention listed as VAL-506440, in accordance with our legacy naming convention. We have since changed our naming convention and have adopted mRNA-1440 in place of VAL-506440.

Doses up to 100 µg administered IM demonstrated immunogenicity in the Phase 1 trial. The 75 µg cohort was started later and we chose not to proceed with its completion because the safety, tolerability, and immunogenicity data generated supported further development of the 100 µg dose. Intradermal vaccination was associated with high rates of solicited adverse events, or AEs (mainly injection site reactions), and we elected to discontinue enrollment of the ID cohorts.

Geometric mean titers, or GMTs, in the participants who received a two-dose IM series of the H10N8 vaccine at doses of 25, 50, and 100 µg at day 43 are shown in panel A of the figure below. Also, for those doses, 34.5%, 55.2%, and 100% of the participants, respectively, reached HAI titers \( \geq 1:40 \) at day 43 as shown in panel B of the figure below.

HAI GMT for H10N8 vaccine (mRNA-1440) in Phase 1 clinical trial

Panel (A)

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Percent of subjects with HAI ≥1:40 at day 43 with H10N8 vaccine (mRNA-1440) in Phase 1 clinical trial

The 100 µg dose showed 100% seroconversion. For this dose, we observed persistence in HAI titer six months after the second dose, with a HAI geometric mean titer of 13.9 and 95.6% of participants remaining seropositive (HAI titer ≥1:10) as shown in the figure below.

HAI antibody persistence at 100 µg dose for H10N8 vaccine (mRNA-1440) in Phase 1 clinical trial

Overall, up to the 100 µg IM dose, mRNA-1440 was well tolerated. A detailed list of the solicited adverse events, or solicited AEs, is provided in the table below. In the 400 µg IM dose group, two out of the three participants developed severe solicited adverse reactions (erythema, headache) within 24 hours of the first vaccination. These events met pre-specified study pause rules, and after safety committee review, further vaccinations at this dose level were stopped. These events resolved spontaneously without the need for medical intervention or medications.

Three severe unsolicited AEs (separately back pain, tonsillitis, and ruptured ovarian cyst) and 2 serious AEs, or SAEs, (separately cholecystitis and ruptured ovarian cyst) were reported and deemed unrelated to mRNA-1440. 124 unsolicited AEs were reported in the IM groups. The most common unsolicited AEs were upper respiratory
Solicited adverse events for H10N8 vaccine at all dose levels within 7 days after each IM vaccination on days 1 and 22

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<th>50 µg</th>
<th>100 µg</th>
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<td>n=35</td>
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<tr>
<td>Fever</td>
<td>1, 3.6 (0)</td>
<td>2, 6.9 (0)</td>
<td>4, 17.4 (0)</td>
<td>1, 3.7 (0)</td>
</tr>
</tbody>
</table>

* Data represent n, % with solicited AEs (% with severe solicited AEs) in the safety population; 75 µg dose group not shown (2 participants had severe solicited AEs of fatigue and injection site swelling following first vaccination, and no participants received dose 2); 400 µg dose group not shown.

The Phase 1 clinical trial for H7N9 vaccine in the United States is ongoing

The Phase 1 trial for H7N9 vaccine has met its objectives of assessing the safety and tolerability profile of mRNA-1851 vs. placebo including capturing solicited and unsolicited local and systemic adverse events. The Phase 1 trial for H7N9 vaccine has also demonstrated immunogenicity and we have observed 96% of the subjects demonstrating HAI titer \( \geq 1:40 \) at day 43 for the 25 µg dose where HAI \( \geq 1:40 \) is regarded as a quantitative measure for protection from influenza. We believe the data provides support to advance the program in clinical development if we choose to with additional government or other funding. The Phase 1 study for H7N9 is ongoing in the United States for long-term safety. This randomized, double-blind, placebo-controlled, dose-ranging study is evaluating intramuscular, or IM, dose levels of 10, 25, and 50 µg using two vaccination schedules (Day 1, Day 22 and Day 1, Month 6). The objectives are safety, tolerability, and immunogenicity by HAI and MN assays. 156 subjects were enrolled in this study. 30 subjects per dose cohort received two doses of 10 µg, 25 µg, and 50 µg at days 1 and 22. 10 subjects per dose cohort received one dose of 10, 25, and 50 µg at day one and a total of 9 of those subjects received a second dose at 6 months (data not shown). 36 subjects received placebo. A total of 10 subjects withdrew from the study. The Phase 1 trial was conducted with the name of the intervention listed as VAL-339851, in accordance with our legacy naming convention. We have since changed our naming convention and have adopted mRNA-1851 in place of VAL-339851.

Doses up to 50 µg administered IM to patients that received vaccinations on Day 1 and Day 22 in this Phase 1 clinical trial demonstrated immunogenicity.
Geometric mean titers in the participants who received a two-dose IM vaccination series on Day 1 and Day 22 at doses of 10, 25, and 50 µg are shown in panel A of the figure below. Also, for those doses, 36.0%, 96.3%, and 89.7% of the participants respectively reached HAI titers ≥1:40 at day 43 as shown in panel B of the figure below.

**HAI GMT for H7N9 vaccine (mRNA-1851) in Phase 1 clinical trial**

![HAI GMT for H7N9 vaccine (mRNA-1851) in Phase 1 clinical trial](image)

Panel (A)

**Percent of subjects with HAI ≥1:40 at day 43 with H7N9 vaccine (mRNA-1851) in Phase 1 clinical trial**

![Percent of subjects with HAI ≥1:40 at day 43 with H7N9 vaccine (mRNA-1851) in Phase 1 clinical trial](image)

Panel (B)
The 25 µg dose achieved 96% seroconversion. For this dose, we observed persistence in HAI titers six months after the second dose. HAI GMT decreased but remained above HAI titer level of 10 as shown in the figure below. In addition, 52% of participants remained seropositive (HAI titer ≥1:10) at six months.

HAI antibody persistence at 25 µg dose for H7N9 vaccine (mRNA-1851) in Phase 1 clinical trial

Overall, up to the 50 µg IM dose of mRNA-1851 was well tolerated. A detailed list of the solicited AEs is provided in the table below. The majority of possibly- and probably-related unsolicited AEs were grade 2 laboratory abnormalities and occurred at similar rates in vaccine and placebo groups. Four severe unsolicited AEs were deemed possibly related to vaccination: two cases of increased alanine aminotransferase (one 50 µg, one placebo), one case of increased aspartate aminotransferase (50 µg), and one case of thrombocytopenia (placebo). All cases were asymptomatic and resolved without intervention.

Solicited adverse events for H7N9 at all dose levels within 7 days after each IM vaccination on days 1 and 22*

<table>
<thead>
<tr>
<th>Dose 1</th>
<th>10 µg</th>
<th>25 µg</th>
<th>50 µg</th>
<th>Placebo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injection site pain</td>
<td>22, 73.3 (0)</td>
<td>17, 56.7 (0)</td>
<td>24, 80.0 (6.7)</td>
<td>5, 13.9 (0)</td>
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<td>Erythema</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Injection site swelling</td>
<td>5, 16.7 (0)</td>
<td>5, 16.7 (0)</td>
<td>9, 30.0 (0)</td>
<td>2, 5.6 (0)</td>
</tr>
<tr>
<td>Headache</td>
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<td>5, 16.7 (0)</td>
<td>7, 23.3 (6.7)</td>
<td>6, 16.7 (0)</td>
</tr>
<tr>
<td>Fatigue</td>
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<td>4, 13.3 (0)</td>
<td>3, 10.0 (0)</td>
<td>2, 5.6 (0)</td>
</tr>
<tr>
<td>Myalgia</td>
<td>3, 10.0 (0)</td>
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<td>8, 26.7 (0)</td>
<td>6, 16.7 (0)</td>
</tr>
<tr>
<td>Arthralgia</td>
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<td>3, 10.0 (0)</td>
<td>4, 11.1 (0)</td>
</tr>
<tr>
<td>Nausea</td>
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<td>1, 3.3 (0)</td>
<td>1, 3.3 (0)</td>
<td>1, 2.8 (0)</td>
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<tr>
<td>Fatigue</td>
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<td>1, 3.3 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Myalgia</td>
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<td>0</td>
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<tr>
<td>Arthralgia</td>
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<td>1, 3.3 (0)</td>
<td>6, 20.0 (3.3)</td>
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</tr>
<tr>
<td>Fever</td>
<td>0</td>
<td>0</td>
<td>1, 3.3 (0)</td>
<td>0</td>
</tr>
<tr>
<td>Nausea</td>
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<tr>
<td>Fever</td>
<td>0</td>
<td>0</td>
<td>6, 20.0 (6.7)</td>
<td>0</td>
</tr>
</tbody>
</table>

* Data represent n, % with solicited AEs (% with severe solicited AEs)
Zika vaccine (mRNA-1325 and mRNA-1893): Summary

In collaboration with BARDA, we brought a Zika vaccine from mRNA sequence design to the clinic in twelve months.

Zika is an infectious disease caused by the Zika virus, in which infection during pregnancy has been linked to severe brain damage in infants with congenital infection and Guillain-Barré Syndrome in adults. To date, no vaccine to prevent Zika infection has been approved. In September 2016, we were awarded a contract with BARDA to be reimbursed up to approximately $125 million for the development of a Zika mRNA vaccine. In order to rapidly respond to a potential epidemic, we developed mRNA-1325, which went from mRNA sequence design to first-in-human clinical testing in twelve months. In addition, we also developed a second Zika vaccine, mRNA-1893. mRNA-1893, at 1/20 of the dose, demonstrated better protection in non-human primates, as compared to mRNA-1325. mRNA-1325 is in a Phase 1 clinical trial in the United States and we are planning for a Phase 1 clinical trial of mRNA-1893. Based on the preclinical and clinical data, in collaboration with BARDA, we will determine which mRNA investigational medicine will be advanced for further clinical development.

Zika vaccine (mRNA-1325 and mRNA-1893): Disease overview

We faced a Zika epidemic in 2015 for which there were no vaccines or treatments.

The Zika virus is a single stranded RNA virus of the flaviviridae family. It was first isolated in a rhesus macaque in the Zika Forest, Uganda in 1947 and the first human case was documented in 1952. Seroepidemiology data suggest that it is endemic to regions of Africa and Asia where the Aedes mosquito vectors are found. Zika virus is predominantly spread by mosquitoes from the Aedes genus, but it can also be transmitted congenitally, sexually, and through blood donation.

In 2007, a Zika infection outbreak progressed across the Pacific islands. It arrived in Brazil in 2015 and the epidemic spread across the Americas. This led to the World Health Organization, or WHO, declaring it a public health emergency of international concern in 2016. During the period, there were tens of thousands of cases of microcephaly and congenital Zika syndrome reported in infants and of resulting neurological sequelae such as Guillain-Barré syndrome reported in adults.

Zika infection is usually asymptomatic or mild in adults, leading to fever, rash and conjunctivitis. However, infection of women during pregnancy can result in devastating microcephaly in newborns. Microcephaly is a birth defect characterized by an abnormally small head and brain, associated with lifelong neurodevelopmental delay, seizures, intellectual disability, balance problems, and dwarfism/short stature, resulting in significant disability and requiring lifelong support. To date, over a million cases of Zika have been officially reported in Latin America. Since most of the cases are asymptomatic, we believe the actual number of cases may be far higher. International travel means that Zika infection has the potential to take on global significance. While the number of cases has declined in the past couple of years, there is currently no treatment or vaccine available for the Zika virus to prevent and respond to potential future epidemics.

Currently, there is no approved vaccine for Zika. Designing and synthesizing conformationally correct protein antigen vaccines, attenuated or vectored live viral vaccines, or inactivated vaccines is time consuming and challenging. These traditional vaccine approaches have therefore found it difficult to respond fast enough to the emerging Zika epidemic.

Zika vaccine (mRNA-1325 and mRNA-1893): Our product concept

We advanced a complex antigen to the clinic in twelve months and followed up with a next generation vaccine.

We believe our platform allows for rapid development of mRNA vaccines with complex, immunogenic antigens faster than traditional vaccines. In order to rapidly deploy an mRNA vaccine for Zika, we leveraged available sequences and legacy LNPs to develop mRNA-1325. mRNA-1325 contains a sequence encoding for structural...
proteins in the Zika virus. The intended design is for translation of a polyprotein and processing inside the cell to make a secreted virus-like particle, or VLP. This process mimics the response of the cell after natural infection as shown in the figure below.

In addition, we continued to develop alternative Zika mRNA vaccine candidates. To this end, we identified mRNA-1706, which contains the same mRNA sequence as mRNA-1325 and now formulated in our proprietary LNP. Continued efforts at identifying different mRNA sequences with improved immunogenicity led to mRNA-1893, a sequence distinct from mRNA-1325 that increases production of Zika VLPs and generates enhanced immunogenicity and protection in preclinical animal models compared to mRNA-1325. mRNA-1893 is also formulated in our proprietary LNP. mRNA-1706 was discontinued in favor of mRNA-1893, which has been shown to have more activity.
Zika vaccine (mRNA-1325 and mRNA-1893): Preclinical information

We have observed and published our immunogenicity data for our Zika vaccine. The mRNA sequences for mRNA-1325 and mRNA-1893 have been tested in mice and non-human primates, or NHPs. We have published a subset of these data in the journal *Cell* in 2017. The mRNA sequence for mRNA-1893 produces equivalent immunogenicity and better protection compared to the sequence used in mRNA-1325 at 1/20 of the dose in NHPs, as shown in the figure below. In this study, mRNA vaccine or placebo was administered intramuscularly in a two-dose vaccination schedule (28 days apart), with five animals included in each group. NHPs were challenged with Zika virus 28 days post-boost, and viral titers were measured post challenge via quantitative PCR. Measurements were quantified in terms of focus forming units, or ffu. Each line on the chart represents an individual animal.

Sequence for mRNA-1893 provided comparable protection to that of mRNA-1325 in non-human primate challenge study

![Graphs showing immunogenicity data for mRNA-1325 and mRNA-1893](image)

Zika vaccine (mRNA-1325 and mRNA-1893): Clinical data

*Our lead Zika vaccine (mRNA-1325) is in a Phase 1 trial in the United States and planning for a Phase 1 trial for the next generation vaccine (mRNA-1893) is ongoing.*

The mRNA-1325 trial is a Phase 1 randomized, blinded, placebo-controlled, dose-ranging study to evaluate the safety, tolerability, and immunogenicity of mRNA-1325 in healthy adults (18 to 49 years of age, inclusive) in a
mRNA-1325 was administered intramuscularly in a two-dose vaccination schedule (28 days apart) at 3 dose levels (10 µg, 25 µg, and 100 µg). Key objectives of the study include:

- assess the safety of a 2-dose vaccination schedule of mRNA-1325 Zika vaccine, given 28 days apart, across a range of dose levels in flavivirus seronegative and flavivirus seropositive subjects compared with placebo; and
- assess the immunogenicity of a range of doses of mRNA-1325 Zika vaccine for further development.

Subjects were randomly assigned in a blinded fashion in an approximate 4:1 ratio to receive mRNA-1325 or placebo at one of three dose levels (10 µg, 25 µg, or 100 µg), with each subject receiving two vaccinations separated by 28 days. Approximately two-thirds of the enrolled subjects at each dose level were flavivirus seronegative and approximately one-third were flavivirus seropositive.

This is a 2-part study. Part A includes dose-finding, safety, and immune testing through 28 days following the second vaccination. Once subjects complete the final visit in Part A, they will be entered into Part B. Part B is a blinded follow-up period with assessment of safety through 12 months.

For each dose cohort, a sentinel safety group enrolled 3 flavivirus seronegative subjects randomized to mRNA-1325 and followed for 7 days after first vaccination. An internal safety team, or IST, reviewed blinded safety data during Part A through 7 days following first vaccination of the sentinel safety lead-in for each dose cohort and approved randomization of the remainder of that dose cohort. The safety monitoring committee, or SMC, approved the escalation to the next higher dose cohort after review of blinded safety data of the currently dosed cohort through seven days following the second vaccination and cumulative safety data of all cohorts. The trial design is shown in the figure below.

As of October 2018, the mRNA-1325 trial has completed enrollment (72 received mRNA-1325, 18 received placebo). mRNA-1325 did not show sufficient immunogenicity at doses up to 100 µg. Although the Phase 1 safety and tolerability data generated would permit additional dose escalation of mRNA-1325, our current development efforts are focused on our next-generation vaccine, mRNA-1893, which has been shown to be 20 times more potent in NHP Zika challenge studies.
Chikungunya vaccine (mRNA-1388): Summary

Our Chikungunya vaccine has generated safety and tolerability data and demonstrated immunogenicity for the Phase 1 clinical study through approximately six months post dosing; we aim to address a public health need with this vaccine.

Chikungunya virus represents a serious public health problem in tropical and sub-tropical regions with over 3 million cases globally. While it is rarely fatal, it can cause long-lasting and debilitating pain in multiple joints from polyarthralgia as well as serious neurological conditions. To date, no vaccine to prevent Chikungunya infection has been approved. Effective mosquito control has proven challenging, even in higher income countries. We believe our platform is well-suited to address this disease, as we can produce and deliver mRNA encoding the entire Chikungunya virus structural polyprotein (capsid and envelope proteins) to cells, which in turn produce and secrete Chikungunya virus-like particles, or Chikungunya VLPs, known to be robust inducers of protective neutralizing antibody responses. This program is supported by DARPA for a Phase 1 trial which is being conducted in the United States. The Phase 1 trial for Chikungunya vaccine in the United States is fully enrolled and has met its objectives of describing the safety and tolerability profile of mRNA-1388 versus placebo through approximately six months post dosing including capturing solicited and unsolicited local and systemic adverse events. The Phase 1 trial for Chikungunya vaccine has also demonstrated immunogenicity for the first part of the trial and we have observed 100% seroresponse for subjects at the 100 µg dose level 28 days post the second dose. We have also observed a durable response for the 100 µg dose, with 13 of 14 subjects at day 196 with neutralizing antibody titers above the seroresponse threshold. The second part of the trial to measure persistence of response at one year post dosing is ongoing. We believe the data provides support to advance the program in clinical development if we choose to with additional government or other funding.

Chikungunya vaccine (mRNA-1388): Disease overview

We aim to address a significant public health need

Chikungunya is a mosquito-borne RNA alphavirus posing a significant public health problem in tropical and subtropical regions. While Chikungunya has been present in Africa for centuries, recent outbreaks and epidemics in new regions have arisen due to the expanding distribution of the *Aedes* mosquito. A Chikungunya epidemic began in 2004 in Kenya, spread to India and was exported to nearly all regions of the world and brought Chikungunya to the attention of the western world. As of April 2016, Chikungunya cases had been reported in over 100 countries and territories around the world, including more than 45 countries and territories throughout the Americas. Chikungunya virus infection causes disease, characterized by an acute onset of fever, rash, myalgia, and sometimes debilitating polyarthralgia, giving the virus its name, which means “that which bends up” when translated from Makonde. It is rarely fatal, but neurological sequelae such as Guillain-Barre syndrome and chronic arthralgia have been associated with infection.

Chikungunya virus is an alphavirus of the Togaviridae family with a positive-strand RNA genome. The viral structural proteins are naturally expressed as a single polyprotein followed by subsequent cleavage by viral and cellular proteases into capsid (C) and envelope (E) glycoproteins E3, E2, 6k, and E1. The E proteins are major targets of protective neutralizing antibody responses.

There are currently no approved vaccines to treat or prevent Chikungunya infection or disease, and effective mosquito control has proven challenging, even in higher income countries. Currently, infected individuals are treated with non-steroidal anti-inflammatory drugs to relieve symptoms. Therefore, there is a need for a safe and effective prophylactic vaccine.
Chikungunya vaccine (mRNA-1388): Our product concept

We are developing a complex polyprotein encoding mRNA encapsulated in a lipid nanoparticle

The mRNA-1388 vaccine consists of a single mRNA encoding the full native structural polyprotein (C-E3-E2-6k-E1) that is naturally processed into C and E proteins, which assemble into VLPs and are released from cells. The E proteins on these VLPs are the major target of neutralizing and protective antibodies, that, in the context of natural infection, can provide essentially life-long immunity to reinfection. The C protein provides structure to the VLP and contains T cell epitopes that could contribute to protective immune responses. The mRNA is encapsulated in a legacy LNP. An illustration of our approach is shown in the figure below.
Chikungunya vaccine (mRNA-1388): Preclinical information

We have conducted preclinical studies in mice and non-human primates.

Preclinical immunogenicity studies have been performed in mice and non-human primates and suggest that our Chikungunya vaccine induces a robust neutralizing antibody response in a dose- and regimen-dependent manner. Further, a one- or two-dose vaccination series protected AG129 mice from a lethal Chikungunya virus challenge administered 56 days and 112 days later, demonstrating durable immunity, as shown in the figure below. In this study, AG129 mice were immunized with 0.4, 2, or 10 µg of the mRNA Chikungunya vaccine in a legacy LNP administered intramuscularly on day 0 (D0) or days 0 and 28 (D0 and D28). Serum neutralizing antibody titers were measured in five mice per group on day 56 by 50% plaque reduction neutralization test (PRNT50), followed immediately by a lethal Chikungunya virus challenge (panels A and C). Neutralizing antibody titers were measured in another five mice per group on day 112, followed by a lethal challenge (panels B and D).

Day 56 neutralizing antibody titer for Chikungunya mRNA vaccine in mouse study

![Day 56 neutralizing antibody titer for Chikungunya mRNA vaccine in mouse study](image)

Day 112 neutralizing antibody titer for Chikungunya mRNA vaccine in mouse study

![Day 112 neutralizing antibody titer for Chikungunya mRNA vaccine in mouse study](image)
**Chikungunya vaccine (mRNA-1388): Clinical data**

The Phase 1 trial for mRNA-1388 in the United States is fully enrolled, has generated safety and tolerability data, and demonstrated immunogenicity through approximately six months post dosing.

The Phase 1 trial for Chikungunya vaccine in the United States is fully enrolled and met its objectives of describing the safety and tolerability profile of mRNA-1388 versus placebo through approximately six months post dosing including capturing solicited and unsolicited local and systemic adverse events. The Phase 1 trial for Chikungunya vaccine has also demonstrated immunogenicity for the first part of the trial and we have observed 100% seroresponse for subjects at the 100 µg dose level 28 days post the second dose. We have observed a durable response for the 100 µg dose, with 13 of 14 subjects at day 196 with neutralizing antibody titers above the seroresponse threshold. The second part of the trial to measure persistence of response at one year post dosing is ongoing. We believe the data provides support to advance the program in clinical development if we choose to with additional government or other funding.
The mRNA-1388 Phase 1 study is a randomized, placebo-controlled, dose-ranging study to evaluate the safety, immunogenicity and tolerability of mRNA-1388 in healthy adults (18 to 49 years of age, inclusive) in a non-endemic region in the United States. The study includes three dose level cohorts (25, 50, and 100 µg), each containing 20 subjects randomized 3:1 (active: placebo). All subjects are given a two-dose intramuscular injection series, spaced four weeks apart (day 0 and 28). The Phase 1 trial was conducted with the investigational medicine named VAL-181388, in accordance with our legacy naming convention. We have since changed our naming convention and have adopted mRNA-1388 in place of VAL-181388. The key objectives of the study include:

- describe the safety and tolerability of mRNA-1388 relative to placebo;
- determine the immunogenicity of three dose levels of mRNA-1388 to inform the choice of dose for further development of this vaccine; and
- assess immunogenicity changes from baseline using serum neutralizing antibody titers to Chikungunya virus and binding antibody titers to Chikungunya-specific proteins.

The schematic of the trial is shown in the figure below. Each dose cohort starts with a sentinel safety group and based on review of the internal safety team, or IST, advances to an expansion of that dose cohort. Advancement to the next dose level is permitted after safety monitoring committee, or SMC, review.

100% seroresponse has been pre-defined as when subjects have post-vaccination titer > lower limit of quantification, or LLOQ where their baseline titer is < LLOQ or when subjects have post-vaccination titer \( \geq 4 \)-fold the baseline titer where their baseline titer is \( \geq \) LLOQ.

As of October 2018, based on the data for all three dose cohorts through approximately 6 months post dosing, we have observed neutralizing antibodies 28 days post dose 2 and persistence through day 196. Panel A below indicates geometric mean titer, or GMT, by time for neutralizing antibody, or NAb, against Chikungunya virus as measured by 50% plaque reduction neutralization test, or PRNT50. A dose-dependent increase in GMT of neutralizing antibodies against Chikungunya virus was observed across the 25, 50 and 100 µg dose groups. PRNT50 titers were low or undetected after the first vaccination at all dose levels, but increased substantially in the 50 and 100 µg dose groups after the second vaccination. A dose-dependent increase in PRNT50 seroresponse was observed across the 25, 50 and 100 µg dose groups, reaching 100% after the second vaccination of 100 µg at day 56. The PRNT50 GMT after the second vaccination (day 28) was elevated at day 56 and day 196 for the two higher dose groups compared to day 0 or 28.
Based on the interim data as of October 2018, there were two grade 3 solicited adverse events, or AEs, which were in the 100 µg cohort. A potential trend towards increased local and systemic solicited reactogenicity including pain, erythema, induration, headache, fatigue, myalgia, arthralgia and nausea post dose 2 was observed in the 50 µg and 100 µg dose groups. Arthralgia was reported in the 100 µg dose group only (21.4 % of subjects); all events were ≤ Grade 2 and all subjects reported full resolution by Day 4 post vaccination, and thereby distinct from the persistent type observed in post Chikungunya virus infection arthralgias. The solicited AEs are provided in the table below.

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Day 0</th>
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<th>Day 56</th>
<th>Day 196</th>
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<td>100 µg</td>
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<td>Placebo</td>
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Solicited AEs after each study vaccination for the safety set in the Phase 1 trial for Chikungunya vaccine (mRNA-1388)

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<td>N=15</td>
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<td>N=15</td>
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</tr>
<tr>
<td>Tenderness</td>
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<td>78.6% (0)</td>
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<tr>
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<td></td>
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<td>N=14</td>
<td>N=14</td>
<td>N=15</td>
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There was one unsolicited SAE in the 100 µg group subject, post the second dose, which was assessed as related and reported as a Suspected Unexpected Serious Adverse Reaction, or SUSAR (subject had asymptomatic Grade 4 elevation in serum AST and Grade 3 elevation in ALT), which was resolved rapidly. A potential dose-dependent increase in the rate of unsolicited related adverse reactions across the dose level groups was observed. There were no safety concerns identified by the IST or the SMC. There were no AEs of special interest or medically-attended AEs. The unsolicited AEs are provided in the table below.

Unsolicited AEs reported for the safety set in the Phase 1 trial for Chikungunya vaccine (mRNA-1388)

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<tr>
<th></th>
<th>25 µg</th>
<th>50 µg</th>
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The trial is ongoing to measure antibody persistence and safety approximately one year after the second dose.
II. PROGRAM DESCRIPTIONS IN OUR CANCER VACCINES MODALITY

We designed our cancer vaccines modality to treat or cure cancer by enhancing immune responses to tumor neoantigens, defined below. This modality has two programs currently for neoantigen vaccines, a personalized cancer vaccine, or PCV, program, and a vaccine against neoantigens related to a common oncogene called KRAS, both conducted in collaboration with Merck. The goal of a cancer vaccine is to safely expose the patient’s immune system to tumor related antigens, known as neoantigens, to enable the immune system to elicit a more effective antitumor response. Our cancer vaccines modality is focused on the use of mRNA to express neoantigens found in a particular tumor in order to elicit an immune response via T cells that recognize those neoantigens, and therefore the tumor. These neoantigens can either be unique to a patient, as in the case of our personalized cancer vaccine program, or can be related to a driver oncogene found across subsets of patients, as in the case of our KRAS vaccine program.

Our cancer vaccines pipeline is shown in the figure below.

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1 See section of the prospectus titled “Business—Third-Party Strategic Alliances” for funding arrangements on clinical development

Abbreviation: CRC, colorectal cancer; NSCLC, non-small cell lung cancer; PCV, personalized cancer vaccine

Oppportunity

More than 1.6 million new cancer cases and approximately 600,000 deaths due to cancer were predicted in the United States for 2017. Despite the recent success of checkpoint inhibitors, the majority of patients with the most common types of epithelial cancer still do not benefit from checkpoint inhibitors, as many patients still have incomplete or no response to currently available therapies. In addition, treatment resistance is thought to arise from a number of mechanisms, principally the local immunosuppressive effects of cancer cells, which prevent either access to or recognition by T cells.

Recent breakthroughs in cancer immunotherapy, such as checkpoint inhibitors and chimeric antigen receptor T cell therapies, have demonstrated that powerful antitumor responses can be achieved by activating antigen specific T cells. We believe one approach to improve the efficacy of checkpoint inhibitors is to develop vaccines that increase both the number and antitumor activity of a patient’s T cells that recognize tumor neoantigens.

Our approach

We are developing mRNA-based cancer vaccines to utilize the anti-tumor killing capacity of T cells to drive anti-tumor efficacy. Evidence of tumor killing by T cells in treating certain cancers has increased in the last decade with advances in immunotherapies. The immune system’s anti-tumor response relies on T cells recognizing tumor cells as non-self and eradicating these “foreign” cells. Human Leukocyte Antigen, or HLA, complexes are a diverse set of genes, or alleles, that present fragments of proteins from inside (HLA I) or outside (HLA II) cells to the immune system. A person’s HLA type defines what HLA alleles they express and can restrict what antigen may be presented to their immune system. Antigens presented in HLA molecules are recognized by T cell receptors, or TCRs, present on the cell surface of CD4 and CD8 T cells. These two main classes of T cells have distinct mechanisms to potentially attack tumor cells; CD4 cells play an important role in activating other immune cells after recognition of antigens in HLA II molecules, whereas CD8 cells can have direct cytotoxic cell killing capabilities upon recognition of antigens in HLA I molecules. Both cell types have been demonstrated to have important roles in driving an effective anti-tumor immune response.
Over the past three decades there have been many attempts to develop cancer vaccines, few of which have been successful. Key reasons include (1) past attempts were directed against shared “self” non-mutated antigens; (2) nearly all previous attempts utilize peptide fragments to try to mimic peptides displayed by HLA I molecules, this method may not have been able to mimic the natural processing and presentation of antigens by the immune system and therefore may not be recognized; and (3) earlier work was done in the era prior to the benefit of checkpoint inhibitors.

We believe one approach to improve the efficacy of checkpoint inhibitors is to develop vaccines that increase both the number and antitumor activity of a patient’s T cells that recognize tumor neoantigens. Our cancer vaccines modality is focused on the use of mRNA to express neoantigens found in a particular cancer in order to elicit an immune response via T cells that recognize those neoantigens, and therefore the tumor. These neoantigens can either be unique, as in the case of our personalized cancer vaccine program, or can be related to a driver oncogene found across subsets of patients, as in the case of our KRAS vaccine program.

PCV (mRNA-4157 and NCI-4650): Summary

We are collaborating with Merck to use the strength of our platform to develop cancer vaccines with multiple neoantigens unique to each patient, also known as personalized cancer vaccines, or PCVs

Recent breakthroughs in cancer immunotherapy have demonstrated that powerful antitumor responses can be achieved by activating antigen specific T cells in a variety of cancer settings. Despite these advances, many patients still have incomplete or no response to anti-cancer therapies. One approach is to administer a cancer vaccine that encodes for peptides containing mutations found in their cancer, i.e., to create a personalized cancer vaccine composed of neoantigens unique to a patient’s tumor. Previous attempts have demonstrated the ability of mRNA and peptide-based platforms to drive immune responses toward patient-specific neoantigens. Preclinical studies have shown that the combination of cancer vaccines with checkpoint inhibitors provides improved benefit over single-agent therapies. Our platform is positioned for bringing personalized cancer vaccines to patients with our proprietary in silico design of each patient’s neoantigen-based mRNA vaccine, to be coupled with our automated cell-free manufacturing processes and infrastructure based in Norwood, MA, as well as our digital infrastructure. We believe these attributes coupled with our proprietary LNPs help differentiate our approach from ongoing efforts at developing mRNA-based cancer vaccines. mRNA-4157 is co-administered with pembrolizumab, marketed in the United States as KEYTRUDA. This is in collaboration with Merck as governed by a joint steering committee. NCI-4650 is a personalized cancer vaccine being tested by the National Cancer Institute, or NCI, as a monotherapy for patients with advanced, metastatic cancers. NCI-4650 only differs from mRNA-4157 in its neoantigen selection process. Both mRNA-4157 and NCI-4650 are in Phase 1 trials in the United States. For the mRNA-4157 Phase 1 clinical trial, as of October 19, 2018, we have interim immunogenicity data for ten cancer patients. Among these ten patients, we have detected potential antigen specific T cell responses for the first patient with melanoma at the 0.13 mg dose level. This occurred after the fourth dose of the mRNA-4157 monotherapy. In patients in which negative controls are below the limit of detection, we have detected immunogenicity in three additional patients at the 0.13 mg dose level after the fourth dose at levels above the lower limit of detection. Because these levels were below the lower limit of quantification of the assay, these data for these three patients are of uncertain significance. We have observed no signal indicating immunogenicity induced by vaccination in the remaining six patients of which four are at the 0.04 mg dose level and two are at the 0.13 mg dose level. We have triggered planning for a randomized Phase 2 trial with Merck.

PCV (mRNA-4157 and NCI-4650): Our product concept

Rapid, personalized current good manufacturing practice, or cGMP, manufacturing to bring personalized cancer vaccines to patients

As tumors grow they acquire mutations, some of which create new protein sequences, or neoantigens, that can be presented on HLA molecules in the tumor and recognized as non-self by T cells. These neoantigens can be shared, as in mRNA-5671, or are completely unique to an individual patient’s tumor. In addition to the neoantigens being unique and patient specific, the presentation of those neoantigens is also dependent on a patient’s specific HLA type. Identification of patient-specific HLA type and tumor neoantigens through next generation sequencing paired with our proprietary, in silico design of each patient’s mRNA vaccine and rapid
manufacturing for a specific patient allows us to rapidly deliver a completely unique and personalized medicine to patients.

We believe that antigen-encoded mRNA is an attractive technology platform for neoantigen vaccination for cancer patients for the following reasons:

- mRNA vaccines can deliver multiple unique and personalized neoantigens in a single mRNA molecule;
- mRNA vaccines unique to each particular patient can be rapidly designed \textit{in silico} and manufactured with automation in personalized, individual cGMP batches; and
- mRNA encoding for neoantigens is translated and processed by patients’ endogenous cellular processing and presentation to the immune system.

Our personalized cancer vaccine program, mRNA-4157, consists of an mRNA that encodes up to 20 neoantigens, predicted to elicit both class I (CD8) and class II (CD4) responses, designed against each individual patient’s tumor mutations and specific to their HLA type. NCI-4650 includes both neoantigens known to be immunogenic as identified through \textit{ex vivo} experimentation on the patient’s immune cells and neoantigens predicted by the NCI bioinformatics algorithm. For both mRNA-4157 and NCI-4650, the neoantigens are encoded in a single mRNA sequence and therefore termed a neoantigen concatemer. Each patient-specific mRNA-4157 and NCI-4650 is formulated in our proprietary LNPs designed for intramuscular injection. An illustration of the intended design of mRNA-4157 and NCI-4650 is shown in the figure below.
Each mRNA-4157 and NCI-4650 is produced using an integrated batch manufacturing process that is the same regardless of the sequence of the neoantigens to be produced. The overall process involves five major steps that are highly integrated to enable a robust chain of custody and chain of identity. An overview of the system is provided in the figure below.

The process includes the following steps:

1. Tumor biopsy;
2. Next generation sequencing, or NGS, of tumor DNA and RNA;
3. Vaccine design using our proprietary bioinformatics algorithm for up to 20 patient-specific neoantigens;
4. Manufacture of the designed mRNA; and
5. Administration of the mRNA to the same patient that provided the tumor biopsy.

Specifically, for each patient, tumor biopsy and peripheral blood samples are collected and immediately sent for NGS analysis. Whole exome sequencing, or WES, data are generated from both tumor and blood samples, with a specific blood sample serving as the germline (un-mutated) reference. WES results from the blood sample are also to be used to determine the patient’s HLA-type using an NGS-based approach. The tumor transcriptome is determined by mRNA sequencing, or RNA-Seq. The HLA typing, WES, and RNA-Seq results for each patient are provided as inputs to our proprietary vaccine design algorithm which predicts which neoantigens could be the most immunogenic. The mRNA sequence is then manufactured using an automated workflow to enable a rapid turnaround time. The final drug product is shipped to the clinical site for administration to the same patient that provided the original biopsy.

PCV (mRNA-4157 and NCI-4650): Preclinical information

We have utilized model antigens as surrogates for PCV to demonstrate the ability to elicit a robust T cell response with a single mRNA

We have completed preclinical studies to characterize the ability of an mRNA vaccine to induce a robust and specific T cell response to multiple antigens. Specifically, the ability of our mRNA vaccines to elicit:

- Specific and robust T cell responses to murine neoantigens were observed by vaccinating mice with mRNA vaccines that encode previously published immunogenic epitopes from the MC38 mouse tumor cell line and measuring T cell responses to mutant but not wild type antigens. The responses to mRNA vaccination were also significantly higher than responses to the adjuvanted peptide as per a study we

200
conducted. In this study, mice were vaccinated with either empty LNP, adjuvanted peptides corresponding to previously published data or mRNAs encoding the same neoantigen sequences formulated in LNPs. Mice were vaccinated on day 1, 8, and 15 and T cell responses were measured on day 18 using flow cytometry by re-stimulating splenocytes with either control (medium), wild type or mutant (neoantigens) peptides. In an ideal case, one would see a high T cell response when re-stimulated with mutant neoantigen and would not see an equivalent response for re-stimulation with media and wild type peptide. We believe this would indicate a clear specific response for mutant neoantigens with no response to self. As shown in the figure below, the T cell response by mRNA encoding for neoantigens was much higher than that for peptides. The T cell response for mRNA vaccine re-stimulated with wild type was higher than baseline and close to that with control (medium). The T cell responses for mutant peptide were significantly higher than those against wild type peptide.

T-cell response for our mRNA PCV in mouse study

- Specific and robust T cell responses to multiple antigens encoded in a single mRNA sequence. The T cell response after vaccinating mice with mRNA vaccine encoding for 16 specific antigens previously reported to be immunogenic in mice as shown in the figure below. mRNA was formulated in a proprietary LNP and delivered intramuscularly to mice on day 1 and day 8. T cell responses were measured on day 15 by re-stimulating splenocytes with either control (medium) or peptides corresponding to each antigen (1, 2, 6, 9, and 12) in the mRNA vaccine and measured by interferon gamma. Measurements are in spot forming units, or SFU, per 1 million cells per well.
An mRNA concatemer encoding distinct class I (antigens 6, 9, and 12) and class II antigens (antigen 2) can elicit specific T cell responses to each antigen as shown in the figure below.

Unique T cell response to specific antigens encoded by mRNA in mouse study

PCV (mRNA-4157 and NCI-4650): Clinical data

Our Phase 1 trial for PCV is currently ongoing in the United States

The Phase 1 trial is an open-label, multicenter study to assess the safety, tolerability, and immunogenicity of mRNA-4157 alone in subjects with resected solid tumors and in combination with the CPI pembrolizumab (marketed in the United States as KEYTRUDA), in subjects with unresectable solid tumors. The study is sponsored by us. mRNA-4157 is administered by intramuscular injection on the first day of each 21-day cycle and for a maximum of 9 doses. mRNA-4157 is administered as monotherapy (Part A) or in combination with pembrolizumab (Parts, B, C, and D) in the United States. Four mRNA-4157 dose levels of 0.04 mg, 0.13 mg, 0.39 mg, and 1 mg will be explored in Part A and Part B through dose escalation. The following cancers are being investigated: non-small cell lung cancer (subject to certain entry criteria), small cell lung cancer, melanoma, bladder urothelial carcinoma, human papillomavirus-negative head and neck squamous cell carcinoma, and a variety of solid malignancies.

The key objectives of the study include:

- for Part A—To determine the safety and tolerability of mRNA-4157 monotherapy in subjects with resected solid tumors and to assess the immunogenicity of mRNA-4157;
- for Parts B, C and D—To determine the safety, tolerability, and recommended Phase 2 dose of mRNA-4157 in a dose escalation cohort administered in combination with pembrolizumab; and
- for Part D—To assess the immunogenicity of mRNA-4157 with pembrolizumab from apheresis samples in certain subjects.
As of October 24, 2018, 23 patients have been dosed with mRNA-4157 of which 12 patients have been treated with mRNA-4157 monotherapy in Part A and 11 patients have been treated with mRNA-4157 and pembrolizumab in Part B. In Part A, patients have been dosed up to the 0.39 mg dose level and the 1 mg dose level is currently recruiting. In Part B, patients have been dosed up to the 0.39 mg dose level which is currently ongoing and the 1 mg dose level is currently recruiting. There have been no dose-limiting toxicities or significant related toxicities observed in these patients to date.

As of October 19, 2018, we have interim immunogenicity data for ten cancer patients, including nine patients for Part A (mRNA-4157 monotherapy) for the 0.04 mg and 0.13 mg dose levels and one patient for Part B (mRNA-4157 and pembrolizumab combination) at the 0.04 mg dose level. Of the immunogenicity data for ten patients, for the first patient with melanoma in Part A at the 0.13 mg dose level, we have detected potential antigen specific T cell responses after the fourth dose of mRNA-4157 monotherapy. This is measured by restimulating unexpanded peripheral blood mononuclear cells with sets of peptides corresponding to neoantigens encoded by the patient-specific mRNA-4157 and is shown in the figure below. Individual data points indicate technical replicates. In patients in which negative controls are below the limit of detection, we have detected immunogenicity in three additional patients at the 0.13 mg dose level after the fourth dose at levels above the lower limit of detection. Because these levels were below the lower limit of quantification, or LLOQ, of the assay, these data for these three patients are of uncertain significance. We have observed no signal indicating immunogenicity induced by vaccination in the remaining six patients of which four are at the 0.04 mg dose level and two are at the 0.13 mg dose level. We have triggered planning for a randomized Phase 2 trial with Merck.

**Antigen-specific T cell responses for one patient at the 0.13 mg dose level in Part A of the Phase 1 clinical trial for PCV vaccine (mRNA-4157)**

NCI-4650 is in an ongoing investigator-initiated, single-arm, open-label trial involving up to 12-patients with advanced metastatic disease sponsored by National Cancer Institute.
KRAS vaccine (mRNA-5671): Summary

In collaboration with Merck, we are developing a cancer vaccine (mRNA-5671) with mRNAs encoding for a concatemer of mutations in the KRAS oncogene protein and a constitutively-active STING protein.

Although monotherapy checkpoint inhibitor treatment can provide significant benefit for some cancer patients, many have incomplete or no response to therapy, presenting a need for alternative therapies to stimulate antitumor immunological responses. Finding oncogenic driver mutations that encode targetable T cell epitopes has considerable therapeutic implications. Point mutations in the KRAS gene occur in about 22% of human cancers, such as colorectal, non-small cell lung and pancreatic cancers. Direct inhibition of KRAS has proven challenging and to date, there are no successful KRAS-targeted cancer therapies. It has been reported that KRAS-mutant neoantigens can be presented on certain human HLAs. Therefore, one approach is to immunize the body to naturally synthesize neoantigen peptides that contain common KRAS mutations for presentation to the immune system by mRNA. Immune-potentiators are sometimes incorporated in vaccine design to improve immune response to the antigens of interest. STimulator of INterferon Gene, or STING, is a cytosolic nucleotide sensor known to trigger type 1 interferon responses and has been reported to promote antigen specific T cell responses and antitumor immunity. We have designed an mRNA to generate and present KRAS neoantigens to the immune system from the four most common KRAS mutations. This mRNA has been co-formulated with an mRNA encoding for a constitutively-active version of STING which may boost anti-tumor T cell responses. We are advancing this program through clinical trials in collaboration with Merck and we have transferred the IND to Merck, since Merck is the sponsor of the Phase 1 trial. Merck has opted to run a Phase 1 clinical trial with mRNA encoding for KRAS neoantigens alone first. Merck may choose to include STING mRNA in further clinical development of this vaccine. Patients will also be co-administered the checkpoint inhibitor pembrolizumab.

KRAS vaccine (mRNA-5671): Our product concept

Our approach is to potentiate our mRNA KRAS vaccine with an mRNA encoding a constitutively-active version of STING as an immune stimulator along with a checkpoint inhibitor.

Oncogenic driver mutations that encode targetable T cell neoantigens have considerable potential therapeutic implications: (1) driver mutations are subject to positive selection, as they confer survival advantages for the tumor, and (2) such neoantigens could be shared between patients, enabling an easier approach to developing and manufacturing such therapeutic or curative interventions.

KRAS is a frequently mutated oncogene in epithelial cancers, primarily lung, colorectal cancer, or CRC, and pancreatic cancers. The four most prevalent KRAS mutations associated with these malignancies are G12D, G12V, G13D, and G12C, which constitute 80% to 90% of KRAS mutations. KRAS has multiple downstream signaling pathways, and although drugs have been developed to target individual effectors, direct inhibition of KRAS could be more efficacious. Direct inhibition of KRAS has proven challenging, as have past efforts at generating a cancer vaccine against KRAS. These attempts have proven to be ineffective, likely due to either the lack of concomitant administration of a checkpoint inhibitor or vaccines which have been only minimally immunogenic. None of the historic attempts at a KRAS vaccine used mRNA.

Immune stimulators are often incorporated in vaccines to improve immune response to the antigens of interest. STING is an endoplasmic reticulum membrane protein that acts as a cytosolic nucleotide sensor known to trigger type 1 interferon responses. STING has been reported to promote antitumor immunity. Vaccines including STING agonists (e.g., cyclic dinucleotides) show overall improvement of immune responses to poorly immunogenic antigens.
In order to drive T cell mediated antitumor responses, our mRNA vaccine includes an mRNA encoding for a concatemer of sequences encoding the four most common KRAS mutations. It also contains mRNA encoding for a constitutively-active STING protein. Our mRNA vaccine will be co-administered with a checkpoint inhibitor. Both mRNA are encapsulated in our proprietary LNP. The mRNA-encoded STING protein is not expected to be systemically active like a small molecule-based STING agonist. An illustration of our approach for mRNA-5671 is shown in the figure below.

**KRAS vaccine (mRNA-5671): Preclinical information**

*We have observed the utility of KRAS and STING mRNA vaccine in vivo*

The immunogenicity of our KRAS vaccine is supported by several preclinical studies in which we observed that our mRNA encoding for KRAS mutations can be made in cells and presented in transgenic mice with specific HLA I alleles. We also have observed that mRNA encoding for constitutively-active STING functioned as an innate immune-stimulator through activation of interferon-ß production in both human cell lines and murine *in vitro* and *in vivo* models.
One of these models was a transgenic mouse model expressing a specific human HLA. This is shown in the figure below. These transgenic mice were vaccinated with either mRNA encoding A11-positive control antigens (control), single mutant KRAS neoantigen or the concatemer of the four most common mutant KRAS neoantigens, plus mRNA encoding STING. mRNA was formulated in our proprietary LNP and delivered intramuscularly on day 1 and day 15. T cell responses were measured on day 22 by re-stimulating splenocytes with either medium, or wild type or mutant KRAS peptides (panel A—KRAS mutation 1 and panel B—KRAS mutation 2). Robust and specific antigen specific CD8^+^ T cell responses were detected in splenocytes after re-stimulation with KRAS mutation 1 peptide and KRAS mutation 2 peptide.

**T-cell response to restimulation with KRAS mutation 1 peptide in mouse model study with mRNA vaccine encoding for KRAS mutation 1 peptide**

![Graph A]

**T-cell response to restimulation with KRAS mutation 2 peptide in mouse model study with mRNA vaccine encoding for KRAS mutation 2 peptide**

![Graph B]
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KRAS vaccine (mRNA-5671): Clinical plan

Merck will lead the clinical development of our KRAS vaccine program

The next step is to conduct an open-label, multi-center, dose-escalation and dose expansion Phase 1 study to evaluate the safety and tolerability of mRNA-5671 administered as an intramuscular injection both as a monotherapy and in combination with pembrolizumab. Merck may choose to measure T cell responses in this trial. The IND was originally filed by us and then transferred to Merck and remains open. Merck has opted to advance mRNA-5671 without STING mRNA, which may require conducting additional IND-enabling GLP toxicology studies. Merck may choose to include STING mRNA in further clinical development of this vaccine.
III. PROGRAM DESCRIPTIONS IN OUR INTRATUMORAL IMMUNO-ONCOLOGY MODALITY

We designed our intratumoral immuno-oncology modality to treat or cure cancer by transforming the tumor microenvironment to drive anti-cancer T cell responses against tumors. This modality currently has three programs. Our mRNA technology within this modality allows for the combination of multiple therapeutics that can be directly injected into a tumor with the goal of activating the tumor microenvironment to kill cancer cells in the injected tumor as well as in distal tumors, known as the abscopal effect. Intratumoral administration allows for localized effect of these therapeutics that could be toxic if administered systemically.

Our intratumoral immuno-oncology pipeline is shown in the figure below.

Our intratumoral immuno-oncology modality is focused on driving robust, specific anti-cancer T cell responses, transforming cold tumors with an immunosuppressive microenvironment into one that is immunologically “hot” thereby resulting in a productive anti-cancer immune response. Our goal is to discover and develop locally administered, or intratumoral, immune-mediated therapies to deliver mRNA encoding for potent immune-stimulatory proteins that can act at the site of the injected tumor, reduce systemic toxicities, and potentially create an “abscoalp effect” where distal tumor sites are also impacted. These may be combined with checkpoint inhibitors to boost the response. All of the mRNAs utilized in this modality are designed to decrease the amount of protein that could be made in hepatocytes through incorporation of microRNA binding sites, thus potentially reducing off-target effects and resulting in better tolerability.

Earlier efforts by others on the utility of intratumoral immune-mediated therapies have been established in murine models of cancer. In many of our preclinical studies focusing on demonstrating bioactivity and efficacy in mice, we have employed surrogate mRNAs encoding murine homologs, given that human proteins may not be sufficiently cross-reactive in mice, and that the use of human proteins in mice would be expected to elicit anti-foreign protein immune responses.

Opportunity

More than 1.6 million new cancer cases and approximately 600,000 deaths due to cancer were predicted in the United States for 2017. There have been several advances in the treatment of cancer through immune-mediated therapies in recent years. However, the outlook for many patients with advanced cancer remains poor, especially in tumors that have little immune system engagement and are therefore termed immunologically “cold.” We aim to activate the tumor microenvironment with our mRNA therapeutics, in conjunction with a checkpoint inhibitor, to activate the immune system against these otherwise immunologically cold tumors.

Our approach

Our intratumoral immuno-oncology modality is focused on driving robust, specific anti-cancer T cell responses, transforming cold tumors with an immunosuppressive microenvironment into one that is immunologically “hot” thereby resulting in a productive anti-cancer immune response. Our goal is to discover and develop locally administered, or intratumoral, immune-mediated therapies to deliver mRNA encoding for potent immune-stimulatory proteins that can act at the site of the injected tumor, reduce systemic toxicities, and potentially create an “abscoalp effect” where distal tumor sites are also impacted. These may be combined with checkpoint inhibitors to boost the response. All of the mRNAs utilized in this modality are designed to decrease the amount of protein that could be made in hepatocytes through incorporation of microRNA binding sites, thus potentially reducing off-target effects and resulting in better tolerability.

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OX40L (mRNA-2416): Summary

Our immuno-oncology approach to enhance specific T cell responses in the tumor microenvironment via expression of the membrane T cell co-stimulator OX40L by intratumoral injection of OX40L mRNA

There have been several recent advances in the treatment of cancer through activation of the immune system. However, many patients with advanced stages of cancer respond to few therapies and continue to face a poor outlook. Alternative strategies to activate an immunologic anti-tumor response, while at the same time reducing systemic toxicities, are required. To this end, we have developed an investigational mRNA therapeutic coding for wildtype OX40 ligand, or OX40L, a membrane protein normally expressed on antigen presenting cells upon immune stimulation that augments an activated immune response. mRNA-2416 encodes for wild-type OX40L which is a membrane protein, a class of proteins that we believe cannot be manufactured for administration to tumor cells by recombinant technologies. mRNA-2416 is being developed for the treatment of solid tumors following local intratumoral injection. We are currently sponsoring a Phase 1 trial that is ongoing in the United States. Of the 26 patients dosed with mRNA-2416 through October 2018, the two patients with ovarian cancer have demonstrated clinical observations of regression in certain injected lesions and in an adjacent uninjected lesion. These clinical observations have not met partial response criteria as per the response evaluation criteria in solid tumors, or RECIST, guidelines version 1.1. In one of these patients with ovarian cancer in group 2A dosed at 2 mg, a reduction in an injected lesion was observed after the fourth dose. In addition, for the same patient, a reduction in an adjacent uninjected lesion was observed. For the second patient with ovarian cancer in group 1B dosed at 1 mg, a reduction in an injected lesion and elevated levels of OX40L protein in the injected lesion have been observed post dosing.

OX40L (mRNA-2416): Mechanistic overview

OX40L is a T cell co-stimulator

The generation of optimal T cell responses requires T cell receptor, or TCR, engagement by presented epitopes (e.g., cancer antigens) and a positive secondary signal achieved through co-stimulatory molecules like OX40. OX40 receptor (also known as TNFRSF4, or CD134) is a member of the tumor necrosis factor, or TNF, receptor superfamily and is upregulated on activated immune effector cells upon TCR activation. OX40 is endogenously stimulated via OX40L, a homotrimeric membrane protein normally expressed on professional antigen presenting cells. Binding of OX40 by OX40L in the presence of a recognized antigen enhances the expansion of CD4 and CD8 T cells, increases T cell effector function, and enhances survival of experienced T cells for increased memory capacity. Prior clinical attempts of activating OX40 with agonist antibodies may have been hampered via antibody interactions with other cells. We believe that introduction of OX40L in tumor sites via mRNA may serve to boost T cell responses, and we believe intratumoral administration of mRNA encoding for OX40L may be an attractive method of enhancing anti-cancer immunity.
OX40L (mRNA-2416): Our product concept

Our approach is to deliver OX40L mRNA in a lipid nanoparticle intratumorally to produce a membrane T cell co-stimulator.

Our product consists of mRNA coding for the human sequence of OX40L formulated in our proprietary LNP. mRNA-2416 was designed to decrease the amount of protein that could be made in hepatocytes through incorporation of a microRNA binding site, thus potentially reducing off-target effects and resulting in better tolerability. Following intratumoral injection, a specific anti-tumor immune response is expected to be induced via proliferation and migration of T cell clones with specificity for the cancer that may also result in systemic anti-tumor responses. An illustration of our approach for this program is shown in the figure below. An earlier concept of this development candidate included a legacy LNP. However, we observed sufficient toxicity findings in an IND-enabling GLP toxicology study to abandon the legacy LNP. Toxicity findings were largely diminished when the development candidate was switched from a legacy LNP to our proprietary LNP.

OX40L (mRNA-2416): Preclinical information

We have demonstrated the ability to inhibit tumor growth in mouse models of cancer using our approach.

Intratumoral administration of mouse OX40L mRNA in our proprietary LNP resulted in production of OX40L protein in the tumor microenvironment and draining lymph node in mice. The activity of mouse OX40L, or mOX40L, was evaluated in syngeneic models, including an H22 hepatocellular carcinoma model. With this model, H22 cancer cells were subcutaneously implanted on the flank of BALB/c mice. Following tumor growth, mice were randomized into treatment groups and treated with weekly intratumoral injections of formulated mRNA encoding mOX40L or a negative control mRNA. Repeated weekly intratumoral injections of mOX40L mRNA in a syngeneic H22 mouse model resulted in 50% of the mRNA-treated mice with no measurable disease at the end of the study. Survival of mice treated with negative control mRNA and mRNA encoding murine OX40L are depicted in gray and red respectively in the figure below. Mice with subcutaneous H22 tumors were treated intratumorally with 7.5 µg of mRNA formulated in LNPs on Days 8, 16, and 24 post cancer cell implant. 6 of 12 mice treated with mOX40L mRNA were complete responders with no detectable tumor burden at day 100, whereas negative control mRNA formulated in LNPs yielded no complete responders. Survival curves were plotted by considering any reason a mouse was removed from study, including the predetermined tumor burden endpoint of 2,000 mm³, as a survival event.
We further demonstrated generation of anti-cancer immunological memory after OX40L mRNA treatment, as no tumor growth was observed in mice in the six initial complete responders that were re-injected with the same H22 cancer cells, as shown below.

<table>
<thead>
<tr>
<th>50% complete responders (n=12) with mouse OX40L mRNA in H22 syngeneic mouse model study</th>
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<td><img src="image.png" alt="Survival curve" /></td>
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**OX40L (mRNA-2416): Clinical data**

Our interim data indicate that intratumoral treatment with OX40L mRNA has no dose limiting toxicities, and has led to clinical observations of tumor regression in two patients with ovarian cancer but the tumor regression at the doses studied do not meet RECIST criteria for partial responses in the Phase 1 trial in the United States.

The Phase 1 trial for mRNA-2416 is an open-label, multicenter study of repeated intratumoral injections of mRNA-2416 in patients with advanced relapsed/refractory solid tumor malignancies and lymphomas in the United States. mRNA-2416 will be administered at day 1 and day 15 of a 28-day cycle with a maximum of 6 cycles. The dose levels being tested are 1 mg, 2 mg, 4 mg, and 8 mg. The objectives of this study include evaluating safety and tolerability of mRNA-2416 administered intratumorally, and to define the maximum tolerated dose and recommended dose for expansion. Other endpoints include pharmacokinetic analyses as well as assessment of biomarkers of immunological response in tumor.

The study includes 2 dosing periods: dose escalation period followed by an expansion period at the recommended dose for expansion. Patients are enrolled into one of the following three biopsy cohorts:

A. Baseline biopsy in abscopal distal, untreated tumor, second biopsy within cycle 1 at day 22 to 28 at distal tumor
B. Baseline biopsy in primary tumor to be treated, second biopsy 24 to 48 hours post-dose cycle 1 day 1 in injected tumor
C. Baseline biopsy in primary tumor to be treated, second biopsy 24 to 48 hours post-dose cycle 2 day 1 in injected tumor
As of October 2018, 26 patients have been dosed with mRNA-2416 in the Phase 1 trial. A subset of biopsies of treated lesions from those patients detected higher OX40L protein levels after mRNA-2416 administration. In approximately 19% of patients, we have observed rapid onset of multiple grade 2 and a single grade 3 transient reversible injection related reactions, all of which were resolved with antihistamines, corticosteroids, or supplemental oxygen. Three suspected unexpected serious adverse reactions, or SUSARs, have been reported. Of the three, one was the grade 3 serious adverse event, or SAE, described above. A second case was reported for a grade 2 non-infectious systemic inflammatory response syndrome, and the patient was kept overnight at the hospital. In the third case, a patient, diagnosed with Stage IIIC ovarian carcinoma, experienced a skin ulceration during treatment, deemed to be a non-serious adverse event, located within the injected tumor, which had begun to regress following treatment with mRNA-2416. After the last administered dose of mRNA-2416, and after the patient withdrew from the trial for personal reasons, the wound was smaller in size. Subsequently, the patient underwent additional treatment for disease progression with Cytoxan/Avastin, the wound increased significantly in size, and Avastin was discontinued due to patient preference and wound healing concerns. The patient was then hospitalized due to worsening of the skin ulceration, by which time the injected tumor was noted to be absent (though other lesions were present). Although no longer in the study, this hospitalization was deemed by the investigator as a suspected unexpected serious adverse reaction related to study drug, but deemed by us as possibly related to study drug. After discharge from the hospital, the patient died. This death was reported to be due to disease progression, not study drug. After the intratumoral injection of mRNA-2416 in 25 other patients, no other skin ulceration has been observed related to study drug.
As of October 22, 2018, 26 patients have been dosed with mRNA-2416. We have collected and analyzed eight paired biopsies of tumors pre- and post-injection of mRNA-2416 through October 2018. Of these eight, six paired biopsies are from injected lesions and two are from uninjected lesions. In three of the six paired biopsies from injected lesions where tumors showed evidence of the location of the injection site and had viable tissue from the biopsy to analyze, we have observed an increase in OX40L protein after mRNA administration. In one of these cases, we have observed OX40L protein expression in the injected lesion for a biopsy collected at cycle 1 day 2 as shown by quantitative immunofluorescence staining in the figure below. Staining in red denotes OX40L protein and 4',6-diamidino-2-phenylindole, or DAPI, stains DNA to indicate nuclei in blue. Cytokeratin staining in green indicates keratin filaments often used to mark epithelial cancer cells.

OX40L protein production in tumor cells of a patient with ovarian cancer in Phase 1 trial with mRNA-2416

Before treatment with mRNA-2416

After treatment with mRNA-2416

In the remaining three of the six paired biopsies from injected lesions, we did not observe OX40L protein increase, possibly because there was no noted evidence of injection site or there was extensive tissue necrosis.

Of the 26 patients dosed with mRNA-2416 as of October 22, 2018, there are two patients with ovarian cancer. These two patients with ovarian cancer have clinical observations of regression in certain injected lesions and in an adjacent uninjected lesion. These clinical observations do not meet partial response criteria as per RECIST guidelines version 1.1. One of these patients in group 2A has received eight doses of 2 mg and is still in treatment. In this patient, a reduction in an injected lesion was observed after the fourth dose. In addition, for the same patient, a reduction in an adjacent uninjected lesion was observed. We did not observe an increase in OX40L protein production in this uninjected lesion in the post-treatment biopsy at cycle 1 day 27. In addition, we have observed modest elevated levels in Granzyme B and in a T cell marker in the uninjected lesion at cycle 1 day 27 relative to pre-treatment biopsy. For the second patient in group 1B dosed at 1 mg, a reduction in an injected lesion has been observed. We have also observed OX40L protein expression in the injected lesion for a biopsy collected at cycle 1 day 2 as shown by quantitative immunofluorescence staining in the figure above. We have also observed increase in Granzyme B level and a T cell marker in these samples post administration.

The Phase 1 trial for OX40L (mRNA-2416) is ongoing.
OX40L+IL23+IL36\(\gamma\) (mRNA-2752): Summary

Our immuno-oncology approach to transform the tumor microenvironment: intratumoral injection of OX40L+IL23+IL36\(\gamma\)

Despite recent advances in immune-mediated therapies for cancer, the outlook for many patients with advanced cancer is poor. We are developing mRNA-2752 and other programs to drive anti-cancer T cell responses by transforming cold tumor microenvironments into productive, “hotter” immune landscapes with local intratumoral therapies. mRNA-2752 utilizes the intrinsic advantage of mRNA to multiplex and to produce membrane and secreted proteins with mRNA in a single investigational medicine. mRNA-2752 includes three mRNAs encoding human OX40L, interleukin 23, or IL23, and interleukin 36 gamma, or IL36\(\gamma\), that are encapsulated in our proprietary LNP and administered intratumorally. OX40L is a membrane protein, whereas IL23 and IL36\(\gamma\) are secreted cytokines. We believe our approach has the advantage of localized high concentration gradients of IL23 and IL36\(\gamma\) compared to recombinant proteins administered systemically or intratumorally. Additionally, the mRNA for OX40L encodes for the wild type membrane protein, which we believe recombinant protein technologies cannot enable. The combination of OX40L, IL23, and IL36\(\gamma\) has shown robust activity in preclinical cancer models and is synergistic with checkpoint inhibitors. In addition, this combination elicits an anti-tumor response on distal tumors (via the “abscopal effect”), as well as treated tumors in preclinical studies. The IND is open and we plan to initiate a Phase 1 study.

OX40L+IL23+IL36\(\gamma\) (mRNA-2752): Mechanistic overview

mRNA-2752 is designed and tailored to activate the immune system in two ways

This potential mRNA medicine is a novel mRNA-based therapeutic agent containing multiple mRNAs that code for the wild type human OX40L, IL23, and IL36\(\gamma\) proteins that have distinct functions yet work synergistically in mediating anti-cancer responses. mRNA-2752 brings two approaches into a single multi-mechanism therapy:

- T cell co-stimulation that could strengthen specific anti-cancer adaptive immune responses (mediated by OX40L); and
- pro-inflammatory cytokines/chemokines to ignite or transform an inflammatory response within the tumor microenvironment (IL23 and IL36\(\gamma\)).

The generation of optimal T cell responses requires T cell receptor, or TCR, engagement by presented epitopes (e.g., cancer antigens) and a positive secondary signal achieved through co-stimulatory molecules like OX40. OX40 receptor (also known as TNFRSF4 and CD134) is a member of the tumor necrosis factor, or TNF, receptor superfamily and is upregulated on activated immune effector cells upon TCR activation. OX40 is endogenously stimulated via OX40L, a homotrimeric membrane protein normally expressed on professional antigen presenting cells. Binding of OX40 by OX40L in the presence of a recognized antigen enhances the expansion of CD4 and CD8 T cells, increases T cell effector function, and enhances survival of experienced T cells for increased memory capacity. Therefore, introduction of OX40L via mRNA may serve to boost T cell responses. We believe that in addition to boosting T cell responses via OX40L expression, the expression of pro-inflammatory cytokines within a treated tumor may serve to ignite and transform an immunologically cold tumor microenvironment into a productive anti-cancer immune response. The initial focus was on cytokines with well-established roles in initiating inflammation and bridging innate to adaptive immunity in humans; namely the IL1 and IL12 families, respectively. Specifically, anti-cancer effects have been observed by introduction of IL1 family member IL36\(\gamma\) in preclinical mouse models of cancer. IL12 family members, including IL23, are often referred to as central coordinators of immune responses, largely due to their capacity to bridge innate to adaptive immunity.

OX40L+IL23+IL36\(\gamma\) (mRNA-2752): Our product concept

The potential advantage of mRNA to target multiple immuno-stimulatory pathways in tumors

We are developing mRNA-2752 for the treatment of advanced or metastatic solid tumor malignancies or lymphoma as a single agent or in combination with checkpoint inhibitors. mRNA-2752 includes three mRNAs
encoding OX40L, IL23, and IL36γ, encapsulated in our proprietary LNP. mRNA-2752 is designed to make these proteins in cells of the local tumor environment or lymph node. Our approach potentially has the advantage of localized gradients of two important cytokines IL23 and IL36γ, rather than a systemic administration or intratumoral injection of cytokine proteins that would lead to quick diffusion away from the tumor. Additionally, the mRNA for OX40L encodes for the wild type membrane protein, which would be challenging to administer to either a tumor or systemically as a recombinant membrane protein capable of co-stimulation of T cells. mRNA for IL23 produces a single-chain fusion protein of the IL12B and IL23A subunits, with a linker between the subunits. mRNA for IL36γ produces a protein with introduced signal peptide to bypass a need for upstream processing for release and activity. In addition, all three mRNA were designed to decrease the amount of protein that could be made in hepatocytes through incorporation of microRNA binding sites, thus potentially reducing off-target effects and resulting in better tolerability. An illustration of our approach for mRNA-2752 is shown in the figure below.
OX40L+IL23+IL36γ (mRNA-2752): Preclinical information

The OX40L+IL23+IL36γ combination promotes tumor killing in mice of injected and non-injected tumors, along with a lasting T cell effect

As described earlier, preclinical work was conducted using mouse homologs. The combination local therapy of OX40L+IL23+IL36γ mRNAs achieved 70-100% complete response rates in two MC38 syngeneic mouse models of cancer, one that is normally relatively responsive and the other completely refractory to systemic checkpoint inhibitor treatment. The triple combination therapy had better results than individual and doublet mRNA combinations. In one study, mice carrying bilateral MC38-S tumors received 5 µg total mRNA injected into the right flank tumor only (2.5 µg each mRNA administered for doublets and 1.67 µg each for triplet combinations). The survival plots are graphed in the figure below. Survival events were triggered when animals surpassed the predetermined tumor burden endpoint of 2,000 mm$^3$ (for both tumors combined). Animals removed from study for other reasons were censored and indicated below as horizontal lines prior to Day 100. 20 mice were included in each cohort depicted, and there were 10, 11, and 20 complete responders (i.e., no measurable disease at either tumor site) for the IL23 + IL36γ, IL23 + OX40L and OX40L + IL23 + IL36γ treatment groups, respectively, at 100 days post cancer cell implant. We also found that a single dose of OX40L+IL23+IL36γ mRNA was able to induce complete disease control at both treated and distal sites, sometimes known as an abscopal effect. This underscores the potential of our approach to lead to a well tolerated and broadly active therapy for treatment of multilesional and metastatic cancers.

In addition to OX40L+IL23+IL36γ mRNA monotherapy activity, we have further observed that a single suboptimal dose of OX40L+IL23+IL36γ mRNA therapy was synergistically active with systemically administered anti-PD-1/PD-L1 as well as anti-CTLA4 antibodies, again demonstrating complete response rates of ~70%.

OX40L+IL23+IL36γ (mRNA-2752): Clinical plan

We have an open IND for mRNA-2752 for a planned Phase 1 trial in the United States and Israel

We plan to initiate a Phase 1 study that is designed as an open-label, multicenter study of intratumoral injections of mRNA-2752 alone or in combination with checkpoint inhibitors. The objectives of this study include:

- safety and tolerability of mRNA-2752 administered alone and in combination with checkpoint inhibitors;
define the maximum tolerated dose, or MTD, and recommended dose for expansion, or RDE, for intratumoral injections of mRNA-2752 alone and in combination with checkpoint inhibitors; and

assessment of anti-tumor activity, protein expression in tumors, and pharmacokinetics, and exploratory endpoints that include assessment of immunological responses.

A schematic of the clinical trial design is shown in the figure below. There are three treatment arms:

- arm A—mRNA-2752 alone;
- arm B—mRNA-2752 in combination with durvalumab, a PD-L1 inhibitor; and
- arm C—mRNA-2752 in combination with tremelimumab, a CTLA-4 inhibitor.

The study consists of 3 dose escalation and 3 dose confirmation parts followed by a dose expansion for Arms B and C. Once the first two dose levels in Arm A are cleared for safety, dose escalation for Arm B will start. Once the first dose level in Arm B is cleared for safety, dose escalation for Arm C will start. There will be a 28-day stagger between the first and second patient in each study arm. The doses for the study are 0.25, 0.5, 1, 2, and 4 mg of mRNA-2752. In Arm A, mRNA-2752 is to be administered every 2 weeks for 3 doses. In Arm B, the combination of mRNA-2752 with durvalumab is to be administered every 4 weeks for 3 cycles. For Arm C, the combination of mRNA-2752 with tremelimumab is to be administered every 4 weeks for 3 cycles. Biopsy and blood samples to be collected pre and post treatment with mRNA in both dose escalation and dose expansion to assess protein expression and changes in tumor immune landscape.

![Clinical Trial Design Schematic]
Our immuno-oncology approach to transform the tumor microenvironment: IL12 as a localized secreted protein in collaboration with AstraZeneca

Another strategy for cancer patients with immunologically cold tumors is to transform the tumor microenvironment by introducing pro-inflammatory cytokines directly into tumors or draining lymph nodes. In collaboration with AstraZeneca, we are developing MEDI1191 that is an mRNA for IL12 encapsulated in our proprietary LNP to be delivered intratumorally. Systemic administration of recombinant IL12 protein was poorly tolerated in early clinical trials and exhibited generally low response rates. MEDI1191 can enhance the immune response by positively impacting both antigen presenting cells and T cells, and local, intratumoral expression of IL12 can potentially improve tolerability compared to systemic protein treatments. AstraZeneca is planning a Phase 1 clinical trial for MEDI1191, which is to be co-administered with a checkpoint inhibitor.

IL12 (MEDI1191): Mechanistic overview

IL12 is a powerful immune-modulator that bridges innate and adaptive responses

The IL12 family members are often referred to as central controllers of immune responses due to their capacity to bridge from innate to adaptive immunity. IL12 is a potent immune-modulator typically associated with a type 1 immune response and production of interferon-gamma. While preclinical studies using IL12 have resulted in dramatic antitumor effects in syngeneic cancer models, clinical development of systemically administered recombinant IL12 has been hampered by systemic toxicity.

IL12 (MEDI1191): Our product concept

In collaboration with AstraZeneca, we are developing intratumoral delivery of IL12 in combination with a checkpoint inhibitor

Intratumoral delivery of IL12 has been observed to be a feasible approach to overcome the toxicity associated with systemic IL12 administration. For example, intratumoral delivery of an IL12 containing DNA plasmid by injection followed by electroporation has shown promising activity in combination with pembrolizumab in a Phase 1 study with patients with metastatic melanoma. Such an approach may be limited to accessible lesions amenable to electroporation. In contrast, it may be more feasible to inject our mRNA delivered by our proprietary LNP into both accessible and visceral tumors.
MEDI1191 is being developed for the treatment of advanced or metastatic solid tumors in combination with a checkpoint inhibitor. MEDI1191 consists of our proprietary LNP encapsulating an mRNA for human IL12B (p40) and IL12A (p35) subunits. The mRNA produces a single-chain fusion protein of the IL12B and IL12A subunits, with a linker between the subunits. The mRNA sequence has been engineered to enhance protein production and is designed to decrease the amount of protein that might be made in hepatocytes for better tolerability. An illustration of our approach for IL12 is shown in the figure below.
IL12 (MEDI1191): Preclinical information

We have conducted several preclinical studies in which we observed activity with our approach.

As described earlier, our preclinical work was conducted with a mouse homolog of IL12. In a tumor model that we have characterized as completely refractory to checkpoint therapy and associated with an immunosuppressive tumor microenvironment, treatment with IL12 transformed the tumor microenvironment, with notable activation of natural killer and dendritic cells, and an increase in cytotoxic lymphocytes. In this checkpoint inhibitor refractory mouse model of cancer, a single dose of IL12 mRNA yielded around 30% complete response rates as an mRNA monotherapy as shown in panel A below and was synergistically active with systemically administered anti-PD-L1 antibody, or αPD-L1, demonstrating complete response rates of ~70%, as shown in panel B of the figure below. The x-axis represents days after subcutaneous implantation of MC38-R tumor cells. Test articles were administered on Day 11 for mRNA treatments and on Days 11, 14, 18, and 21 for antibody treatments. All antibody treatments were administered at 20 mg/kg. There were 15 mice per group in this study. Survival curves were plotted by considering any reason a mouse was removed from study, including the predetermined tumor burden endpoint of 2,000 mm$^3$, as a survival event. NTC is a non-translating control mRNA. Synergy of locally administered IL12 mRNA with systemic αPD-L1 treatment was also observed on distal tumors that were not directly administered mRNA.

Approximately 30% (n=15) complete responders with highest dose tested for mouse IL12 mRNA in MC38 mouse model study

![Graph showing survival rates and treatments for IL12 mRNA therapy in MC38 mouse model study.](image)
Approximately 70% (n=15) complete responders at highest dose tested
for mouse IL12 mRNA with α PD-L1 antibody in MC38 mouse model study

Panel (B)

IL12 (MEDI1191): Clinical plan

AstraZeneca will sponsor and lead the clinical development for MEDI1191.

We are responsible for generating a preclinical data package to support IND/CTA filing and clinical supply for early clinical development. AstraZeneca will lead the early clinical development and is planning a Phase 1 clinical trial. We expect a lower starting dose for MEDI1191 in the clinical trial compared to our other intratumoral programs.

The Phase 1 study is being planned as an open-label, international multicenter study of intratumoral injections of MEDI191 alone or in combination with a checkpoint inhibitor.
IV. PROGRAM DESCRIPTIONS IN OUR LOCALIZED REGENERATIVE THERAPEUTICS MODALITY

We designed our localized regenerative therapeutics modality to develop mRNA medicines to address injured or diseased tissues. Our mRNA technology in this modality allows for the local production of proteins that provide a therapeutic benefit in the targeted tissue. The development of our program in this modality, AZD8601 for the local production of VEGF-A, is being led by our strategic collaborator AstraZeneca. This program recently completed a Phase 1a/b clinical trial in which we observed in patients dose-dependent protein production and a pharmacologic effect, as measured by changes in local blood flow. We believe these data provide clinical proof of mechanism for our mRNA technology outside of the vaccine setting as a potential therapeutic.

Our localized regenerative therapeutics pipeline is shown below.

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1 See section of the prospectus titled “Business—Third-Party Strategic Alliances” for funding arrangements on clinical development.

Abbreviation: AZ, AstraZeneca; VEGF-A, vascular endothelial growth factor A.

Localized regenerative therapeutics modality: Opportunity

There are multiple applications for tissue regeneration. With AstraZeneca, we have focused on ischemic heart failure for the first program. Coronary artery disease, the primary cause of ischemic heart failure, affects the arteries providing blood supply to the cardiac muscle. In 2015, coronary artery disease resulted in 366,000 deaths in the United States, and 8.9 million deaths globally.

VEGF-A (AZD8601): Program summary

Addressing ischemic heart failure—VEGF-A as a localized therapeutic in collaboration with AstraZeneca

Heart disease is the leading cause of death in the United States, accounting for one in every four deaths, and is often due to the inability of adult humans to regenerate heart tissue. Current approved therapies do not specifically address heart regeneration. Previous attempts at cardiac regeneration have included stem cell grafting and gene therapy, but have faced challenges with safety or efficacy. In collaboration with AstraZeneca, we are pioneering a unique approach to treating ischemic heart failure, a condition where the cardiac muscle does not get enough blood supply to perform its contractile function. Vascular Endothelial Growth Factor A, or VEGF-A, can promote cardiac tissue revascularization. The goal of this program is to promote recovery of cardiac function through partial tissue regeneration. The mRNA in this program is in a saline formulation without LNPs and is expected to act locally. Our strategic collaborator AstraZeneca has conducted a Phase 1a/b clinical study in diabetic patients in Europe. The study has met its primary objectives of describing safety and tolerability and secondary objectives of dose-dependent protein production and changes in blood flow. AstraZeneca has moved this program to a Phase 2a trial that is being conducted in Europe and is designed to test safety and tolerability of epicardial injections for patients undergoing coronary artery bypass grafting surgery.

VEGF-A (AZD8601): Disease overview

VEGF-A can promote blood vessel growth to potentially address ischemic heart failure

Heart disease is the leading cause of death in the United States, accounting for one in every four deaths. Coronary artery disease, or CAD, the primary cause of ischemic heart failure, affects the arteries providing blood supply to the cardiac muscle. CAD resulted in 366,000 deaths in the United States, and 8.9 million deaths globally in 2015.
Several treatments are available for patients with ischemic heart failure. Current treatments include revascularization of the coronary arteries to relieve symptoms and improve cardiac function; and therapies that reduce blood pressure or potentially help eliminate excess fluids in congested tissues, including: beta-blockers, angiotensin-converting enzyme inhibitors, angiotensin II inhibitors, and aldosterone receptor blockers as diuretics. However, adult humans are unable to regenerate myocardium tissue following injury and the treatment options described above cannot compensate for this.

VEGF-A is a potent angiogenic factor that promotes growth of blood vessels. Preclinical data suggests that expression of this growth factor in the ischemic heart could increase blood flow and partially restore cardiac function.

**VEGF-A (AZD8601): Our product concept**

Local delivery of VEGF-A mRNA to increase local concentration of VEGF-A protein while reducing systemic distribution of therapeutic VEGF-A protein

VEGF-A protein acts as a powerful promoter of blood vessel growth. Systemic injection of VEGF-A protein increases VEGF-A exposure throughout the body, which can lead to side effects, but is very short-lived in circulation. Therefore, any therapy involving VEGF-A needs to be localized to elevate local protein concentration and drive revascularization while minimizing systemic side effects. AstraZeneca has opted to pursue the localized application of VEGF-A mRNA in a simple saline formulation in the heart muscle to elevate local protein concentration for longer periods due to increased local protein production. This potentially allows for an extended pharmacodynamic effect at the specific site of injection compared to systemic or local administration of a recombinant protein version of VEGF-A. Some of the early animal work for mRNA VEGF-A was published by our academic co-founder Dr. Kenneth Chien in *Nature Biotechnology* in 2013, showing improved cardiac function with increased survival with treatment.

**VEGF-A (AZD8601): Preclinical information**

*AstraZeneca has observed the activity of VEGF-A for ischemic heart failure in several preclinical animal models*

Preclinical work has been conducted at AstraZeneca in models of ischemic heart failure. In mouse, rat, and pig models of myocardial infarction, direct injection in the heart muscle (myocardium) of VEGF-A mRNA led to elevated cardiac VEGF-A protein levels and improved cardiac function. The data have been published by AstraZeneca in *Molecular Therapy* in 2018. The table below illustrates the beneficial effects of AZD8601 in the mini pig, two months after the myocardial infarct procedure and injection of the VEGF-A mRNA. In this table, left ventricular ejection fraction, or LVEF, was measured using echocardiography two months after intracardial mRNA administered 7 days after myocardial infarction. The data are means ± standard error of the means.

<table>
<thead>
<tr>
<th></th>
<th>LVEF, %</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control—Citrate saline</td>
<td>47.0 ± 0.8</td>
<td></td>
</tr>
<tr>
<td>AZD8601 1 mg dose</td>
<td>51.0 ± 0.9</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>AZD8601 10 mg dose</td>
<td>52.0 ± 1.0</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

**VEGF-A (AZD8601): Clinical data**

*AstraZeneca has completed a Phase 1a/b trial in Germany and a Phase 2a trial is ongoing in Finland*

The Phase 1a/b clinical trial for the AZD8601 program has met its primary objectives of describing safety and tolerability and secondary objectives of protein production and changes in blood flow post AZD8601 administration. AstraZeneca has moved this program to a Phase 2a trial.
The Phase 1a/b study was a randomized, double-blind, placebo-controlled study in men with type 2 diabetes mellitus. VEGF-A mRNA was administered by intradermal injection into the forearm skin in single ascending doses. The study was conducted in Europe. The primary objective was to evaluate the safety and tolerability of the drug product into the forearm skin, with safety follow-up for 6 months.

The study was divided into Part A (single ascending-dose cohorts) and Part B (pharmacodynamic cohort). There were three treatment regimens in Part A. Regimens were either AZD8601 at site 1 and placebo at site 2, placebo at site 1 and AZD8601 at site 2, or placebo at both sites. Each regimen comprised six 50 µL injections at one site and six 50 µL injections at a second site on the forearm. In part B, the regimen comprised one 50 µL intradermal injection of either AZD8601 or placebo at each of four sites on the forearm.

There were 27 patients in Part A with 18 receiving AZD8601 in at least one site of the forearm and 9 patients receiving placebo. There were three dose cohorts in Part A, each with 9 patients. In the first cohort, AZD8601 dose was at 24 µg per patient (4 µg per injection). The AZD8601 dose was increased to 72 µg and 360 µg in the next two dose cohorts. There were 15 patients in Part B receiving AZD8601 in at least two sites on the forearm per patient. In Part B, each patient received 200 µg of AZD8601 or placebo.

VEGF-A protein post injection of mRNA was produced at a high level, above the set expected threshold, as shown in the figure below. Expression was measured by skin microdialysis. At each sampling time, mean VEGF-A protein levels across all mRNA treated sites from patients across all cohorts were higher than that of placebo up to the 24-26 hour time point. Data are means with error bars showing standard error of the mean, or SEM. Asterisk indicates p-value <0.05.

**VEGF-A protein levels in patients in Part A of the Phase 1a/b trial**
The bioactivity of the VEGF-A protein post injection of mRNA was observed by an increase in blood flow at injection sites up to 7 days following a single injection, as shown in the figure below. Measurements were made using laser doppler imaging 7 and 14 days after administration (study part A, n = 27). Data shown are means with error bars showing SEM. Asterisk indicates p-value <0.05

VEGF-A led to increase in blood flow at day 7 and day 14 in patients in the Phase 1a/b trial
As shown above, administration of AZD8601 demonstrated protein production and changes in local blood flow in diabetic patients. Tolerability of our mRNA injected intradermally was demonstrated for all dose levels. The only causally treatment-related adverse events were mild injection-site reactions, occurring in 32 of 33 participants receiving VEGF-A mRNA across both parts of the study design. All adverse events of injection-site reaction were of mild intensity. No deaths, serious adverse events, or adverse events leading to discontinuation occurred. A list of adverse events is provided in the table below.

### Adverse events for the Phase 1a/b trial for AZD8601

<table>
<thead>
<tr>
<th>Part A (n = 27)</th>
<th>Part B (n = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VEGF-A mRNA/</td>
</tr>
<tr>
<td></td>
<td>placebo(1) (n = 18)</td>
</tr>
<tr>
<td>Placebo only(1)</td>
<td>5 (55.6)</td>
</tr>
<tr>
<td>Causally treatment-related, n (%)</td>
<td>0</td>
</tr>
<tr>
<td>Treatment-unrelated, n (%)</td>
<td>5 (55.6)</td>
</tr>
<tr>
<td>Participants with any AE, n (%)</td>
<td>18 (100.0)</td>
</tr>
<tr>
<td>Participants with causally treatment-related AEs, n (%)</td>
<td>18 (100.0)</td>
</tr>
<tr>
<td>Injection-site reaction [mild]</td>
<td>0</td>
</tr>
<tr>
<td>Injection-site erythema [mild]</td>
<td>1 (11.1)</td>
</tr>
<tr>
<td>Asthenia [mild]</td>
<td>1 (11.1)</td>
</tr>
<tr>
<td>Tinea pedis [mild]</td>
<td>0</td>
</tr>
<tr>
<td>Arthropod bite [mild]</td>
<td>0</td>
</tr>
<tr>
<td>Injury [moderate]</td>
<td>0</td>
</tr>
<tr>
<td>Skin abrasion [mild]</td>
<td>0</td>
</tr>
<tr>
<td>Muscle spasms [mild]</td>
<td>0</td>
</tr>
<tr>
<td>Back pain [mild or moderate]</td>
<td>2 (22.2)</td>
</tr>
<tr>
<td>Mynalgia [moderate]</td>
<td>0</td>
</tr>
<tr>
<td>Dizziness [mild]</td>
<td>0</td>
</tr>
<tr>
<td>Headache [mild]</td>
<td>1 (11.1)</td>
</tr>
<tr>
<td>Pruritus [mild]</td>
<td>0</td>
</tr>
<tr>
<td>Tooth extraction [mild]</td>
<td>0</td>
</tr>
<tr>
<td>Nasopharyngitis [moderate]</td>
<td>1 (11.1)</td>
</tr>
</tbody>
</table>

(1) There are two injection sites and it can be either VEGF-A mRNA/placebo, placebo/VEGF-A mRNA, or placebo/placebo at injection sites 1/2.
(2) Randomized order of VEGF-A and placebo injections.

The program is currently in a Phase 2a clinical trial. It is a randomized, double-blind, placebo-controlled, multi-center, Phase 2a study to evaluate safety and tolerability of epicardial injections of AZD8601 during coronary artery bypass grafting surgery. Some of the outcomes to be monitored in the Phase 2a study include adverse and serious adverse events, electrocardiogram, or ECG, and LVEF. The study is being conducted in Europe. The study is intentionally designed to provide initial safety and tolerability data in about 24 coronary artery bypass patients.
V. PROGRAM DESCRIPTIONS IN OUR SYSTEMIC SECRETED THERAPEUTICS MODALITY

We designed our systemic secreted therapeutics modality to increase levels of desired proteins in circulation or in contact with the extracellular environment. We aim to use cells in the human body to produce proteins encoded by mRNA that are secreted to achieve a therapeutic effect in one or more tissues or cell types. The goal of this modality is to provide secreted proteins, such as antibodies or enzyme replacement therapies across a wide range of diseases, such as heart failure, infectious diseases, and rare genetic diseases. This modality has benefitted from our strategic alliances with AstraZeneca, DARPA, and the Bill & Melinda Gates Foundation.

This modality currently has three programs. Our pipeline for systemic secreted therapeutics is shown in the figure below.

1 See section of the prospectus titled “Business—Third-Party Strategic Alliances” for funding arrangements on clinical development.

Abbreviations: AZ, AstraZeneca; α-GAL, alpha galactosidase.

Systemic secreted therapeutics modality: Opportunity

The ability to systemically deliver mRNA for a therapeutic effect would allow us to address a number of diseases of high unmet medical need. Systemically delivered, secreted therapeutics address conditions often treated with recombinant proteins that are typically administered to the bloodstream. These current therapies include:

- Enzyme replacement therapies, or ERTs, for rare diseases;
- Antibodies for membrane and extracellular soluble targets; and
- Circulating modulation factors for common and rare diseases such as growth factors and insulin.

Our approach

Our systemic secreted therapeutics modality comprises programs where mRNAs instruct various cells of the human body to secrete proteins for therapeutic effect. For systemic therapeutic programs that utilize cells in the liver, the liver is a highly productive tissue for secreted protein production. The human liver can make tens of grams of proteins per day, well above the amounts necessary for the pharmacologic effect for virtually all protein therapeutics. We have demonstrated that mRNA can make and secrete monoclonal antibodies and soluble modulating factors in non-human primates. These proteins made in non-human primates can exert their pharmacological activity by binding to targets with biological effect.

The antibody against Chikungunya virus is our first systemic secreted therapeutic for which we have filed an IND. It will help us understand the fundamental relationship between mRNA dose and secreted protein production. The secreted human antibody is also a protein complex, not ordinarily made by the liver, which will be a test case for making human proteins in liver normally made by other cell types.

This modality also includes engineered proteins such as our Relaxin and PKU programs and is not limited to native forms of proteins. Recombinant protein therapeutics, which focus on secreted proteins, today generate over $200 billion in annual worldwide sales.
Antibody against Chikungunya virus (mRNA-1944): Summary

Systemic mRNA administration to instruct cells to secrete antibodies, in this case for passive immunization to prevent Chikungunya infection

We are using this program to help understand how mRNA can be used to make complex secreted proteins in the human body and to address the potential health threat of Chikungunya virus, particularly for the military and others exposed to this virus. This program highlights a potentially important advancement of our platform and expansion of our modalities.

Chikungunya is a serious health problem with and is estimated to have caused at least three million cases during the 2005-2015 epidemic. There are no vaccines or prophylactic treatments for this disease. This virus can cause severe arthritic-like conditions in approximately 15% of the infected people. This program offers a passive immunization approach using antibodies to prevent infection, to complement our vaccine approach. In this program, we utilize two mRNAs encoding for light chain and heavy chain of an antibody against the envelope glycoprotein E. We plan to administer these mRNAs encapsulated in our proprietary LNPs intravenously to people to prevent infection by the Chikungunya virus. We are being financially supported for specific activities by DARPA and have an open IND for mRNA-1944.

Antibody against Chikungunya virus (mRNA-1944): Disease overview

Addressing a significant global health need

Chikungunya virus is a mosquito-borne alphavirus posing a significant public health problem in tropical and subtropical regions. While Chikungunya has been present in Africa for centuries, recent outbreaks and epidemics in new regions have arisen due to the expanding distribution of the *Aedes* mosquito in which it resides. A Chikungunya epidemic beginning in 2004 in Kenya spread to India and was exported to nearly all regions of the world and brought Chikungunya to the attention of the western world. As of April 2016, Chikungunya cases had been reported in 103 countries and territories around the world, including 46 countries and territories throughout the Americas. Chikungunya virus infection is characterized by an acute onset of fever, rash, myalgia, and sometimes debilitating polyarthritis, giving the virus its name, which means “that which bends up” when translated from Makonde. It is rarely fatal, but neurological sequelae such as Guillain-Barre syndrome and chronic arthritis have been recognized.

Chikungunya virus is an alphavirus of the Togaviridae family with a positive-strand RNA genome. The viral structural proteins are naturally expressed as a single polyprotein followed by subsequent cleavage by viral and cellular proteases into capsid (C) and envelope (E) glycoproteins E3, E2, 6k, and E1. The E proteins are major targets of protective neutralizing antibody responses that can be tested for in assays.

There are currently no effective therapies or approved vaccines to treat or prevent Chikungunya infection or disease, and effective mosquito control has proven challenging, even in higher income countries. Currently, infected individuals are treated with non-steroidal anti-inflammatory drugs to relieve some symptoms. Therefore, in addition to an effective prophylactic vaccine, we believe there is a need for systemic secreted antibody for passive immunity to the Chikungunya virus.

Antibody against Chikungunya virus (mRNA-1944): Our product concept

A systemically delivered mRNA instructing cells to secrete an antibody to glycoprotein E to neutralize Chikungunya

The mRNA-1944 development candidate contains two mRNAs that encode the heavy and light chains of the Chikungunya antibody and utilizes our proprietary LNPs. The mRNA-1944 development candidate encodes a fully human IgG antibody isolated from B cells of a patient with a prior history of Chikungunya infection. Thus
mRNA-1944 encodes a fully human IgG antibody against the envelope protein E2. The systemic antibody against Chikungunya virus titers can be evaluated in clinical trials by enzyme-linked immunosorbent assay, or ELISA, to quantify the amount of expressed IgG. A neutralization assay can be used to ensure that the mRNA expressed antibody was properly folded and functional.

Antibody against Chikungunya virus (mRNA-1944): Preclinical information

Systemic mRNA administration results in antibody production and protection from Chikungunya infection in animals

In immunodeficient AG129 mice (lacking the IFN-α/β and -γ receptors) Chikungunya causes a lethal disease and mice succumb to infection within 3-4 days with ruffled fur and weight loss. Protection in this model is mediated by antibodies against the Chikungunya viral proteins that must provide complete protection or sterilizing immunity. Therefore, this challenge model was used to establish a correlate of protection using activity and systemic IgG concentration data.

An in vivo study in AG129 mice was completed to determine the activity of mRNA encoded antibody against Chikungunya virus. The test article was administered to mice as prophylaxis at 0.02, 0.1, and 0.5 mg/kg by IV tail injection. A subset of animals (n=10) were challenged 24 hours post prophylaxis with Chikungunya virus strain LR006 and monitored for morbidity and mortality. Complete survival of mice was observed after treatment with the highest dose of 0.5 mg/kg of mRNA-1944.

In addition, the pharmacokinetics were evaluated in cynomolgus monkeys through intravenous infusion at 0.3, 1.0, and 3.0 mg/kg. The average serum antibody level was quantified at various time points to demonstrate a half-life of 23 days. The maximum serum concentration of the antibody was found to be 16.2 µg/mL with dose 1 and 28.8 µg/mL with dose 2, as shown in the figure below.

Expression of antibody against Chikungunya virus with repeat dosing of mRNA-1944 or placebo in non-human primate study

In addition, mRNA-1944 was tested in rats and non-human primates in a repeat-dose study via IV infusion up to 5 and 3 mg/kg, respectively. There were no dose-limiting toxicities related to mRNA-1944 observed and all other observations were generally reversible.
Antibody against Chikungunya virus (mRNA-1944): Clinical plan

We have an open IND for mRNA-1944 for a planned Phase 1 trial in the United States.

We plan to conduct a Phase 1 single ascending dose study in healthy adults that is randomized and placebo-controlled. The objective is to evaluate the safety and tolerability of escalating doses (0.1, 0.3, 0.6, 1 mg/kg cohorts with 8 patients per cohort) of mRNA-1944 administered via intravenous infusion. Other objectives are to determine the pharmacokinetics of four dose levels of mRNA-1944, to determine if the antibodies produced are sufficiently active to neutralize viral infection in assays and to determine the pharmacodynamics of anti-Chikungunya virus IgG levels. The IND for this program is open.

Each of the four dose level cohorts will initially dose three sentinel subjects, with a seven-day interval between each sentinel subject. Safety data on each sentinel subject as well as cumulative safety data will be reviewed by the internal safety team, or IST, seven days following infusion of mRNA-1944 prior to the second and third sentinel subjects are dosed, as per the schematic described below. The IST will also review safety data for the three sentinels and recommend expansion to five subjects at that dose level with an overall randomization ratio of 3:2 (mRNA-1944:placebo). The safety monitoring committee, or SMC, will review the safety data for the dose level and recommend escalation to the next dose level. A schematic of the trial design is shown below.

Blood samples will be collected at pre-defined time points post dose to determine mRNA-1944 concentration and concentration of encoded antibody against Chikungunya virus.
Relaxin (AZD7970): Summary

In collaboration with AstraZeneca we are developing a secreted systemic engineered protein for heart failure

Chronic heart failure continues to be a leading cause of death worldwide. While numerous treatments are currently available, the needs of many heart failure patients are not met. Relaxin is a well-studied natural protein hormone that is known to have cardiovascular protective effects. Earlier attempts at developing relaxin as a protein therapeutic have failed. Novartis has been developing a recombinant relaxin protein therapeutic with a short 30 minute half-life called serelaxin in a Phase 3 trial, which recently failed to meet its primary endpoints. We believe patient selection and duration of action of the protein therapeutic played a role in its failure, and that engineering the Relaxin protein for a longer duration and repeat dosing might overcome the shortcomings of earlier attempts. In collaboration with AstraZeneca, we use mRNA encoding for a relaxin protein designed for a long duration of action. It is also designed to be produced by the body with human post-translational modifications.

Relaxin (AZD7970): Disease overview

Heart failure continues to be a major health concern despite multiple treatment options

Heart failure is the inability of the heart to pump blood efficiently and presents itself as either an impairment of ejection of the blood (systolic heart failure) or defective ventricular filling (diastolic heart failure). It is associated with fluid retention in peripheral tissues, including the lungs, leading to tissue congestion, dyspnea, fatigue, and ultimately death. Heart failure is a major unmet medical need, as the leading worldwide cause of hospitalization in the elderly with 1.1 million cases annually in the United States. Its incidence is increasing with an aging population and improved survival rates from myocardial infarcts with the lifetime risk of developing heart failure being one in five.

Current treatments for heart failure include therapies that reduce blood pressure or potentially help eliminate the excess of fluid in congested tissues (beta-blockers, angiotensin-converting enzyme inhibitors, angiotensin II inhibitors, and aldosterone receptor blockers). Despite long-term combined treatments, the needs for these patients are often unmet, as evidenced by the high mortality rate in this patient population (i.e., 36.5% in a median 3-year follow-up).

Relaxin is a naturally occurring hormone, present in both men and women, that has been shown to promote vasodilation and angiogenesis, regulate extracellular matrix turnover, and suppress arrhythmias post myocardial infarction. Though prior studies have failed to demonstrate long-term benefit in clinical studies, we believe a novel approach can overcome potential flaws of previous approaches.

Relaxin (AZD7970): Our product concept

We have engineered a long-acting Relaxin to extend its otherwise short half-life

AZD7970 is an mRNA encoding a human relaxin protein designed and engineered to have an extended half-life. We have also utilized our proprietary LNPs to enable repeat dosing. We believe AZD7970 can address the short half-life of serelaxin. AZD7970 is intended for IV-administered repeat dosing.

Relaxin (AZD7970): Preclinical information

We have observed extended exposure with our mRNA encoding for an engineered version of Relaxin

We have observed that relaxin mRNA gives rise to a long-lasting systemic and functional protein following IV dosing with proprietary LNPs. Prolonged duration of relaxin protein production was observed both in rodents and non-human primates. Exposure to the fusion protein made from our mRNA was considerably extended (up to 10 days), as shown in the figure below. In contrast, as per earlier studies published, the half-life of relaxin
administered as a recombinant protein has been observed to be a few minutes. Systemic protein levels of the Relaxin protein in plasma of IV dosed cynomolgus monkeys following a single injection of mRNA were assessed using a commercially available antibody.

Relaxin protein levels in serum upon administration of mRNA encoding for relaxin in our proprietary LNP in non-human primate study

Relaxin (AZD7970): Clinical plan
We are planning to conduct an IND-enabling GLP toxicology program for AZD7970. Pending results, AstraZeneca may conduct a Phase 1 trial.

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Fabry disease (mRNA-3630): Summary

Our approach to Fabry disease with a secreted alpha galactosidase protein

Fabry disease is an X-linked hereditary defect in glycosphingolipid metabolism caused by mutations in the GLA gene, which encodes for the lysosomal protein alpha galactosidase, or α-GAL. It is one of a number of lysosomal storage diseases. Decreased activity of α-GAL results in the lysosomal accumulation of substrates (Gb3 and Lyso-Gb3) within cells and tissues, ultimately impairing cell/tissue function. Currently, there are several approved therapies for the treatment of Fabry disease including enzyme replacement therapy, or ERT, and chaperone therapy. However, patients continue to suffer from renal decline with ERTs and limited patient eligibility for chaperone therapy, as well as immunogenic side effects of ERTs. With our platform technology, the cells in the human body can be instructed to produce α-GAL from the liver and other tissues to properly insert α-GAL into lysosomes. Additionally, these tissues can secrete it into circulation for delivery to other tissues. We are developing an intravenously administered mRNA that encodes α-GAL enzyme and we plan to conduct a Phase 1/2 clinical trial to evaluate the safety and efficacy of mRNA-3630 in Fabry patients.

Fabry disease (mRNA-3630): Disease overview

Fabry disease is a lysosomal storage disorder

Fabry disease is a progressive, multiorgan, X-linked lysosomal storage disorder with an annual incidence of approximately 1:80,000. Affected individuals have a deficiency in α-GAL, resulting in a reduced or complete inability to metabolize glycosphingolipids in the lysosomes. Thus, patients accumulate glycosphingolipids such as Gb3 within lysosomes, which ultimately results in cellular and tissue dysfunction. In Fabry patients, multiple organs are impacted including the kidney and heart; and the vasculature gastrointestinal, and neurological systems. The severity of the disease is related to the lack of enzyme activity in patient cells. Classic Fabry patients are the most affected individuals, and generally retain <1% of normal enzyme activity. Diagnosis of Fabry disease occurs generally during childhood, but in some patients it is diagnosed later in life, usually after the patient presents with a stroke or renal complications.

Currently, there are several approved therapies for the treatment of Fabry disease. Agalsidase beta, which is marketed as Fabrazyme by Sanofi Genzyme, and Agalsidase alpha, which is approved and marketed as Replagal outside the United States by Shire, are enzyme replacement therapies, or ERTs, administered to most Fabry patients. Both of those therapies are versions of α-GAL ERTs that are administered intravenously, often require long infusion times and can lead to undesired immune reactions. These enzymes are effective at decreasing substrate accumulation in some tissues and slowing disease progression, however patients that have been on ERTs for 10 years still have renal function decline at a rate greater than normal healthy individuals. In addition to ERTs, Amicus Therapeutics has approval in the United States and European market for migalastat, a small molecule chaperone therapy which treats a subset of patients.

Fabry disease (mRNA-3630): Our product concept

We intend to utilize the cells in the human body to produce and secrete α-GAL

The mRNA encoding α-GAL is designed to instruct the cells of the human body to produce complex functional intracellular proteins for utilization in the lysosome and secretion out of the cell for uptake by other tissues. This is intended to replace the enzyme α-GAL insufficient or missing in Fabry patients. Our mRNA-3630 program consists of an mRNA encoding human α-GAL encapsulated in our proprietary LNP. The mRNA sequence is optimized for protein expression. mRNA-3630 will be administered intravenously to encode enzymatically-active α-GAL protein to restore this deficient or defective enzyme.

An illustration of our approach is shown in the figure below. The mRNA encoding for α-GAL, once inside the cell, is translated to α-GAL protein by ribosomes and translocated to the endoplasmic reticulum. The protein sequences traverse the secretory pathway of the cell. The protein is either sent to the lysosome where it reduces...
the level of Gb3 in target cells or is directed for secretion outside the cells, allowing for broad distribution of the protein.

**Fabry disease (mRNA-3630): Preclinical information**

*With a single dose of our mRNA encoding for α-GAL, we observed a sustained reduction in lyso-Gb3*

We have conducted several *in vivo* pharmacology studies to demonstrate nonclinical proof-of-concept for α-GAL therapy. Administration of proprietary LNP formulated α-GAL mRNA to the Fabry mouse model resulted in a significant and durable reduction of globotriaosylsphingosine, or lyso-Gb3, in tissue and serum for 12 weeks following a single dose, as shown in the figure below. In this study, there were 3 Fabry GLA −/− mice per group. Data was normalized to the control sequence group for the specific time point.

**Reduction in lyso-Gb3 in tissue with single administration of α-GAL mRNA in mouse model study**
In addition, we have evaluated plasma α-GAL in non-human primates following IV administration of 0.5 mg/kg mRNA-3630 every other week for four doses. There were four animals per group. These data indicate consistent circulation of enzyme in circulation following repeated administrations as shown in the figure below.

**Repeat dosing of α-GAL mRNA in non-human primate study**

![Graph showing enzyme activity](image)

Anti α-GAL antibodies were not detected in these animals. Non-human primate tissues were examined after the last dose and showed greater than wild-type levels of enzyme as determined by activity assessment and shown in the figure below.

**Increase in α-Galactosidase level in key tissues after repeat dosing of α-GAL mRNA in non-human primate study**

![Bar graph showing enzyme activity](image)

**Fabry disease (mRNA-3630): Clinical plan**

We plan to conduct a Phase 1/2 open label clinical trial with multiple ascending doses to evaluate the safety, tolerability, and efficacy of our development candidate in patients.
VI. PROGRAM DESCRIPTIONS IN OUR SYSTEMIC INTRACELLULAR THERAPEUTICS MODALITY

We designed our systemic intracellular therapeutics modality to increase levels of intracellular proteins. We aim to use cells in the human body to produce proteins encoded by mRNA that are located in the cytosol or specific organelles of the cell to achieve a therapeutic effect in one or more tissues or cell types. The goal of this modality is to provide intracellular proteins, such as intracellular enzymes and organelle-specific proteins, as safe, tolerable, and efficacious therapies. Our initial focus within this modality is on rare genetic diseases.

This modality currently has three programs. Our pipeline for systemic intracellular therapeutics is shown in the figure below.

Systemic intracellular therapeutics modality: Opportunity
Systemically delivered, intracellular therapeutics focus on areas currently not addressable with recombinant proteins, which are typically administered systemically and cannot reach the inside of the cell. Objectives for potential new therapies in this area include increasing the levels of:

- intracellular pathway proteins;
- soluble organelle-specific proteins; and
- organelle-specific membrane proteins.

Methylmalonic acidemia (mRNA-3704): Summary
Program aims to produce an intracellular, mitochondrial enzyme to treat a pediatric, genetic, metabolic disorder
Isolated methylmalonic academia, or MMA, is a rare, life-threatening, inherited metabolic disorder that is primarily caused by a defect in the mitochondrial enzyme methylmalonyl-coenzyme A mutase, or MUT. It primarily affects the pediatric population. There is no approved therapy for the disorder, including no approved enzyme replacement therapy, due to the complexity of the protein and its mitochondrial localization. Liver or combined liver-kidney transplant is one option for severely affected individuals. Our platform may allow the cells in the human body to produce these and other complex mitochondrial enzymes. Therefore, we are developing an intravenously (IV)-administered mRNA encoding MUT in our proprietary LNP, in order to restore this deficient or defective mitochondrial enzyme in the liver and other cells. We have observed preclinical proof-of-concept in two different MMA mouse models, notably with a marked improvement in survival and reduction of biochemical abnormalities in a severe MMA mouse model, and have received Rare Pediatric Disease Designation and Orphan Drug Designation from the FDA and Orphan Drug Designation from the European Commission. We expect to initiate the Phase 1/2 clinical trial in MMA patients with MUT deficiency.
Methylmalonic acidemia (mRNA-3704): Disease overview

MMA is a rare, life-threatening pediatric disorder with no approved therapies that address the underlying defect

MMA associated with MUT deficiency is a serious inborn error of metabolism disorder with significant morbidity and mortality. There are approximately 500-2,000 MMA MUT deficiency patients in the United States based on estimated birth prevalence (0.3-1.2:100,000 newborns) and mortality rates. Mortality is significant, with reported mortality rates of 50% for MMA patients with complete MUT deficiency (mut0) (median age of death 2 years) and 40% for MMA patients with partial MUT deficiency (mut-) (median age of death 4.5 years) in a large European study.

MMA mainly affects the pediatric population and usually presents in the first few days or weeks of life. The occurrence of acute metabolic decompensations is the hallmark of the disorder and decompensations are typically more frequent in the first few years of life. Each decompensation is life-threatening and often requires hospitalization and management at an intensive care unit. Surviving patients often suffer from numerous complications including chronic renal failure and neurologic complications such as movement disorders, developmental delays, and seizures. Consequently, the health-related quality of life for MMA patients and their families is significantly impaired.

The disorder is autosomal recessive and primarily caused by loss-of-function mutations in the gene encoding MUT, a mitochondrial enzyme that metabolizes certain proteins and fats, resulting in complete (mut0) or partial (mut-) enzyme deficiency. Over 250 mutations have been reported to date for MUT, with many MMA patients carrying private mutations. The most frequent mutations include p.N219Y and p.R369H, occurring with allelic frequencies of 8% in a large European cohort (n=151). Population-specific mutations have been reported, such as the p.R108C and p.G717V mutations identified in Hispanic and African-American patients, respectively. Due to a deficiency in the MUT enzyme resulting in a blockage in a metabolic pathway, the disorder is biochemically characterized by the accumulation of toxic metabolites such as methylmalonic acid in all body fluids and tissues.

There are no approved therapies that address the underlying defect for MMA as of today. Carglumic acid (marketed as Carbaglu) is approved in the EU for the acute treatment of hyperammonemia due to various organic acidemias including MMA but does not address the underlying defect. Liver transplant and combined liver-kidney transplant have emerged as effective treatment options for severely affected individuals, resulting in substantial reductions in metabolic decompensations and circulating methylmalonic acid concentrations. However, liver or kidney transplant is not curative, and the risks associated with the procedure and the limited number of donors prohibit the widespread implementation of transplantation.

Methylmalonic acidemia (mRNA-3704): Our product concept

We are utilizing our ability to produce a complex intracellular enzyme (MUT) that is localized to the mitochondria

MUT is a complex intracellular enzyme that exists as a homodimer, and requires mitochondrial localization and engagement with its cofactor (a derivative of vitamin B12) to be enzymatically active. mRNA has the capability to encode any type of protein, including a functional, intracellular protein that is trafficked to the proper subcellular localization within target cells.

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We are developing an mRNA encoding human MUT encapsulated in our proprietary LNPs for intravenous, or IV, administration for the treatment of isolated MMA associated with MUT deficiency. The sequence has been engineered to improve protein translation. To function, the mRNA-encoded MUT protein is translocated to its site of action in the mitochondria as shown in the figure below.

Currently, there are no gene therapy treatments being tested in the clinic for patients with MMA. We believe that there are potential advantages for mRNA therapeutics to treat MMA over current gene therapy approaches as described in the systemic intracellular therapeutics modality section.

Methylmalonic acidemia (mRNA-3704): Preclinical information

We have observed pronounced improvement in survival due to mRNA treatment in an MMA mouse model

We have conducted a series of in vitro and in vivo pharmacology studies to demonstrate preclinical proof-of-concept for human MUT mRNA in two different mouse models of MMA representing the spectrum of MUT deficiency (mut⁰ and mut⁻) as published by us in *Cell Reports* in 2017. As an example, a 12-week repeat-dose study in MMA mut⁰ mice (Mut⁻; TgINS-MCK-Mut) at 0.5 mg/kg IV every other week has shown a pronounced improvement in survival due to human MUT mRNA treatment, with all treated mice surviving 12 weeks in contrast to control mice which all perished within a few weeks. The figure below shows the Kaplan-Meier curve of PBS-injected (n=6 mice) and human MUT mRNA (n=6 mice) treated MMA mut⁰ mice and PBS-injected (n=6 mice) healthy heterozygote mice. The three asterisks indicate p-value < 0.001 for human MUT mRNA vs. PBS-injected MMA mut⁰ mice from the log-rank test.
In addition, the data indicated that the treated MMA mut0 mice doubled their body weights and approached the body weights of PBS-injected healthy mice in this 12-week repeat dose study. In contrast, surviving PBS-injected MMA mut0 mice did not gain weight.

hMUT mRNA treated MMA mut0 mice showed significant and sustained reductions in the toxic disease metabolites, including plasma methylmalonic acid, compared to pre-treatment levels, in a 6-week repeat dose study in MMA mut0 mice. This is shown in the figure below. Arrows denote weekly IV administration of human MUT mRNA (0.2 mg/kg). Plasma was collected 4 days prior to treatment and 3 days after each dose administration. Washout levels were for the 10-day washout following 5th dose administration of human MUT mRNA. The asterisk indicates a p-value < 0.01 from paired t-tests of post-treatment vs. pre-treatment levels.
Additionally, a pharmacokinetic study performed in wild type mice demonstrated that human MUT can be elevated above wild type level MUT levels. Specifically, human MUT protein expression in liver peaked at 16 hours after a single IV injection of human MUT mRNA (0.5 mg/kg) with a concentration of 85 ng/mg protein, ~2-3 fold higher than endogenous human and mouse MUT in liver.

There were no dose-limiting toxicities related to mRNA-3704 in juvenile rats and immature non-human primates in a repeat IV dose one-month IND-enabling GLP toxicology study up to the top doses tested. An independent IND-enabling GLP cardiovascular safety study in non-human primates also indicated mRNA-3704 showed no dose-limiting toxicities.

Methylmalonic acidemia (mRNA-3704): Clinical plan

We are conducting a global natural history study and are planning a Phase 1/2 clinical trial

We are conducting a global natural history study in methylmalonic acidemia, or MMA, and propionic acidemia, or PA, that was initiated in 2018. Some of the patients participating in the natural history study may enter our interventional clinical trials.

Our natural history study aims to identify and correlate clinical and biomarker endpoints for both MMA and PA. We also have a PA program (mRNA-3927) that addresses a disease closely related to MMA. There is synergy in combining the natural history study for MMA and PA. The natural history study is a global, multi-center, non-interventional study for patients with confirmed diagnosis of MMA due to MUT deficiency or PA. Up to 60 MMA patients and up to 60 PA patients in the United States and Europe will be followed prospectively for 1-3 years. Retrospective data will be collected as available.

We also plan to conduct an open-label, multi-center, dose escalation Phase 1/2 study of multiple ascending doses of mRNA-3704 in primarily pediatric patients with isolated MMA due to MUT deficiency. The primary objective of this study is to evaluate the safety and tolerability of mRNA-3704 administered via IV infusion. The secondary objectives of the study are to assess the pharmacodynamic response (as assessed by changes in plasma methylmalonic acid, the primary metabolite that accumulates in the disorder), to characterize the pharmacokinetic profile of mRNA-3704, and to assess the frequency and severity of clinical events and their relationship to plasma methylmalonic acid. The Phase 1/2 study is expected to be conducted in the United States and Europe.
Propionic acidemia (mRNA-3927): Summary

We aim to produce an intracellular, mitochondrial enzyme complex to treat a pediatric metabolic disorder

Propionic acidemia, or PA, is a rare, life-threatening, inherited metabolic disorder due to a defect in the mitochondrial enzyme propionyl-CoA carboxylase, or PCC. It primarily affects the pediatric population. There is no approved therapy for PA, including no approved enzyme replacement therapy, due to the complexity of the enzyme, which comprises six copies each of two different subunits (PCCA and PCCB), and its mitochondrial localization. The only effective treatment for severely affected individuals is liver transplant, aimed at increasing enzyme activity to reduce the occurrence of life-threatening acute metabolic crises. Our platform is uniquely positioned to potentially address this disease by enabling synthesis of this complex enzyme that is localized in the mitochondria of the cell. We are developing an IV-administered mRNA therapeutic comprising two different mRNAs encoding PCCA and PCCB in our proprietary LNP to replace the defective PCC enzyme with functional enzyme in liver and other cells. We expect to initiate a Phase 1/2 clinical trial in PA patients.

Propionic acidemia (mRNA-3927): Disease overview

PA is an inherited metabolism disorder with significant morbidity and mortality and no approved therapy

PA is a serious inborn error of metabolism disorder, closely related to MMA, with significant morbidity and mortality. There are approximately 325-2,000 PA patients in the United States based on estimated birth prevalence (0.2-1.2/100,000 newborns) and mortality rates. The vast majority of patients present with life-threatening metabolic crises during the first days or weeks of life, with mortality rates ranging from 13-53% during the neonatal period. Similar to MMA, the cardinal feature of the disorder is the occurrence of life-threatening acute metabolic decompensations that are more frequent in the first few years of life. Longer term sequelae include cardiac complications (cardiomyopathy, arrhythmias) and severe neurologic complications.

The disorder is caused by a defect or deficiency in PCC, an enzyme that is one step upstream in the same metabolic pathway as the MUT enzyme that is deficient in MMA. PCC is a complex hetero-dodecamer enzyme composed of six alpha subunits (PCCA) and six beta subunits (PCCB). The disorder is autosomal recessive, with PA patients generally having loss-of-function mutations in either PCCA or PCCB (and in rare instances, mutations in both PCCA and PCCB). To date, over 100 mutations have been identified for both PCCA and PCCB genes and, similar to MMA, most of the mutations are private. Also similar to MMA, due to this enzyme deficiency resulting in a metabolic block, the disorder is biochemically characterized by the accumulation of toxic metabolites such as 3-hydroxypropionic acid and 2-methylcitrate, among others, and these metabolites may be used as biomarkers of disease.

There is no approved therapy for PA to treat the underlying defect, including no enzyme replacement therapy, due to the complexity of PCC and mitochondrial localization. Carglumic acid (marketed as Carbaglu) is approved in the EU for the acute treatment of hyperammonemia due to various organic acidemias, including PA, but does not address the underlying defect. Management of the disorder is otherwise limited to strict dietary restrictions and other supportive measures similar to MMA. Liver transplant is a radical yet effective treatment, with the aim of increasing PCC enzyme activity in liver for severely affected individuals. However, transplant as a therapeutic option has significant limitations, including the risks of the procedure itself.

Propionic acidemia (mRNA-3927): Our product concept

We are utilizing the strength of our platform to produce a complex enzyme comprising two different proteins that localize to the mitochondria

The ability of our platform to encode for large, multimeric complexes such as PCC and enable production of intracellular, mitochondrial proteins makes mRNA especially suited to potentially address PA. We are developing an IV-administered combination mRNA approach, which contains two mRNAs, one for each of the subunits of
PCC (PCCA and PCCB) encapsulated in our proprietary LNP. The intent is to potentially treat the entire PA population, regardless of whether an individual has a defect or deficiency in the PCC alpha or beta subunit. The mRNA sequences have been engineered to improve protein translation and encode enzymatically-active PCC with the proper subcellular localization in the mitochondria. An illustration of our approach is shown in the figure below.

Currently there are no gene therapy treatments being tested in the clinic for patients with PA. We believe that there are potential advantages for mRNA therapeutics to treat PA over current gene therapy approaches, as described in the systemic intracellular therapeutics modality section.
Propionic acidemia (mRNA-3927): Preclinical information

We have demonstrated activity in a PA mouse model in a long-term repeat dose study

A series of in vitro and in vivo pharmacology studies have been performed to demonstrate preclinical proof-of-concept for the combined PCCA and PCCB mRNA therapy. PCCA and PCCB mRNAs administered in PA patient fibroblasts (both PCCA and PCCB-deficient) showed production of active PCC enzyme with the proper subcellular localization in mitochondria at concentrations above wild-type levels. In vivo studies in PA (PCCA-/-[A138T]) mice have resulted in a dose-dependent increase in hepatic PCC activity with a concomitant decrease in disease biomarkers. Notably, a reduction in plasma ammonia levels was observed 3-4 weeks after a single IV administration (1 mg/kg) of PCCA and PCCB mRNA encapsulated in our proprietary LNP in PA mice (n=4-5/group). The data is shown in panel A of the figure below. Additionally, a 6-month repeat-dose study in PA mice showed decreased heart weight (normalized to body weight) in mice treated with monthly IV administration of PCCA and PCCB mRNA (1 mg/kg) compared to control mRNA (n=6/group). This is shown in panel B of the figure below. Data in both panels is presented as mean ± standard deviation.

Reduction in plasma ammonia with PCCA+PCCB mRNA in PA mouse model study

![Figure](image_url)

Panel (A)
In the 6-month repeat dose study in PA mice, a significant and sustained lowering of additional disease biomarkers (e.g., 2-methylcitrate, or 2MC) was observed throughout the duration of the 6-month study. A comparison of 2-methylcitrate levels as a result of monthly IV administration of PCCA and PCCB mRNAs (0.5-1 mg/kg) compared to control mice injected with a control (luciferase) mRNA is shown in the figure below (n=6/group). Data is presented as mean ± standard deviation.

**Plasma 2-methylcitrate levels with repeat dosing of PCCA+PCCB mRNA in PA mouse model study**
Propionic acidemia (mRNA-3927): Clinical plan

We are conducting a global natural history study and are planning a Phase 1/2 clinical trial

The clinical development plan for mRNA-3927 includes a global, natural history study that was initiated in 2018 and a planned Phase 1/2 study in pediatric patients diagnosed with PA.

We have launched a natural history study aimed at identifying and correlating clinical and biomarker endpoints. This is a global, multi-center, non-interventional study for patients with confirmed diagnosis of PA or MMA due to MUT deficiency. Up to 60 PA and 60 MMA patients in the United States and Europe will be followed prospectively for 1-3 years. Retrospective data will be collected as available.

We plan to conduct an open-label, multi-center, dose escalation Phase 1/2 study of multiple ascending doses of mRNA-3927 in pediatric patients with PA in the United States and Europe. The primary objective of this study is to evaluate the safety and tolerability of mRNA-3927 administered via IV infusion. The secondary objectives of the study are to assess the pharmacodynamic response as assessed by changes in plasma biomarkers to characterize the pharmacokinetic profile of mRNA-3927, and to assess the frequency and severity of clinical events and their relationship to plasma biomarker levels.
Phenylketonuria (mRNA-3283): Summary

Our approach to Phenylketonuria with an mRNA encoding for an intracellular protein

Phenylketonuria, or PKU, is a rare inherited metabolic disease resulting from a deficiency in the metabolism of phenylalanine, or PHE, due to mutations within the enzyme phenylalanine hydroxylase, or PAH. The most effective treatment is a restrictive diet of low protein, which controls PHE intake. Approximately 20-56% of PKU patients respond to sapropterin dihydrochloride (marketed as Kuvan in the United States), a synthetic BH4 cofactor for PAH which improves PHE metabolism, but does not fully cure patients. In addition, Biomarin has received approval for pegylated phenylalanine lyase, or PAL, marketed as Palynziq. Palynziq is a pegylated recombinant bacterial enzyme which metabolizes PHE in the blood. Severe anaphylaxis is associated with Palynziq and patients are provided epinephrine to self-administer in the event of a serious allergic reaction. We believe the immune risk is, at least in part, driven by bacterial PAL. With our mRNA technology, cells in the human body can be instructed to produce functional PAH, decreasing PHE levels in the blood and restoring production of tyrosine. We are developing an intravenously administered mRNA which encodes for the PAH enzyme and is encapsulated in our proprietary LNP. We plan to conduct a Phase 1 clinical trial for mRNA-3283.

Phenylketonuria (mRNA-3283): Disease overview

There are options to treat PKU which are not widely applicable, and efforts by other companies are likely to face hurdles

PKU occurs in approximately 1:10,000-15,000 live births in the United States. Based on current population estimates that would translate into approximately 21,000-32,000 PKU patients in the United States. Affected individuals have a deficiency in the enzyme PAH, resulting in a reduced or complete inability to metabolize the essential amino acid phenylalanine into tyrosine. Thus, PKU patients suffer from a phenylalanine intoxication and a subsequent deprivation of tyrosine, leading to severe mental disability if left untreated.

PAH is expressed as a monomer, but functions as a tetramer and requires tetrahydrobiopterin (BH4) as a cofactor to complete the conversion of PHE to tyrosine, thereby maintaining adequate PHE:TYR ratios within circulation. To date, greater than 950 gene variants have been identified in the PAH gene, resulting in PKU.

Diagnosis of PKU occurs primarily through newborn screening in available countries, followed by genetic confirmation. Newly diagnosed patients receive medical formulas containing protein with low PHE content to control blood PHE and provide adequate nutrition for growing infants. As patients age they are tested for sensitivity to synthetic BH4 and may transition to Kuvan. Approximately 20% of patients respond favorably to Kuvan, which can aid in PHE control. Nonresponsive patients are treated mainly with restricted diet; however, adherence to the diet is challenging, resulting in poor compliance. When PHE levels are not adequately controlled, patients begin to show multiple signs of disease, including depression, anxiety, poor executive function, and attention deficit hyperactivity disorder, or ADHD.

In May 2018, Biomarin received approval to market Palynziq. However, treatment with Palynziq has resulted in a number of hypersensitivity reactions as well as the formation of anti-drug antibodies in PKU patients. In addition to tolerability concerns associated with Palynziq administration, this bacterial enzyme does not convert PHE to tyrosine and may not restore optimal PHE to TYR ratios in patients.

One option for PKU patients may be treatment with gene therapy. We believe there are potential advantages for mRNA therapeutics for this disorder over gene therapy as described in the systemic intracellular therapeutics modality section.
Phenylketonuria (mRNA-3283): Our product concept

We intend to utilize the cells in the human body to produce PAH intracellularly.

We believe mRNA therapy is a viable therapeutic modality for PKU patients due to its ability to instruct cells in the human body to produce complex functional intracellular proteins such as PAH. Our program mRNA-3283 consists of an mRNA encoding human PAH encapsulated in our proprietary LNPs. The mRNA sequence is optimized for protein synthesis and contains a microRNA binding site to reduce or potentially eliminate synthesis of protein outside of the target tissues. mRNA-3283 is designed to be administered intravenously to encode enzymatically-active PAH protein in liver to restore this deficient or defective enzyme as illustrated in the figure below.

Phenylketonuria (mRNA-3283): Preclinical information

We have demonstrated the ability to impact PHE levels by repeat dosing of our mRNA in preclinical studies.

We have conducted several in vitro and in vivo pharmacology studies to demonstrate preclinical proof-of-concept for PAH therapy. A PKU mouse model demonstrated a significant reduction of blood PHE levels post dose as shown in the figure below. The study included IV administration of PAH mRNA every 7 days at 0.5 mg/kg in a PAH-/- mouse model. Data point with asterisk is marked zero since it was not collected due to a snow storm. PHE level was measured using liquid chromatography with a combination of two mass analyzers (LC-MS/MS).

PHE reduction with repeat dosing of PAH mRNA in PKU mouse model study
Phenylketonuria (mRNA-3283): Clinical plan

We plan to conduct a Phase 1 open label clinical trial with single ascending dose to evaluate the safety, tolerability, and activity of our development candidate in patients.
MANUFACTURING (PRODUCT SUPPLY AND TECHNICAL DEVELOPMENT)

We believe manufacturing plays a critical role in our value chain and ability to develop a new category of medicines. Our manufacturing capabilities currently support the Research Engine and the Early Development Engine, with future plans to support demand from the Late Stage Development and Commercial Engine. Within the Research Engine, our manufacturing provides mRNA drug substance and formulated drug product for platform research and therapeutic area drug discovery. For the Early Development Engine, we manufacture mRNA and drug product for IND-enabling GLP toxicology studies and initial human clinical studies. Our approach to date has been to proactively build capacity in anticipation of demand from internal research and development, as well as from our strategic collaborators. We have done so by making significant investments in our internal manufacturing capability and in a network of external manufacturing partners.

Overview of our manufacturing operating model

Our manufacturing activities focus on the following:

- **Manufacturing Technology.** Our manufacturing technology development includes state-of-the-art technologies for mRNA and drug product manufacturing and testing to attain robust, consistent supply that matches target product profiles. Manufacturing technology also needs to support scale-up and industrialization of products for ultimate commercial approval.

- **Supply.** The product supply for the Research Engine enables platform research and drug discovery in our therapeutic areas. Within the Early Development Engine, supply is directed towards IND-enabling GLP toxicology studies or current good manufacturing practice, or cGMP, supplies for early clinical studies of our investigational medicines.

In 2016, we began investing in a dedicated in-house manufacturing facility in Norwood, MA, given our expectations for significant ongoing pipeline expansion and the long lead time required in building manufacturing infrastructure. Construction of the facility began in the second half of 2016 and the site was operationalized in July 2018. Through September 30, 2018, we had net capitalized costs of approximately $130 million related to our Norwood facility. The facility is approximately 200,000 square feet; can scale up to 100 cGMP lots per year; and can accommodate over 200 of our employees. This facility is expected to support our Research Engine supply, IND-enabling GLP toxicology study supplies, and our Phase 1 and Phase 2 pipeline activities, and potentially later-stage clinical development activities, as well as certain commercial activities. The picture below is an exterior view of Norwood.

Norwood includes the following areas:

- five cGMP suites for the manufacture of mRNA drug substance and bulk drug product;
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- dedicated cGMP suites for sterile filling;
- cGMP suites for the manufacture of personalized cancer vaccines, or PCVs;
- cGMP suites for the manufacture of critical raw materials;
- space for packaging, labeling, and storage of vialled products;
- temperature-controlled warehouse for incoming and outgoing products;
- quality control laboratories;
- pilot scale manufacturing space for scale-up and manufacture of toxicology supplies;
- space for the manufacture of research grade mRNA; and
- clean utilities including purified water and water for injection generation and controlled distribution.

The facility has been designed with a high level of automation and digital integration of manufacturing records and data. In addition, we have deployed an automated material and resource management system, a manufacturing execution system, a laboratory execution system, a laboratory information management system, and an asset and document management system, to ensure the digital integration of our manufacturing, product testing and release, and regulatory filings.

**Manufacturing technology development**

In order to support our broad pipeline of products spanning multiple therapeutic areas and multiple routes of administration, the technology underpinning product manufacturing is critical to our success. Over the last few years, we have invested heavily in this technology to enable the breadth and depth of our pipeline, and to prepare us to meet future needs and requirements as our programs enter later phases of development and commercialization.

Our technology efforts are intended to span the development of robust and consistent manufacturing processes, assays to fully characterize the product, and fit-for-purpose formulations and product presentations. In addition, manufacturing activities include the development of novel hardware platforms that incorporate significant automation and robotics which are applicable broadly across programs but also specifically to personalized cancer vaccines. All of these activities are being developed with a focus on achieving appropriate cost of goods and scalability.

Our advances over the last few years have enabled us to more efficiently scale our mRNA and drug product manufacturing at successfully larger production yields. We have made significant investments in analytical characterization to determine critical product quality attributes and enable manufacturing site and scale changes over the course of development. In addition, pharmaceutical readiness of our drug product has enabled a wide variety of routes of administration (e.g., intramuscular, intratumoral, and intravenous).

We have also invested in the establishment of technology for the manufacture of some of our key raw materials, including DNA plasmid and many small molecules. This vertical integration allows us to exert significant control over the value chain, though we will continue to use a combination of internal and external manufacture of these raw materials.

**Supply of mRNA for the Research Engine and Early Development Engine**

*Supply for the Research Engine*

We believe that our internal manufacturing capacity is key to the advancement of our platform technology development and therapeutic area discovery efforts. High throughput automation and custom-engineered
equipment enable us to produce multiple high quality mRNA and formulated constructs within a limited timeframe from order to delivery. We currently have infrastructure capable of producing up to 1,000 lots of mRNA sequences and formulations per month with a turnaround time of a few weeks from sequence to final product. The typical scale of mRNA manufactured by this team is 1-10 mg. We have produced more than 18,000 lots of research grade mRNA.

Supply for the Early Development Engine

Analogous to the Research Engine, we have proactively established manufacturing capabilities for the Early Development Engine. We started supplying product to enable IND-enabling GLP toxicology studies, and for human clinical studies, meeting required cGMP standards, with a combination of internal manufacturing at our Cambridge headquarters and external manufacturing at well-established contract manufacturing organizations, or CMOs. Most recently, we invested in Norwood, which opened in July 2018 and has extensive capability and capacity to produce research and clinical supply for our programs as well as to enable technology development and scale-up for future needs. We will continue to selectively use CMOs to complement our internal capacity to provide supply contingency and expanded capability where needed.

This extensive capacity has helped enable our broad pipeline of 21 development candidates, including the significant output necessary to supply our toxicological and human clinical studies. Though the underpinnings of the technology utilized across these 21 programs are the same, each program typically requires customization driven in part by its target product profile. These custom features range from varying molecular architecture to different routes of administration, and often necessitate multivalent products. For example, our CMV vaccine (mRNA-1647) requires six different mRNA sequences to be manufactured for inclusion in an intramuscular mRNA medicine, whereas OX40L (mRNA-2416) requires a single mRNA sequence for inclusion in an intratumoral mRNA medicine. All programs, with the exception of PCV, require that we scale up supply over time to meet the clinical demand required in the different phases of development and prepare the process for regulatory approval and eventually commercial supply, where bigger batch sizes will be required. In contrast, the PCV program is designed to provide each patient with a cancer vaccine that is designed and manufactured for that specific patient, thus increasing the number of batches to match the number of patients treated. As we scale the manufacturing output for particular programs, we plan to continuously improve yield, purity, and the pharmaceutical properties of our development candidates from IND-enabling GLP toxicology studies through commercial launch, including improvement to shelf life stability and solubility properties of drug product and drug substance. Typically after a change in process, more time may be required for pharmaceutical property testing, such as 6- or 12-month stability testing. This time lag may necessitate resupplying clinical materials, or making additional cGMP batches to meet clinical trial demand, before such pharmaceutical property testing is completed.

Supply of mRNA and formulated product for toxicology studies: Early on, we established the internal capability to produce mRNA and formulated product for IND-enabling GLP toxicology studies for our development candidates under GLP standards. To date, we have produced more than 50 batches of mRNA to support these studies.

Supply of cGMP mRNA and formulated product for human clinical studies: We have incrementally built the capability to produce and supply mRNA drug product for clinical development. In our early years, we outsourced cGMP supply. We selected specialized CMOs to support a total of five programs by the end of 2015. In 2016, we built and qualified two cGMP suites in our Cambridge facility for the manufacture of mRNA drug substance and formulated drug product. While we had the internal capability to produce drug product, we continued to work with our external CMO network for redundant capacity and to provide sterile filling capability. To date, we have manufactured over 45 cGMP drug substance batches in our facilities or with the help of our CMO partners.

cGMP manufacture of PCV: Due to the specialized nature of personalized medicine, in which a batch is specifically manufactured for a single patient, the PCV program has unique requirements. In this program,
we digitally integrate patient-specific data from sequencing tumor samples and automatically design PCVs for patients. We have developed proprietary bioinformatics design algorithms, and have linked them to an automated manufacturing process for rapid production of formulated mRNA that can be turned around in a matter of weeks. The PCV manufacturing capability is termed Personalized Vaccine Unit, or PVU. PCV manufacturing is conducted using custom automated and engineering solutions utilizing single-use systems with fast “needle-to-needle” turnaround time. We have operationalized PCV manufacture within our external CMO network to meet our Phase 1 supply needs, while in parallel working to internalize manufacturing. Unlike traditional process development, where the product is scaled up in quantity for later phases of development and commercialization, each PCV is manufactured for a single patient and thus scaled-out with extensive use of automation and robotics for the larger numbers of patients involved in later phases of development and commercialization.

Supply for the Late Stage Development and Commercialization Engine

As our pipeline advances to later stage development and potential commercialization, we will need to evolve our manufacturing suites and other capabilities at Norwood. We believe at this time the modular nature of the Norwood suites will permit us to manufacture drug substance and drug product for a number of registrational trials and potentially drug substance and drug product for commercialization for certain rare disease indications. In other instances, we may build additional capabilities to support our Late Stage Development and Commercialization Engine.

Quality unit

Quality is core to the way we operate. We seek to ensure quality at Moderna through a combination of a robust Quality Management System, or QMS, our quality culture, and through our people. In accordance with applicable regulations we have established, documented, and implemented a QMS to assure continued compliance with the requirements therein. The QMS facilitates cGMP compliance by implementing practices that identify the various processes required by the QMS, their application throughout the organization, and the sequence of interaction of these processes.

The primary mode of documenting these key practices is through policies, standard operating procedures, forms, and other quality records, which include an overarching Quality Policy and Quality Manual. We have implemented measurement tools and metrics to monitor, measure, and analyze these practices to support cGMP operations, achieve planned results, and support continuous improvement. We monitor these quality metrics through formal governance processes, including Quality Management Review, or QMR, and our Quality Council to enable continuous improvement. We have also established an independent Quality Unit that fulfills quality assurance and quality control responsibilities.

While the Quality Unit is ultimately accountable and responsible for quality, quality is everyone’s responsibility. All cGMP personnel are empowered to ensure quality systems are appropriately maintained and executed.

We have established a culture that encourages transparency, accountability, and ownership of quality at all levels in the organization. As we scale the quality organization, we have focused on hiring the best talent with the required experience, training, and education.

Supply chain unit

We have established a robust supply chain to enable sufficient supply of the raw materials used to produce our mRNAs and components of our formulations. We have worked with our supply chain vendors to characterize critical raw materials and to understand their impact on the quality of mRNA drug substance and formulated drug product. We have also assessed the quality system and performance of our supply chain vendors and worked with them to comply with regulatory requirements.
DIGITAL INFRASTRUCTURE

We believe that digital technologies, such as robotics, automation, artificial intelligence, and cloud computing, are critical to operationalize our strategy, accelerate our pace of learning and execute at scale. Our approach to bring these digital technologies into our workflows and processes has involved the following:

• utilization of a consistent set of digital building blocks;
• application of digital technologies in multiple business processes; and
• rapid iterations for maximum optimization.

We have seen several benefits from our investments in digitization, most importantly through the depth of our platform technology and breadth of our pipeline. Other benefits include:

• Quality: Reduction in human errors by enabling automation, repeatability, and seamless integration;
• Scalability: Growth in our pipeline to 21 programs, as of October 2018;
• Speed: Rapid manufacture of research-grade mRNA from the Research Engine; and
• Cost efficiencies: Digital infrastructure utilized across our platform, drug discovery, clinical development, and manufacturing to maximize efficiencies.

Our digital building blocks

We utilize six building blocks for our digital infrastructure:

• Cloud enablement is a critical component of our digital infrastructure. We are at the forefront of mRNA technology. We generate complex data sets, and our scientists need computational power and agility to operate without being limited by traditional computing technology. Maintaining digital infrastructure in the cloud provides the benefits of lower costs by simplifying provisioning and administration, flexibility, scalability, ease of maintenance, disaster recovery, and information security.

• Integration of business processes enables us to streamline processes and bring data together in a consistent manner, avoiding caches of information and manual intervention. This efficient flow of data between systems enables the automation of our business processes.

• Internet of things allows for smart interconnected devices that provide real-time synchronization of operations. The data from equipment provides real-time guidance to our scientists and engineers.

• Automation allows us to scale our operations reliably and reproducibly. With the help of custom hardware solutions and state-of-the-art robotics, we can continue to increase our operating efficiency, reduce errors, and improve our quality and compliance.

• Advanced analytics enable us to draw insights from our data. We are constantly generating large data sets that can provide important insights if mined appropriately and regularly.

• Artificial intelligence, or AI, is enabling key breakthroughs in predictive modeling. It will allow us to improve our mRNA design algorithms based on machine learning, and will provide us with critical insights into research, supply chain, manufacturing, and other processes.

Digital technologies to enable our Research Engine

We have deployed multiple digital technologies across our Research Engine to drive a rapid pace of learning, enable efficient workflows and business processes, and draw insights from vast amounts of data. Our aim is to provide our platform and discovery scientists with access to an environment that helps them through each step of their research cycle.
**Drug Design Studio:** Our proprietary in-house digital application suite contains a Sequence Designer module to tailor an entire mRNA, with ever-improving rule sets that contain our accumulated learning about mRNA design. A screenshot of the Sequence Designer application is shown below.

Drug Design Studio utilizes cloud-based computational capacity to run various algorithms we have developed to design each mRNA sequence. The utility of cloud-based capacity allows us to provide flexible computational capacity on demand, allowing the Research Engine to power parallel intake and design of multiple mRNA sequences.

![Sequence Designer Application Screenshot](image1)

Once a sequence is designed, it can be ordered digitally using an internal order form application within Drug Design Studio. Screenshots of the order form are shown below.

![Order Form Application Screenshot](image2)
Manufacture of research grade mRNA: Once an order is optimized, the mRNA production process is triggered. We have developed proprietary interfaces that allow the manufacturing team to track production orders at every stage. We have automated several manufacturing steps using both off-the-shelf and custom automation. The equipment used in the manufacture of research-grade mRNA is integrated with the digital interfaces to capture, extract, and interpret the data generated at each step of the manufacturing process, building digital traceability on each mRNA order. We have also embedded real-time algorithms and analytics tools to allow for automated decision-making at some stages, accelerate the quality control workflows, and provide for continuous improvement of manufacturing processes.

Dispatching and shipping mRNA: Because we produce large quantities of research-grade mRNA, we require digital tools to track their shipment to our scientists and to external contract research organizations, or CROs, conducting in vivo studies. Our dispatching and shipping application automatically generates bar-coded labels, allowing for traceability of product.

Inventory and registry: Material used in research and created in production, including mRNA, cell lines, chemicals, and reagents, is tracked in our Inventory application. This application supports numerous workflow tools such as consumption, aliquoting, material transfer, and stock alerts. Critical material types are assigned unique registry identification by our Registry application.

Study design: Using our Drug Design Studio, our scientists can design their in vivo studies using our proprietary Study Design application. This application captures in vivo study protocol design parameters, including dose amount, number of doses, frequency, samples, and assays for each sample. This application serves two purposes. It allows our scientists to maintain and track their in vivo study designs and associated research grade mRNA. Our Study Design application also allows our in vivo pharmacology teams to track the various ongoing studies and leverage external CROs to manage the in vivo demand as needed.

Experiment management: We have deployed Electronic Lab Notebooks for experiment management, allowing our scientists to streamline documentation of their experiments and track it in a standardized, searchable
repository. We have also integrated Electronic Lab Notebooks further with our other research tools to connect inventory, *in vivo* studies, and instrument data.

**Advanced analytics and AI to accelerate the pace of learning:** We utilize AI to enable various parts of our platform and drug discovery. Examples include:

- **Neural networks for protein engineering:** One way to optimize the efficacy of the proteins encoded by our mRNA is to engineer the sequence of the protein itself. We use neural networks to analyze and model protein sequences. We train these models by inputting orthologous sequences from thousands of organisms, from which we can generate potential protein sequences optimized for specific attributes.

- **Neural networks for mRNA engineering:** The redundancy in the genetic code allows for a large number of mRNA sequences that encode the same protein. mRNA sequence may impact translation, thereby impacting the amount of protein produced in circulation. We are developing AI tools to predict mRNA sequences that can enhance protein expression.

- **Bayesian AI for sequencing mRNA:** We analyze the mRNA sequence produced in our Research Engine as part of our quality control requirements. Analysis of sequencing data can be cumbersome and time-consuming. We are developing Bayesian models to accelerate the assessment of sequencing data and more rapidly provide our scientists with high quality mRNA.

**Digital technologies to enable our Early Development Engine**

We have deployed multiple digital technologies across our Early Development Engine to drive the rapid pace of advancement, in parallel, of our development candidates into the clinic.

**Digital systems for cGMP manufacture:** We are committed to having integrated systems connected with robotics to drive our manufacturing in a paperless environment, and have designed and deployed automation to drive efficient manufacturing operations. We have also deployed digital tools within manufacturing process development that give us the ability to track, analyze, and rapidly deploy manufacturing process improvements. Additionally, we have implemented several digital systems across manufacturing process development, quality, supply chain, and operations, including:

- enterprise Quality Management System, or QMS, to electronically manage deviations, investigation, and correction and preventive actions;

- Laboratory Information Management System, or LIMS, to manage our analytical development data and automate our manufacturing quality control;

- computerized maintenance management system to manage equipment maintenance and calibration; and

- SAP/S4 Hana system for enterprise resource planning, or ERP, manufacturing execution system, and manufacturing control system to manage inventories, track raw material consumption, digitally integrate equipment with manufacturing recipes in batch records, and control automated equipment.

**Digital systems for clinical development and clinical operations:** In order to track the timelines of various development candidates through the Early Development Engine, we have created a set of integrated applications. Workflows include timelines for regulatory filings, planning for IND-enabling GLP toxicology studies, scheduling for cGMP manufacturing, and clinical operations management. Below is a summary of our applications:

- Our portfolio application is a digital interface that maintains and tracks the timelines across multiple workstreams for each of our development candidates.

- The supply application manages the manufacturing schedule of IND-enabling GLP toxicology supplies and cGMP manufacture of clinical supplies to support our programs. This application helps us see how the manufacturing schedule changes over time, identifies supply/demand mismatches, and enables resource planning with real-time alerts should we have any issues.
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• The GLP toxicology application tracks the planned and ongoing IND-enabling GLP toxicology studies and allows us to manage timelines with our external vendors.

• The regulatory application tracks timelines related to regulatory affairs including, pre-IND meetings, IND/CTA submission dates, and other planned regulatory interactions.

• Our clinical operations application allows us to track our ongoing trials by accessing clinical operations information in real-time from our CROs. It also has multiple tools and analytics to draw key insights, including, for example, enrollment by trial and enrollment by site to maintain our program timelines.

Digital systems for PCV: The PCV program aims to design, manufacture, and deliver a drug product that includes an mRNA sequence encoding for each patient’s specific neoantigens. The personalized nature of the PCV program adds additional steps and complexity in the overall patient treatment process. We have addressed those additional steps and complexity by digitizing and automating steps within the process, as described below.

• Each patient is provided a unique identifier. We track the entire workflow using a single integrated tracker based on this unique identifier. This is one of many ways we ensure that each patient receives the specific drug product lot manufactured for them.

• We use neural networks to design the mRNA sequences for the PCV program. Our proprietary vaccine design algorithm selects the top twenty neoantigens to be used and determines their amino acid sequences to trigger the desired immune response.

• We utilize Monte Carlo simulations of PCV supply/demand to manage our capacity. Since each drug product lot is personalized to a patient, there is a need to manage supply and demand to avoid bottlenecks at any stage of the workflow.

Digital technologies to support our business processes

We have deployed several digital systems across finance, manufacturing, and human resources to automate our business processes and drive efficiencies. We have implemented the SAP S4/Hana system for ERP. In December 2016 we implemented the finance, procurement and inventory management modules and further scaled the ERP to support manufacturing, quality and supply chain in September 2017 and added the Norwood site and processes in July 2018. We have implemented various cloud-based solutions to improve business processes and drive efficiencies. For example, we have implemented the Workday system for human resource planning and management and integrated various applications across payroll, 401k services, equity plan management and expense reporting.
THIRD-PARTY STRATEGIC ALLIANCES

Strategic alliances

To accelerate the discovery and advancement of potential mRNA medicines across therapeutic areas, we have entered into, and intend to seek other opportunities to form, alliances with a diverse group of strategic collaborators. As of October 31, 2018, we have forged productive strategic alliances with pharmaceutical and biotechnology companies, government agencies, academic laboratories, foundations and research institutes with therapeutic area expertise and resources in an effort to advance our discovery and development programs, while leveraging our platform and our Research and Early Development Engines.

One key principle of our approach to strategic alliances is to share the rewards and risks of developing a new mRNA modality, where we may have early research data and desire a strategic collaborator to join us in advancing early development candidates within such modality into the clinic. Representative relationships and associated programs include the following:

- AstraZeneca for the localized regenerative therapeutics modality, such as the VEGF-A (AZD8601) program currently in Phase 2;
- AstraZeneca for the intratumoral immuno-oncology modality, such as the IL12 program (MEDI1191);
- AstraZeneca for the systemic secreted therapeutics modality, such as the Relaxin program (AZD7970);
- Merck for the prophylactic vaccines modality, such as the RSV vaccine program (mRNA-1777) currently being prepared for a Phase 2;
- Merck for the cancer vaccines modality, such as the personalized cancer vaccine program (mRNA-4157) currently in Phase 1 using a workflow that enables a rapid turnaround time to bring personalized vaccines to patients, and the KRAS vaccine program (mRNA-5671);
- DARPA for the systemic secreted therapeutics modality, such as the antibody against Chikungunya virus program (mRNA-1944) currently in Phase 1; and
- Vertex for the lung delivery modality, such as the CF/CFTR program currently in research.

We view strategic alliances as important drivers for accelerating execution of our goal of rapidly developing mRNA medicines to treat patients across a wide range of medical and disease challenges. To maintain the integrity of our platform, the terms of our agreements with our strategic collaborators generally provide that our strategic collaborators receive rights to develop and commercialize potential mRNA medicines that we design and manufacture, as opposed to rights to use our platform to generate new mRNA, and that we generally own mRNA-related intellectual property arising from research activities performed under the strategic alliance.

We plan to continue to identify potential strategic collaborators who can contribute meaningful resources and insights to our programs and allow us to more rapidly expand our impact to broader patient populations.

AstraZeneca (NYSE: AZN)—Strategic Alliances in Cardiovascular and Oncology

We have three alliances with AstraZeneca. Our first strategic alliance established in 2013 and amended and restated in 2018, was to discover, develop, and commercialize potential mRNA medicines for the treatment of cardiovascular and cardiometabolic diseases, as well as selected targets for cancer. The relationship with AstraZeneca was expanded in 2016 by entering into a new immuno-oncology strategic alliance which is now focused on the joint development of a potential mRNA medicine to make the IL12 protein. It was further expanded in 2017 by entering into another strategic alliance which is focused on the joint development of a potential mRNA medicine to make the relaxin protein, following discovery and preclinical development of the relevant development candidate internally. Additionally, AstraZeneca has made several equity investments in Moderna, which total approximately $290.0 million through September 30, 2018.
In March 2013, we entered into an Option Agreement and a related Services and Collaboration Agreement with AstraZeneca, which were amended and restated in June 2018. We refer to these amended and restated agreements as the 2018 A&R Agreements. Under the 2018 A&R Agreements, we granted AstraZeneca certain exclusive rights and licenses to research, develop and commercialize potential therapeutic mRNA medicines directed at certain targets for the treatment of cardiovascular and cardiometabolic diseases and cancer, and agreed to provide related services to AstraZeneca. The activities to be performed by the parties under the 2018 A&R Agreements are limited to defined biological targets in the cardiovascular and cardiometabolic fields and one defined target in the cancer field.

Pursuant to the 2018 A&R Agreements, AstraZeneca is responsible for all research, development and commercialization activities and associated costs, while we provide specified research and manufacturing services, at AstraZeneca’s expense, during a research and evaluation period, as described below, to further AstraZeneca’s activities conducted pursuant to an agreed upon services plan. AstraZeneca may request we provide additional services, at AstraZeneca’s expense. Subject to customary “back-up” supply rights granted to AstraZeneca, we exclusively manufacture (or have manufactured) mRNA for all research, development and commercialization purposes under the 2018 A&R Agreements until, on a product-by-product basis, the expiration of the time period for which we are entitled to receive earn-out payments with respect to such product pursuant to the 2018 A&R Agreements.

As of the effective date of the original Option Agreement and Services and Collaboration Agreement in 2013, and as further reflected in the 2018 A&R Agreements, AstraZeneca acquired forty options that it may exercise to obtain exclusive rights to clinically develop and commercialize identified development candidates (and related back-up candidates) directed to specified targets that arise during the research and evaluation period. During the research and evaluation period for research candidates, AstraZeneca may elect to designate a limited number of research candidates as development candidates in order to continue preclinical development on such development candidates (and related back-up candidates). From such pool of development candidates designated by AstraZeneca, during a specified option exercise period, AstraZeneca may then exercise one of its options to obtain exclusive rights to clinically develop and commercialize an identified development candidate (and related back-up candidates) in certain fields.

If AstraZeneca does not exercise one of its options to acquire exclusive rights to clinically develop and commercialize a particular development candidate during the defined option exercise period for such development candidate, AstraZeneca’s rights to exercise an option and other rights granted under the 2018 A&R Agreements with respect to such development candidate (and related back-up candidates) will terminate, all rights to exploit such development candidate (and related back-up candidates) will be returned to us and all data and results generated by AstraZeneca with respect to such development candidate (and related back-up candidates) will be either assigned or licensed to us. Upon the earlier of termination of the 2018 A&R Agreements for any reason and a specified anniversary of the effective date of the original Option Agreement and Services and Collaboration Agreement in 2013, all unexercised options, and the right to exercise any and all options if not previously exercised by AstraZeneca, will automatically terminate.

On a target-by-target basis, we and AstraZeneca have agreed to certain defined exclusivity obligations under the 2018 A&R Agreements with respect to the research, development and commercialization of mRNA medicines for such target in certain fields. In addition, we and AstraZeneca have agreed to certain defined exclusivity obligations with respect to the research, development and commercialization of mRNA medicines coding for the same polypeptide as any development candidate being developed under the 2018 A&R Agreements.

As of the effective date of the original Option Agreement and Services and Collaboration Agreement in 2013, AstraZeneca made upfront cash payments to us totaling $240.0 million in exchange for the acquired options and our performance of certain research-related services, each as described above. AstraZeneca will pay us a $10.0 million option exercise payment with respect to each development candidate (and related back-up candidates) for which it exercises an option. We are also eligible to receive, on a product-by-product basis, up to $400.0 million
in aggregate contingent option exercise payments upon the achievement of certain development, regulatory and commercial milestone events. Additionally, we are entitled to receive, on a product-by-product basis, earn-out payments on worldwide net sales of products ranging from a high-single digit percentage to 12%, subject to certain reductions, with an aggregate minimum floor. As of October 31, 2018, we have received from AstraZeneca an option exercise payment of $10.0 million and a clinical milestone payment of $30.0 million with respect to AstraZeneca’s VEGF-A product (AZD8601) that is currently being developed in a Phase 2 clinical trial in the cardiovascular and cardiometabolic fields. Additionally, as of October 31, 2018, we have received $120.0 million from AstraZeneca under the 2018 A&R Agreements for the achievement of specified technical milestones.

Unless earlier terminated, the 2018 A&R Agreements will continue until the expiration of AstraZeneca’s earn-out and contingent option exercise payment obligations for optioned product candidates. Either party may terminate the 2018 A&R Agreements upon the other party’s material breach, either in its entirety or in certain circumstances, with respect to relevant candidates, subject to a defined materiality threshold and specified notice and cure provisions. If AstraZeneca has the right to terminate the 2018 A&R Agreements for our material breach, then AstraZeneca may elect, in lieu of terminating the 2018 A&R Agreements, in their entirety or with respect to such candidates, to have the 2018 A&R Agreements remain in effect, subject to reductions in certain payments we are eligible to receive and certain adjustments to AstraZeneca’s obligations under the 2018 A&R Agreements. AstraZeneca may terminate the 2018 A&R Agreements in full, without cause, upon 90 days’ prior notice to us.

2016 Strategic Alliance with AstraZeneca—IL12

In January 2016, we entered into a new Strategic Drug Development Collaboration and License Agreement, which we refer to as the 2016 AZ Agreement, with AstraZeneca to discover, develop and commercialize potential mRNA medicines for the treatment of a range of cancers. Under the terms of the 2016 AZ Agreement, we and AstraZeneca have agreed to work together on an immuno-oncology program focused on the intratumoral delivery of a potential mRNA medicine to make the IL12 protein. The 2016 AZ Agreement initially included research activities with respect to a second discovery program. During a limited period of time, each party may propose additional discovery programs and the parties may agree to add such additional discovery programs to the 2016 AZ Agreement. We are responsible for conducting and funding all discovery and preclinical development activities under the 2016 AZ Agreement in accordance with an agreed upon discovery program plan for the IL12 program and any other discovery program the parties agree to conduct under the 2016 AZ Agreement. For the IL12 program and any other discovery program the parties agree to conduct under the 2016 AZ Agreement, during a defined election period that commenced as of the effective date of the 2016 AZ Agreement (for the IL12 program) and otherwise will commence on initiation of any such new discovery program, AstraZeneca may elect to participate in the clinical development of a development candidate arising under the 2016 AZ Agreement from such program. If AstraZeneca so elects (as it has for the IL12 program), AstraZeneca will lead clinical development activities worldwide and we will be responsible for certain activities, including being solely responsible for manufacturing activities, all in accordance with an agreed upon development plan. AstraZeneca will be responsible for funding all Phase 1 clinical development activities (including costs associated with our manufacture of clinical materials in accordance with the development plan), and Phase 2 clinical development activities (including costs associated with our manufacture of clinical materials in accordance with the development plan) up to a defined dollar threshold. We and AstraZeneca will equally share the costs of Phase 2 clinical development activities in excess of such dollar threshold, all Phase 3 clinical development activities and certain other costs of late-stage clinical development activities, unless we elect not to participate in further development and commercialization activities and instead receive tiered royalties, as described below.

We and AstraZeneca will co-commercialize products in the United States in accordance with an agreed upon commercialization plan and budget, and on a product-by-product basis we will equally share the U.S. profits or losses arising from such commercialization. Notwithstanding, on a product-by-product basis, prior to a specified stage of development of a given product, we have the right to elect not to participate in the further development
and commercialization activities for such product. If we make such election, instead of participating in the U.S. profits and losses share with respect to such product, we are obligated to discuss future financial terms with AstraZeneca. If we are unable to agree on future financial terms within a short defined period of time, we are entitled to receive tiered royalties at default rates set forth in the 2016 AZ Agreement, ranging from percentages in the mid-single digits to 20% on worldwide net sales of products, subject to certain reductions with an aggregate minimum floor. AstraZeneca has sole and exclusive responsibility for all ex-U.S. commercialization efforts. Unless we have elected to not to participate in further development (in which case royalties on ex-U.S. net sales will be at the default rates as described above, unless otherwise agreed by the parties), we are entitled to tiered royalties at rates ranging from 10% to 30% on ex-U.S. net sales of the products, subject to certain reductions with an aggregate minimum floor. Subject to customary “back-up” supply rights granted to AstraZeneca, we exclusively manufacture (or have manufactured) products for all development and commercialization purposes. We and AstraZeneca have agreed to certain defined exclusivity obligations with each other under the 2016 AZ Agreement with respect to the development and commercialization of mRNA medicines for IL12. Any exclusivity obligations for any new discovery program the parties agree to conduct under the 2016 AZ Agreement will be agreed to at the time such new discovery program is added.

Unless earlier terminated, our strategic alliance under the 2016 AZ Agreement will continue on a product-by-product basis (i) until both parties cease developing and commercializing such product without the intention to resume, if we have not elected our right not to participate in further development and commercialization of such product or (ii) on a country-by-country basis, until the end of the applicable royalty term for such product in such country, if we have elected our right not to participate in further development and commercialization of such product.

Either party may terminate the 2016 AZ Agreement upon the other party’s material breach, subject to specified notice and cure provisions. Each party may also terminate the 2016 AZ Agreement in the event the other party challenges such party’s patent rights, subject to certain defined exceptions. AstraZeneca has the right to terminate the 2016 AZ Agreement in full or with respect to any program for scientific, technical, regulatory or commercial reasons at any time upon 90 days’ prior written notice to us. On a product-by-product basis, we have the right to terminate the 2016 AZ Agreement in certain cases if AstraZeneca has suspended or is no longer proceeding with the development or commercialization of such product for a period of twelve consecutive months, subject to specified exceptions, including tolling for events outside of AstraZeneca’s control. On a product-by-product basis, if the 2016 AZ Agreement is terminated with respect to a given product, AstraZeneca’s rights in such product will terminate and, to the extent we terminated for AstraZeneca’s breach, patent challenge or cessation of development or AstraZeneca terminated in its discretion, AstraZeneca will grant us reversion licenses and take certain other actions so as to enable us to continue developing and commercializing such product in the oncology field.

If we continue developing and commercializing a given product following termination of the 2016 AZ Agreement by AstraZeneca in its discretion with respect to such product, AstraZeneca is entitled to receive a mid-single digit royalty on our worldwide net sales of such product and a high-single digit percentage of the amounts received by us from a third party in consideration of a license to such third party to exploit such product, in each case, until AstraZeneca recovers an amount equal to specified development costs incurred by AstraZeneca under the 2016 AZ Agreement with respect to such product prior to such termination. Such percentages increase by a low to mid-single digit amount to the extent such termination occurs after such product achieves a specified stage of development.

### 2017 Strategic Alliance with AstraZeneca—Relaxin

In October 2017, we entered a new Collaboration and License Agreement, which we refer to as the 2017 AZ Agreement, under which AstraZeneca may clinically develop and commercialize a development candidate, now known as AZD7970, which is comprised of an mRNA construct for the relaxin protein designed by us and encapsulated in one of our proprietary LNPs. We discovered and performed preclinical development activities for AZD7970 prior to the initiation of the strategic alliance with AstraZeneca under the 2017 AZ Agreement.
Under the terms of the 2017 AZ Agreement, we will fund and be responsible for conducting preclinical development activities for AZD7970 through completion of IND-enabling GLP toxicology studies and AstraZeneca will lead pharmacological studies, each in accordance with an agreed upon discovery program plan. During a defined election period that commences as of the effective date of the 2017 AZ Agreement, AstraZeneca may elect to participate in further development and commercialization of AZD7970. Upon such election, AstraZeneca will lead clinical development activities for AZD7970 worldwide and we will be responsible for manufacturing AZD7970, certain regulatory matters and any other development activities that we agree to perform and that are set forth in an agreed upon development plan. AstraZeneca will be responsible for funding Phase 1 clinical development activities (including costs associated with our manufacture of clinical materials in accordance with the development plan, up to a cap above which such costs are shared), and Phase 2 clinical development activities (including costs associated with our manufacture of clinical materials in accordance with the development plan, up to a cap above which such costs are shared) up to a defined dollar threshold. Thereafter, we and AstraZeneca will equally share the costs of Phase 2 clinical development activities in excess of such defined dollar threshold, all Phase 3 clinical development activities and certain other costs of late-stage clinical development activities, unless we elect not to participate in further development and commercialization activities and instead receive tiered royalties as described below. If the development candidate is determined to be IND-ready, and AstraZeneca does not timely elect to participate in the clinical development of AZD7970, AstraZeneca is obligated to reimburse us for certain costs we incurred in the manufacture and development of AZD7970 since execution of the 2017 AZ Agreement.

We and AstraZeneca will co-commercialize AZD7970 in the United States in accordance with an agreed upon commercialization plan and budget, and will equally share U.S. profits or losses arising from such commercialization. Notwithstanding, prior to a specified stage of development of AZD7970, we have the right to elect not to participate in the further development and commercialization activities for AZD7970. If we make such election, instead of participating in the U.S. operating profits and losses share with respect to AZD7970, we are obligated to discuss future financial terms with AstraZeneca. If we are unable to agree on future financial terms within a short, defined period of time, we are entitled to receive tiered royalties at default rates set forth in the 2017 AZ Agreement, ranging from percentages in the mid-single digits to the low 20s on worldwide net sales by AstraZeneca of AZD7970, subject to certain reductions with an aggregate minimum floor. AstraZeneca has sole and exclusive responsibility for all ex-U.S. commercialization efforts. Unless we have elected not to participate in further development (in which case royalties on ex-U.S. net sales will be at the default rates as described above, unless otherwise agreed by the parties), we are entitled to receive tiered royalties at rates ranging from 10% to 30% on annual ex-U.S. net sales of AZD7970, subject to certain reductions, with an aggregate minimum floor. Subject to customary “back-up” supply rights granted to AstraZeneca, we exclusively manufacture (or have manufactured) products for all development and commercialization purposes. Additionally, we and AstraZeneca have agreed to certain defined exclusivity obligations under the 2017 AZ Agreement with respect to the development and commercialization of mRNA medicines for Relaxin.

Unless earlier terminated, our strategic alliance under the 2017 AZ Agreement will continue (i) until the expiration of AstraZeneca’s election period, if it does not elect to participate in the clinical development of AZD7970, (ii) until both parties cease developing and commercializing AZD7970 on a country-by-country basis, until the end of the applicable royalty term for AZD7970 in such country, if we have elected our right not to participate in further development or commercialization of AZD7970 or (iv) following completion of IND-enabling studies with respect to AZD7970, if we provide AstraZeneca with written notice that we do not reasonably believe that the product is IND-ready.

Either party may terminate the 2017 AZ Agreement upon the other party’s material breach, subject to specified notice and cure provisions. Each party may also terminate the 2017 AZ Agreement in the event the other party challenges the validity or enforceability of such party’s patent rights, subject to certain defined exceptions. AstraZeneca has the right to terminate the 2017 AZ Agreement in full for scientific, technical, regulatory or commercial reasons at any time upon 90 days’ prior written notice to us. We have the right to terminate the 2017 AZ Agreement.
AZ Agreement in certain cases if AstraZeneca has suspended or is no longer proceeding with the development or commercialization of AZD7970 for a period of twelve consecutive months, subject to specified exceptions, including tolling for events outside of AstraZeneca’s control. If AstraZeneca does not timely elect to participate in clinical development of AZD7970, or the Agreement is terminated, AstraZeneca’s rights in AZD7970 will terminate and, to the extent we terminated for AstraZeneca’s breach, patent challenge or cessation of development or AstraZeneca terminated in its discretion, AstraZeneca will grant us reversion licenses and take certain other actions so as to enable us to continue developing and commercializing AZD7970 in the cardiovascular and cardiometabolic fields.

If we continue developing and commercializing AZD7970 following a termination of the 2017 AZ Agreement by AstraZeneca in its discretion, AstraZeneca is entitled to receive a mid-single digit royalty on our worldwide net sales of AZD7970 and a high-single digit percentage of the amounts received by us from a third party in consideration for a license to such third party to exploit AZD7970, in each case until AstraZeneca recovers an amount equal to specified development costs incurred by AstraZeneca under the 2017 AZ Agreement with respect to AZD7970 prior to such termination. Such percentages increase by a low to mid-single digit amount to the extent such termination occurs after such product achieves a specified stage of development.

Merck (NYSE: MRK)—Strategic Alliances in Infectious Diseases and Cancer Vaccines

We have established a multi-faceted relationship with Merck Sharp & Dohme Corp., or Merck, that includes distinct strategic alliances directed to the research, development, and commercialization of mRNA medicines for the prevention and treatment of viral infections and for the treatment of cancer. Merck has also made several equity investments in Moderna totaling approximately $182.0 million.

2015 Strategic Alliance with Merck—Infectious Disease

In January 2015, we entered into a Master Collaboration and License Agreement with Merck, which we refer to as the 2015 Merck Agreement, to research, develop, and commercialize potential mRNA medicines for the prevention and treatment of infections by RSV and three additional undisclosed viruses. Pursuant to the 2015 Merck Agreement, Merck is primarily responsible for research, development and commercialization activities and associated costs. We are responsible for designing and manufacturing all mRNA constructs for preclinical and Phase 1 and Phase 2 clinical development purposes, and Merck pays us for such manufacture. Responsibility for manufacturing mRNA constructs for late stage clinical development and commercialization purposes is to be determined.

The focus of the initial four-year period of the 2015 Merck Agreement, ending in January 2019, is the discovery and development of mRNA vaccines and antibodies directed to the four viruses that are the subject of the 2015 Merck Agreement. The 2015 Merck Agreement also includes an additional three-year period during which Merck may continue to preclinically and clinically develop product candidates that arise from the initial four-year research period. Merck may, prior to the end of the seventh year of the 2015 Merck Agreement, elect to exclusively develop and commercialize up to five product candidates.

During the four-year discovery and development phase of the alliance, we and Merck will work exclusively with each other to develop potential mRNA medicines for the prevention and treatment of infections by the four viruses that are the subject of the 2015 Merck Agreement. Additionally, we and Merck have agreed to certain defined exclusivity obligations following the four-year discovery and development phase of the alliance.

Under the terms of the 2015 Merck Agreement, we received a $50.0 million upfront payment. We are eligible to receive, on a product-by-product basis, up to $300.0 million in aggregate milestone payments upon the achievement of certain development, regulatory and commercial milestone events. To date, we have received from Merck a clinical milestone payment of $5.0 million with respect to the initiation of a Phase 1 clinical trial for a Merck RSV vaccine product candidate. On a product-by-product basis, we are also entitled to receive
royalties on Merck’s net sales of products at rates ranging from the mid-single digits to low teens, subject to certain reductions, with an aggregate minimum floor. Additionally, concurrent with entering into the 2015 Merck Agreement, Merck made a $50.0 million equity investment in us.

Unless earlier terminated, the 2015 Merck Agreement will continue on a product-by-product and country-by-country basis for so long as royalties are payable by Merck on a given product in a given country. Either party may terminate the 2015 Merck Agreement upon the other party’s material breach, either in its entirety or with respect to a particular program, product candidate, product or country, subject to specified notice and cure provisions. Merck may terminate the 2015 Merck Agreement in full or with respect to a particular product candidate or product upon certain advance notice to us for any reason, or earlier if Merck determines the alliance or product is no longer commercially practicable. If Merck has the right to terminate the 2015 Merck Agreement, in its entirety or with respect to a program, product candidate or product, for our material breach, then Merck may elect, in lieu of terminating the 2015 Merck Agreement, to have the 2015 Merck Agreement remain in effect, subject to reductions in certain payments we are eligible to receive with respect to the terminable rights. Upon a termination of the 2015 Merck Agreement with respect to a program, all licenses and other rights granted to Merck with respect to such program will terminate and the continued development and commercialization of product candidates and products will revert to us. If the 2015 Merck Agreement is terminated with respect to a given product candidate or product, all licenses and other rights granted to Merck with respect to such product candidate or product will terminate and, to the extent we terminated for Merck’s breach, Merck will grant us licenses under select Merck technology for our continued development and commercialization of such product candidate or product.

2016 Expansion of the Infectious Disease Strategic Alliance with Merck

In January 2016, we expanded our infectious disease strategic alliance with Merck. Specifically, we agreed to amend the original 2015 Merck Agreement to include the research, development, and commercialization of mRNA medicines for the prevention and treatment of infection by the varicella zoster virus in place of one of the viruses initially included under the 2015 Merck Agreement. Under the terms of the amended 2015 Merck Agreement, we received an upfront payment of $10.0 million from Merck for the inclusion of the new program and we agreed with Merck to increase the tiered royalty rates ranging from the mid-single digits to low-teens for net sales of products directed to this virus.

2016 Cancer Vaccine Strategic Alliance—Personalized mRNA Cancer Vaccines with Merck

In June 2016, we entered into a personalized mRNA cancer vaccines (PCV) Collaboration and License Agreement with Merck, which we refer to as the PCV Agreement, to develop and commercialize PCVs for individual patients using our mRNA vaccine and formulation technology. Under the strategic alliance, we identify genetic mutations present in a particular patient’s tumor cells, synthesize mRNA for these mutations, encapsulate the mRNA in one of our proprietary LNPs and administer to each patient a unique mRNA cancer vaccine designed to specifically activate the patient’s immune system against her or his own cancer cells.

Pursuant to the PCV Agreement, we are responsible for designing and researching PCVs, providing manufacturing capacity and manufacturing PCVs, and conducting Phase 1 and Phase 2 clinical trials for PCVs, alone and in combination with KEYTRUDA (pembrolizumab), Merck’s anti-PD-1 therapy, all in accordance with an agreed upon development plan and budget. We received an upfront payment of $200.0 million from Merck, which we will use to fund the performance of our activities set forth in the agreed upon development plan and budget. In November 2017, we and Merck announced the achievement of a key milestone for the first-in-human dosing of a PCV (mRNA-4157) as a part of the alliance. The Phase 1 open-label, dose-escalation, multicenter clinical trial in the United States (KEYNOTE-603) is designed to assess the safety, tolerability and immunogenicity of mRNA-4157 alone in subjects with resected solid tumors and in combination with KEYTRUDA, in subjects with unresectable solid tumors.

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Until the expiration of a defined period of time following our completion of Phase 1 and Phase 2 clinical trials for PCVs under the PCV Agreement and delivery of an associated data package to Merck, Merck has the right to elect to participate in future development and commercialization of PCVs by making a $250.0 million participation payment to us. If Merck exercises its election and pays the participation payment, then the parties will equally co-fund subsequent clinical development of PCVs, with Merck primarily responsible for conducting clinical development activities under a jointly agreed development plan and budget. Each party may also conduct additional clinical trials for PCVs that are not included in the jointly agreed development plan and budget, in which case the non-conducting party will reimburse the conducting party for half of the total costs for such trials, plus interest, from its share of future profits resulting from sales of such PCVs, if any. Merck will lead worldwide commercialization of PCVs, subject to Moderna’s option to co-promote PCVs in the United States, and the parties will equally share the profits or losses arising from worldwide commercialization. Until a PCV becomes profitable, we may elect to defer payment of our share of the commercialization and related manufacturing costs and instead reimburse Merck for such costs, plus interest, from our share of future profits resulting from sales of such PCV, if any. Subject to customary “back-up” supply rights granted to Merck, we will manufacture (or have manufactured) PCVs for preclinical and clinical purposes. Manufacture of PCVs for commercial purposes will be determined by the parties in accordance with the terms of the PCV Agreement.

If Merck does not exercise its right to participate in future development and commercialization of PCVs, then we will retain the exclusive right to develop and commercialize PCVs developed during the strategic alliance, subject to Merck’s rights to receive a percentage in the high teens to the low 20s, subject to reductions, of our net profits on sales of such PCVs. During a limited period following such non-exercise, Merck has the right to perform clinical trials of such PCVs in combination with KEYTRUDA, for which we agree to use reasonable efforts to supply such PCVs. During such limited period, we also have the right to perform clinical studies of PCVs in combination with KEYTRUDA, for which Merck agrees to use reasonable efforts to supply KEYTRUDA. In addition, following its non-exercise, Merck is also entitled to receive a percentage in the high teens to the low 20s, subject to reductions, of our net profits on sales of certain PCVs first developed by us following such non-exercise and reaching a specified development stage within a defined period of time.

We and Merck have agreed to certain defined, limited exclusivity obligations with respect to the development and commercialization of PCVs.

2018 Expansion of the Cancer Vaccine Strategic Alliance with Merck—Shared Neoepitope Cancer Vaccines

In April 2018, we and Merck agreed to expand our cancer vaccine strategic alliance to include the development and commercialization of our KRAS vaccine development candidate, mRNA-5671, and potentially other shared neoantigen mRNA cancer vaccines (SAVs). We preclinically developed mRNA-5671 prior to its inclusion in the cancer vaccine strategic alliance and it is comprised of novel mRNA constructs designed by us and encapsulated in one of our proprietary LNPs. The PCV Agreement was amended and restated to include the new SAV strategic alliance, which we refer to as the PCV/SAV Agreement.

We and Merck have agreed to certain exclusivity obligations with respect to SAVs and particular SAV programs, which obligations are subject to termination or expiration upon certain triggering events.

Under the PCV/SAV Agreement, Merck will be responsible for conducting Phase 1 and Phase 2 clinical trials for mRNA-5671 and for all costs associated with such activities, in accordance with a jointly agreed development plan and budget, and we will be responsible for manufacturing and supplying all mRNA-5671 required to conduct such trials and for all costs and expenses associated with such manufacture and supply. Under the PCV/SAV Agreement, our budgeted commitment for PCVs increased to $243.0 million. Until the expiration of a defined period of time following our completion of Phase 1 and Phase 2 clinical trials for mRNA-5671 under the PCV/SAV Agreement and delivery of an associated data package to Merck, Merck has the right to elect to participate in future development and commercialization of mRNA-5671 by making a participation payment to us. If Merck exercises its participation rights, then the parties will equally co-fund subsequent clinical
development of mRNA-5671, with Merck primarily responsible for conducting clinical development activities under a jointly agreed development plan and budget. If Merck declines to participate in future development and commercialization activities following the initial Phase 1 and Phase 2 clinical trials for mRNA-5671, then we will retain the rights to develop and commercialize mRNA-5671. If Merck elects to participate in future development and commercialization of mRNA-5671, Merck may also conduct additional clinical trials for mRNA-5671 that are not included in the jointly agreed development plan and budget, in which case we will reimburse Merck for half of the total development costs for such clinical trials, plus interest, from our share of future profits resulting from sales of mRNA-5671, if any. Merck will lead worldwide commercialization of mRNA-5671, subject to our option to co-promote mRNA-5671 in the United States, and the parties will equally share the profits or losses arising from worldwide commercialization. Until mRNA-5671 becomes profitable, we may elect to defer payment of our share of the commercialization and related manufacturing costs and instead reimburse Merck for such costs, plus interest, from our share of future profits resulting from sales of mRNA-5671, if any. Subject to “back-up” supply rights granted to Merck, we will manufacture (or have manufactured) mRNA-5671 and other SAVs for preclinical and clinical purposes. After Merck exercises its right to participate in future development and commercialization of mRNA-5671 and other SAVs, the parties are obligated to discuss responsibility for future manufacturing, giving consideration to applicable criteria.

Pursuant to the PCV/SAV Agreement, for a defined period of time, either party may propose that the parties conduct additional programs for the research and development of SAVs directed to different shared neoantigens. If the parties agree to conduct any such programs, then we will be responsible for conducting and funding pre-clinical discovery and research activities for such SAVs, and otherwise the programs would be conducted on substantially the same terms as the mRNA-5671 program. If we or Merck propose a new SAV program and the other party does not agree to conduct such program, then the PCV/SAV Agreement includes provisions allowing the proposing party to proceed with such development, at the proposing party’s expense. In such case, the non-proposing party will have the right to opt-in to such SAV program any time before the proposing party commits to performing Good Laboratory Practice (GLP)-toxicity studies. Until the expiration of a defined period of time following our completion of Phase 1 and Phase 2 clinical trials for any SAV program mutually agreed by the parties under the PCV/SAV Agreement and delivery of an associated data package to Merck, Merck has the right to elect to participate in future development and commercialization of such SAV by making a participation payment to us.

Unless earlier terminated, the PCV/SAV Agreement will continue on a program-by-program basis until Merck terminates its participation in such program. Following any such termination, we will retain the exclusive right to develop and commercialize PCVs or SAVs developed as a part of such program, subject to restrictions and certain limited rights retained by Merck.

In connection with the amendment of the PCV Agreement to include the development and commercialization of mRNA-5671 and potentially other SAVs, Merck made a $125.0 million equity investment in us.

Vertex (Nasdaq: VRTX)—2016 Strategic Alliance in Cystic Fibrosis

In July 2016, we entered into a Strategic Collaboration and License Agreement, with Vertex Pharmaceuticals Incorporated, and Vertex Pharmaceuticals (Europe) Limited, together, Vertex, which we refer to as the Vertex Agreement. The Vertex Agreement is aimed at the discovery and development of potential mRNA medicines for the treatment of cystic fibrosis, or CF, by enabling cells in the lungs of people with CF to produce functional CFTR proteins.

Pursuant to the Vertex Agreement, we lead discovery efforts during a three-year research period, leveraging our Platform technology and mRNA delivery expertise along with Vertex’s scientific experience in CF biology and the functional understanding of CFTR. Vertex is responsible for conducting development and commercialization activities for candidates and products that arise from the strategic alliance, including the costs associated with such activities. Vertex is also obligated to pay us for research services in connection with our performance of
activities during the research period in accordance with a jointly agreed research plan. Subject to customary “back-up” supply rights granted to Vertex, we exclusively manufacture (or have manufactured) mRNA for pre-clinical, clinical, and commercialization purposes.

Under the terms of the Vertex Agreement, we received a $20.0 million upfront payment from Vertex. Vertex has the right to extend the initial three-year research period by one additional year by making an additional payment to us. We are eligible to receive up to $275.0 million in aggregate milestone payments upon the achievement of certain development and regulatory milestone events, and Vertex will also pay us tiered royalties at rates ranging from the low- to high-teens on worldwide net sales of products arising from the strategic alliance, subject to certain reductions, with an aggregate minimum floor. In connection with the strategic alliance, Vertex also made a $20.0 million equity investment in us.

During the term of the Vertex Agreement, we and Vertex have agreed to certain defined exclusivity obligations under the Vertex Agreement with respect to the development and commercialization of certain mRNA medicines.

Unless earlier terminated, the Vertex Agreement will continue until the expiration of all royalty terms. Vertex may terminate the Vertex Agreement for convenience upon 90 days’ prior written notice, except if termination relates to a product in a country where Vertex has received marketing approval, which, in such case, Vertex must provide 180 days’ prior written notice. Either party may terminate the Vertex Agreement upon the other party’s material breach, subject to specified notice and cure provisions. Each party may also terminate the Vertex Agreement in the event that the other party challenges the validity or enforceability of such party’s patent rights, subject to certain exceptions, or if the other party becomes insolvent.

Alexion (Nasdaq: ALXN)—2014 Alliance in Rare Diseases

In January 2014, we entered into an Option Agreement and a related Services and Collaboration Agreement, which we refer to as the 2014 Alexion Agreements, with Alexion Pharma Holding Unlimited Company (Alexion) to research, develop, and commercialize potential therapeutic mRNA medicines for the treatment of certain rare diseases. Pursuant to the 2014 Alexion Agreements, we granted certain licenses to Alexion and we provided specified research and manufacturing services pursuant to an agreed upon services plan. Under the 2014 Alexion Agreements, Alexion could have requested we provide additional services, at Alexion’s expense, following the end of the research and evaluation period. Under the terms of the 2014 Alexion Agreements, we received an upfront payment of $100.0 million from Alexion. On July 27, 2017, Alexion exercised its right to terminate the 2014 Alexion Agreements without cause. At the time of termination, Alexion had not exercised any options to acquire rights to develop and commercialize any products. Upon the termination of the 2014 Alexion Agreements, all rights to mRNA researched, developed, or supplied as a part of the programs under the 2014 Alexion Agreements reverted back to us. During the term of the 2014 Alexion Agreements, the parties were subject to certain exclusivity obligations. Additionally, Alexion has made equity investments in us totaling $37.5 million through September 30, 2018.

Strategic alliances with government organizations and foundations

Defense Advanced Research Projects Agency (DARPA)

In October 2013, DARPA awarded Moderna up to approximately $25 million under Agreement No. W911NF-13-1-0417 to research and develop potential mRNA medicines as a part of DARPA’s Autonomous Diagnostics to Enable Prevention and Therapeutics, or ADEPT, program, which is focused on assisting with the development of technologies to rapidly identify and respond to threats posed by natural and engineered diseases and toxins. As of October 31, 2018, $19.7 million of the award amount has been funded. This award followed an initial award from DARPA of approximately $1.4 million given in March 2013 under Agreement No. W31PQQ-13-1-0007. The DARPA awards have been deployed primarily in support of our vaccine and antibody programs to protect against Chikungunya infection.
Biomedical Advanced Research and Development Authority (BARDA)

In September 2016, we received an award of up to approximately $125 million under Agreement No. HHSO100201600029C from BARDA, a component of the Office of the Assistant Secretary for Preparedness and Response, or ASPR, within the U.S. Department of Health and Human Services, or HHS, to help fund our Zika vaccine program. Under the terms of the agreement with BARDA, an initial base award of approximately $8 million supported toxicology studies, a Phase 1 clinical trial, and associated manufacturing activities. Additionally, four contract options were awarded under the agreement with BARDA. Three out of four of these options have been exercised, bringing the total current award to approximately $117 million to support an additional Phase 1 study of an improved Zika vaccine candidate, Phase 2 and Phase 3 clinical studies, as well as large-scale manufacturing for the Zika vaccine.

The Bill & Melinda Gates Foundation

In January 2016, we entered a global health project framework agreement with the Bill & Melinda Gates Foundation to advance mRNA-based development projects for various infectious diseases. The Bill & Melinda Gates Foundation has committed up to $20.0 million in grant funding to support our initial project related to the evaluation of antibody combinations in a preclinical setting as well as the conduct of a first-in-human Phase 1 clinical trial of a potential mRNA medicine to help prevent human immunodeficiency virus, or HIV, infections. Follow-on projects which could bring total potential funding under the framework agreement up to $100.0 million (including the HIV antibody project) to support the development of additional mRNA-based projects for various infectious diseases can be proposed and approved until the sixth anniversary of the framework agreement, subject to the terms of the framework agreement, including our obligation to grant to the Bill & Melinda Gates Foundation certain non-exclusive licenses.
INTELLECTUAL PROPERTY

Our patent estate and approach, a strategic asset

Since our inception, we have considered the creation and building of our intellectual property, or IP, portfolio as a critical part of our mission. We make every effort to protect IP, having filed over 1,500 patent applications between 2010 and present. In a relatively short amount of time, we have built a significant patent estate that includes over 580 world-wide pending patent applications and over 100 issued or allowed U.S. and foreign patents covering key components of our proprietary platform technology, investigational medicines, and development candidates. The figure below shows our internally-developed estate and indicates the number of patents approved since 2010.

We regularly identify inventions and trade secrets as we surmount various challenges with our platform to create modalities. We seek to protect our proprietary position by, among other means, filing U.S. and certain foreign patent applications related to our platform, modality, and program inventions. Our company trade secrets and know-how are appropriately guarded to maintain our business advantage. We also seek to identify and obtain third party licenses where useful to maintain our advantageous IP position in the mRNA medicines field. We seek to obtain and maintain, and intend to strategically enforce, patents in appropriate jurisdictions for our platform technologies, modalities, and programs, in particular, in instances where insurmountable business competition threatens advancement of future commercial products. As part of our IP strategy, we seek to reduce the IP footprint of others through post-grant proceedings, in particular, in the U.S. and European patent offices.

Protecting our platform, modality and program investments: Building an expansive, multi-layered IP estate

We have built a substantial IP estate that includes numerous patents and patent applications related to the development and commercialization of mRNA vaccine and therapeutic development candidates, including related platform technologies. Our platform IP protects advances in mRNA design and engineering, proprietary LNP components, delivery systems, processes for the manufacture and purification of drug substances and products, and analytical methods. A significant portion of our platform IP estate further provides multi-layered protection for our modalities and programs.

With respect to our platform, and as of October 25, 2018, our solely-owned patent portfolio consists of more than 70 issued or allowed U.S. patents or patent applications and approximately 180 pending U.S. patent applications covering certain of our proprietary platform technology, inventions, and improvements, and covering key aspects of our clinical and most advanced development candidates, as well as more than 30 granted patents in jurisdictions outside of the United States and more than 400 patent applications pending in jurisdictions outside

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of the United States that, in many cases, are counterparts to the foregoing U.S. patents and patent applications. The patents and patent applications outside of the United States are held primarily in Europe, Canada, Japan, and Australia, although some of our key patent families are filed in a larger number of countries including several South American and Asian jurisdictions.

As of October 25, 2018, most of the patents and applications (if issued) in our portfolio have or will have expiry dates extending out to 2033 at the earliest and at least 2038 for patents ultimately granting based on recently-filed patent applications.

We also rely on trademarks, trade secrets, and know-how relating to our proprietary technology and programs, continuing innovation, and in-licensing opportunities to develop, strengthen, and maintain our proprietary position in the field of mRNA therapeutic and vaccine technologies. We additionally plan to rely on data exclusivity, market exclusivity, and patent term extensions when available, and plan to seek and rely on regulatory protection afforded through orphan drug designations. We also possess substantial proprietary know-how associated with related manufacturing processes and expertise.

Our commercial success may depend in part on our ability to obtain and maintain patent and other proprietary protection for our technology, inventions, and improvements; to preserve the confidentiality of our trade secrets; to maintain our licenses to use intellectual property owned by third parties; to defend and enforce our proprietary rights, including our patents; and to operate without infringing on the valid and enforceable patents and other proprietary rights of third parties. We cannot be sure that patents will be granted with respect to any patent applications we have filed or may file in the future, and we cannot be sure that any patents that have been granted or may be granted to us in the future will not be challenged, invalidated, or circumvented or that such patents will be commercially useful in protecting our technology.

In circumstances where we rely on trade secrets or proprietary know-how to protect our technology, we seek to protect such IP, in part, by entering into confidentiality agreements with those who have access to our confidential information, including our employees, contractors, consultants, collaborators, partners and advisors. We also internally designate levels of sensitive information with certain groups within the company. We also seek to preserve the integrity and confidentiality of our trade secrets or proprietary know-how by maintaining physical security of our premises and physical and electronic security of our information technology systems. Although we have confidence in these individuals, organizations, and systems, agreements or security measures may be breached and we may not have adequate remedies for any breach. In addition, our trade secrets or proprietary know-how may otherwise become known or may be independently discovered by competitors. To the extent that our employees, contractors, consultants, collaborators, and advisors use intellectual property owned by others in their work for us, disputes may arise as to the rights in related or resulting know-how and inventions. For this and more comprehensive risks related to our proprietary technology, inventions, improvements and product candidates, please see the section titled “Risk Factors—Risks related to our intellectual property.”

Supporting an expansive IP estate within our digital capabilities

Moderna has invested significantly in its digital infrastructure for advancing the development and protection of a new category of medicines. Our advanced digital systems and resources allow us to run experiments not only to advance drug development, but to support and strengthen our IP filings. Using digital technologies, we are able to run enabling experiments faster and at scale to advance mRNA design, delivery, manufacturing, and analytical technologies and to help generate data to potentially protect this new category.

We also utilize automated processes to identify and follow the intellectual property of other parties competing in the mRNA medicines space. These efforts include the tracking of various competitor intellectual property by program and by company.

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1. Protecting a new category of medicines

Our IP protection involves the creation and maintenance of a patent estate covering a new category of medicines. As such, we file for patent protection around mRNA chemistry, enabling delivery formulations and manufacturing processes, for example, processes that enable large-scale commercial production of formulated mRNA drug products. A schematic of our approach is shown in the figure below.

2. Intellectual property protecting our platform

We have a broad IP estate covering key aspects of our platform. This estate provides multiple layers of protection covering the making and use of the mRNA drug substance and delivery technologies.

Our platform IP includes patent coverage of key components for this category of medicines that features informatics-based approaches to the design and synthesis of mRNA molecules. We have also identified compositions we believe are protectable with this approach.

With respect to our platform, we have a portfolio that includes approximately 65 issued U.S. patents, more than 115 pending U.S. patent applications, approximately 30 granted foreign patents and more than 200 pending foreign patent applications cover platform innovations that are directly related to the design, formulation and manufacturing of mRNA medicines.

For example, these patents and patent applications include claims directed to:

- mRNA chemistry imparting improved properties for vaccine and therapeutic uses;
- methods for mRNA sequence optimization to enhance the levels and fidelity of proteins from our mRNA medicines;
- methods for identifying epitopes having superior suitability in cancer vaccine contexts;
- engineering elements tailored to enhance stability and the \textit{in vivo} performance of mRNA medicines;
- proprietary lipid nanoparticle, or LNP, delivery systems, including novel lipid components designed for optimal expression of both therapeutic and vaccine mRNAs, in particular, prophylactic infectious disease and cancer vaccine mRNAs, intratumoral immuno-oncology therapeutics, local regenerative therapeutics, systemic secreted therapeutics, and systemic intracellular therapeutics; and
- innovative processes for the manufacture and analysis of mRNA drug substance and formulated drug product.
Representative patents and patent applications directed to key platform advancements include the following. These are highlighted from within our numerous platform patent families, as they are believed to provide additional patent protection for our various modalities and for many, if not all of, the development candidates in our pipeline.

- three issued U.S. patents (U.S. 9,334,328, U.S. 9,657,295 and U.S. 10,064,959), and in addition to pending U.S. and European patent applications that feature the making of chemically modified mRNAs having reduced immuno-stimulatory properties, in particular, reduced stimulation of undesirable innate immune responses;
- three issued U.S. patents (U.S. 8,710,200, U.S. 9,533,047 and U.S. 9,950,068) and a granted Japanese patent (JP 5981615) as well as pending Canadian, Japanese, U.S., European and Australian patent applications that feature chemically-modified mRNAs having the above properties, formulated in lipid nanoparticles, for in vivo use;
- an issued U.S. patent (U.S. 9,428,535), two granted Japanese patents (JP 6113737 and JP 6388977), a granted Australian patent (AU 2012318752) and several additional U.S. and foreign pending applications directed to chemically modified mRNAs and uses of such mRNAs in producing enhanced protein expression in vivo combined with reduced immune stimulation;
- two issued U.S. patents (U.S. 9,751,925 and U.S. 10,072,057), a European patent intended for grant (EP 3 041 948), and pending U.S. and European patent applications directed to an alternative mRNA chemistry having substantially reduced immunogenicity;
- an issued U.S. patent (U.S. 9,597,380), two granted Japanese patents (JP 6144355 and 6377804), a granted Australian patent (AU 201348363), pending European, Canadian, Japanese, Australian and U.S. patent applications that feature mRNAs under the control of tissue-specific microRNA regulation, and one U.S. patent application is recently allowed and soon to issue and broadly claims chemically modified mRNAs engineered to include any microRNA binding site to facilitate tissue-specific regulations;
- issued U.S. patents featuring proprietary lipid nanoparticle components, in particular, cationic lipids featured in many of our vaccine and therapeutic mRNA compositions (U.S. 9,868,691 and U.S. 9,868,692), in addition to other issued and pending patent applications directed to alternative lipid components suitable for use in lipid nanoparticle formulations of mRNA; and
- a patent family including pending applications in Australia, Canada, Europe, Japan and the United States directed to novel lipid nanoparticle compositions and methods for therapeutic use of such compositions, particularly, for repeat dosing of therapeutic mRNAs.

3. Intellectual property protecting investigational medicines and development candidates

Our IP estate provides protection for the multiple programs within our modalities both at the product-specific level and at various broader levels. For example, we have patent coverage for LNP-encapsulated mRNAs having specific chemical modification suited for vaccine and therapeutic mRNA use. Our estate also includes pending and issued patents that feature proprietary lipid components and LNP-formation processes. We also have IP covering certain LNP-encapsulated mRNAs coding for infectious disease antigens for use in prophylactic vaccination. Many individual development candidates are protected at the mRNA sequence level and at the level of the encoded antigen. Moreover, broad method claims cover specific methods of synthesizing mRNAs, for example, using improved enzymatic processes, methods of making LNPs, and methods for improved and efficient encapsulation of mRNA to formulate mRNA medicines.

Our patent portfolio for our investigational medicines and development candidates features five issued or scheduled-to-issue patents, and more than 150 pending applications, with approximately 25 pending U.S. patent applications and approximately 130 pending foreign patent applications directed to our development candidates.
For each development program, we have one or more patent applications pending and in certain instances, for example, for our mRNA vaccines, we have obtained composition-of-matter and method of use claims in the United States. Our mRNA chemistry, formulation and manufacturing patent applications and related know-how and trade secrets may also provide us with additional intellectual property protection relating to our development candidates.

4. IP protection from a modality perspective

Prophylactic vaccines

For programs within our prophylactic vaccines modality, we typically pursue patent protection featuring composition of matter and method of use claims. Our global patent protection strategy may vary based on the unique geographic prevalence of various infectious diseases.

Our earliest investigational medicines in the infectious disease pipeline, vaccines containing mRNA encoding HA antigens including H10 and H7, for the prevention of human infection with the influenza H10N8 or H7N9 avian influenza A viruses, respectively, are protected by a patent family that includes two issued U.S. patents, three pending U.S. patent applications and pending patent applications in each of Europe, Japan, Canada, Australia, Brazil, China, Hong Kong, India, Japan, Russia, and Singapore. Issued U.S. Patent No. 9,872,900 features claims to H10 and H7 mRNA vaccine compositions. A request for ex parte reexamination of U.S. Patent No. 9,872,900 was filed July 16, 2018. Issued U.S. Patent No. 10,022,435 features claims directed to methods of vaccinating subjects against infection with the lipid nanoparticle-encapsulated mRNAs encoding infectious disease antigens. Also pending is a PCT application covering certain prophylactic vaccination methods relating to our influenza H10N8 or H7N9 mRNA vaccines.

We have two collaborations for infectious disease vaccines, an RSV vaccine and a VZV vaccine, that have extensive patent coverage, each vaccine having two pending PCT applications and over 30 pending patent applications outside the United States, for example, in several African, Asian, European, Middle Eastern, South American and other jurisdictions.

Patent coverage for our human CMV vaccine, which includes mRNAs encoding several surface glycoproteins of the CMV virus, can be found in one pending PCT application, pending applications in Australia, Canada, Europe, Japan, and the United States, and in one issued U.S. patent. U.S. Patent No. 10,064,935 features claims relating to a combination of mRNAs encoding 6 key surface glycoproteins of the CMV virus.

Patent applications directed to our hMPV+PIV3 vaccine have been filed internationally. The patent family features an issued U.S. patent, a pending U.S. patent application, a pending PCT application, and pending patent applications in at least a half dozen countries throughout Asia, the Middle East, and South America. Issued U.S. Patent No. 10,064,934 has claims covering LNP-encapsulated mRNA vaccines that encode the PIV3 and hMPV fusion proteins.

Our Chikungunya and Zika mRNA vaccines are covered in a patent family directed to various mosquito-borne viruses. This patent family includes seven pending U.S. patent applications, two of which are recently allowed and soon to be issued as U.S patents, a PCT application, and two pending European applications, as well as several additional applications filed in various Asian and South American jurisdictions.

Cancer vaccines

Composition of matter and method claims also protect programs within our cancer vaccines modality. Proprietary methods around the making and therapeutic use of our PCVs and resulting vaccine compositions are described and claimed in, a pending U.S. provisional patent application two pending U.S. patent applications, a PCT application, two pending European patent applications, and a pending patent application in each of
Australia, Canada, China, and Japan. These applications also relate to various vaccine design formats, in particular, polyepitopic vaccine formats, and methods of treating cancer with such personalized cancer vaccines. We also possess substantial know-how and trade secrets relating to the development and commercialization of our cancer vaccine programs, including related manufacturing process and technology.

Likewise, our KRAS antigen cancer vaccine and methods of treating cancer featuring such vaccines are covered in one pending U.S. patent application and two pending PCT applications.

**Intratumoral immuno-oncology**

To protect programs within our intratumoral immuno-oncology modality, we have filed numerous patent applications featuring claims to mRNAs encoding immune-stimulatory proteins and methods of treating cancer using such compositions.

Three of our immuno-oncology programs are designed to be administered intratumorally to alter the tumor microenvironment in favor of mounting an immune response against tumors. Our OX40L mRNA therapeutic and our mRNA program that includes mRNAs that encode OX40L, IL23 and IL36γ are covered by three pending U.S. patent applications, two of which are recently allowed and soon to be issued as U.S. patents, a pending European patent application and three pending PCT applications featuring claims to the mRNA therapeutics as compositions of matter, formulations that include such mRNAs and methods of reducing tumors and treating cancer featuring these development candidates. Similar claims cover our IL12 development candidate which can be found in a third pending PCT application.

**Localized regenerative therapeutics**

Our localized regenerative therapeutics modality is focused on regenerative therapeutics. Our sole program, VEGF-A, is being developed in collaboration with AstraZeneca and is covered by a pending PCT patent application and direct national phase patent applications filed in certain South American, Asian and Middle Eastern jurisdictions. The VEGF patent applications are solely-owned by Moderna.

**Systemic intracellular therapeutics**

Within our systemic intracellular therapeutics modality, we have three programs featuring expression of intracellular enzymes for the treatment of rare diseases. For our rare disease programs, we generally pursue patent protection featuring composition of matter and method of use claims, for example, pharmaceutical composition and method of treatment claims. Our most advanced rare disease development candidate, MMA, is covered by a patent family that includes a pending international patent application, and foreign patent applications filed in Australia, Canada, Japan, Europe, and the Middle East. Also pending are three U.S. patent applications having focused, product-specific claims for MMA, all of which are undergoing accelerated examination in the United States Patent Office.

For our PA development candidate, we have five U.S. provisional patent applications and a pending PCT patent application covering mRNA encoding the alpha and beta subunits of the enzyme propionyl-CoA carboxylase (PCCA and PCCB, respectively), for the treatment of PA.

For our PKU development candidate, we have two U.S. provisional patent applications covering mRNA encoding phenylalanine hydroxylase, or PAH, for the treatment of PKU.

Any U.S. and foreign patents that may issue from these three patent families would be expected to expire in 2036 for the earliest of the MMA patents and 2038 for the remaining MMA, PA, and PKU patents, excluding any patent term adjustments and any patent term extensions.
As further described below, we have filed or intend to file patent applications on these and other aspects of our technology and development candidates, and as we continue the development of our intended products, we plan to identify additional means of obtaining patent protection that would potentially enhance commercial success, including protection for additional methods of use, formulation, or manufacture.

**Systemic secreted therapeutics**

Our systemic secreted therapeutics modality features programs directed to expression of secreted proteins including antibodies, circulating modulation factors and secreted enzymes. Antibodies are featured in a passive vaccination approach we are developing to protect individuals against infectious disease viruses. In this regard, we are advancing an antibody against Chikungunya virus in the clinic and are seeking patent protection for this development candidate by way of three pending provisional patent applications, two in which we share joint ownership rights and one which is non-exclusively in-licensed.

Our Relaxin development candidate is being developed in collaboration with AstraZeneca and is covered by a pending PCT patent application and a pending U.S. application undergoing accelerated examination in the United States Patent Office.

For our Fabry development candidate, we have three pending U.S. patent applications undergoing accelerated examination and a pending international patent application covering mRNA encoding alpha-galactosidase A.

**Trademarks**

As of October 25, 2018, our registered trademark portfolio currently contains approximately 80 registered trademarks, consisting of at least 10 registrations in the United States and approximately 70 registrations in Australia, China, the EU, Japan, Singapore, Sweden, and under the Madrid Protocol. In addition, we have at least 50 pending trademark applications, consisting of approximately 20 trademark applications in the United States and at least 30 trademark applications in Australia, Canada, China, the EU, Italy, Japan, Singapore, and under the Madrid Protocol.

**In-licensed intellectual property**

While we develop and manufacture our potential mRNA medicines using our internally created mRNA technology platform, we also seek out and evaluate third party technologies and intellectual property that may be complementary to our platform. We have entered into over 20 material transfer agreements to test various agents. We in-license very few of them.

**Patent sublicense agreements with Cellscript and mRNA RiboTherapeutics**

The Trustees of the University of Pennsylvania, or Penn, owns nine issued U.S. patents and two pending U.S. patent applications directed, in part, to nucleoside-modified mRNAs and their uses, or the Penn Modified mRNA Patents. mRNA RiboTherapeutics, Inc., or MRT, obtained an exclusive license to the Penn Modified mRNA Patents and granted its affiliate, Cellscript, LLC, or Cellscript, a sublicense to the Penn Modified mRNA Patents in certain fields of use.

In June 2017, we entered into two sublicense agreements, one with Cellscript, and one with MRT, which agreements we collectively refer to as the Cellscript-MRT Agreements. Together, the Cellscript-MRT Agreements grant us a worldwide, sublicensable sublicense to the Penn Modified mRNA Patents to research, develop, make, and commercialize products covered by the Penn Modified mRNA Patents, or licensed products, for all in vivo uses in humans and animals, including therapeutic, prophylactic, and diagnostic applications. The Cellscript-MRT Agreements are non-exclusive, although Cellscript and MRT are subject to certain time restrictions on granting additional sublicenses for in vivo uses in humans under the Penn Modified mRNA Patents.

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We paid Cellscript and MRT aggregate sublicense grant fees of $28 million upon entering into the Cellscript-MRT Agreements and aggregate sublicense grant fees of $25 million in early 2018. We are required to pay Cellscript and MRT additional aggregate sublicense grant fees of $22 million in early 2019. Cellscript and MRT are collectively eligible to receive, on a licensed product-by-licensed product basis, milestone payments totaling up to $0.5 million upon the achievement of certain regulatory-based events for diagnostic products, and milestone payments totaling up to $1.5 million upon the achievement of certain development and regulatory-based events for either therapeutic or prophylactic products, and up to $24 million upon the achievement of certain commercial-based events for either therapeutic or prophylactic products. The Cellscript-MRT Agreements require us to pay royalties based on annual net sales of licensed products at rates in the low single digits for therapeutic, prophylactic, and diagnostic uses, and royalties based on annual net sales of licensed products sold for research uses at rates in the mid-single digits, subject to certain reductions, with an aggregate minimum floor. Following the first commercial sale of licensed products under a Cellscript-MRT Agreement, we are required to pay Cellscript or MRT, as applicable, minimum annual royalties ranging from $10,000—$400,000 depending on the use of such licensed product, with all such payments creditable against earned royalties on net sales.

The Cellscript-MRT Agreements will expire upon the expiration or abandonment of the last to expire or become abandoned of the Penn Modified mRNA Patents. Cellscript or MRT, as applicable, may terminate its respective Cellscript-MRT Agreement if we fail to make required payments or otherwise materially breach the applicable agreement, subject to specified notice and cure provisions. Cellscript or MRT, as applicable, may also terminate the applicable Cellscript-MRT Agreement upon written notice in the event of our bankruptcy or insolvency or if we challenge the validity or enforceability of the Penn Modified mRNA Patents. We have the right to terminate each Cellscript-MRT Agreement at will upon 60 days’ prior notice to Cellscript or MRT, as applicable, provided that we cease all development and commercialization of licensed products upon such termination. If rights to MRT or Cellscript under the Penn Modified mRNA Patents are terminated (e.g., due to bankruptcy of MRT or Cellscript), the terminated party will assign its interest in the respective Cellscript-MRT Agreement to the licensor from which it received rights under the Penn Modified mRNA Patents and our rights will continue under the new licensor.

**Formulation technology in-licenses**

Our development candidates use internally developed formulation technology that we own. We do, however, have rights to use and exploit multiple issued and pending patents covering formulation technologies under licenses from other entities. If in the future we elect to use or to grant our strategic collaborators sublicenses to use these in-licensed formulation technologies, we or our strategic collaborators may be liable for milestone and royalty payment obligations arising from such use. We consider the commercial terms of these licenses and their provisions regarding diligence, insurance, indemnification and other similar matters, to be reasonable and customary for our industry.

In addition, we have executed at least two dozen material transfer agreements that have provided us with opportunities to evaluate third party delivery systems.
PEOPLE AND CULTURE

We have approximately 680 full-time employees, more than 55% of whom hold Ph.D., M.D., J.D., or Master’s degrees. Among our employees, 45% identify as female, 54% identify as male, and <1% have chosen not to identify themselves or selected other. None of our employees is represented by a labor union, and none of our employees has entered into a collective bargaining agreement with us. We consider our employee relations to be good.

We believe that our employees are highly engaged, and we have for the last four years been recognized by surveys conducted by external groups. *Science* magazine ranked us as a top 10 employer for the last four years; we were ranked #5 in 2015, #3 in 2016, #6 in 2017, and #4 in 2018. We were also named a top workplace by the *Boston Globe* in 2016 and 2017.

Our approach to attracting and retaining talent within Moderna

We are committed to ensuring that our employees find that their careers at Moderna are filled with purpose, growth and fulfillment. We believe that a career at Moderna provides opportunity for:

- **Impact:** Our people will have the opportunity to do work that is unparalleled in terms of its innovation and scope of impact on people’s lives.
- **Growth:** For the intellectually curious, we provide incredible opportunities for growth. We invest in the development of our people as scientists and as leaders.
- **Wellness:** We are committed to the health and wellbeing of our employees and their families by providing family friendly benefits and opportunities to be healthy.
- **Inclusive environment:** We believe in the benefits of bringing together a diverse set of perspectives and backgrounds, and creating an environment where differences are celebrated and leveraged.
- **Compelling rewards:** To attract and retain the best talent, we provide competitive rewards that help to drive groundbreaking work and allow employees to share in the value we will create together.

Our approach to training our employees

We have established a structured training curriculum for our employees called Moderna University and have a full-time team dedicated to developing the curriculum and conducting activities for Moderna University. The objective of Moderna University is for every employee to be deeply familiar with our core technology and able to learn about technologies that might further enable our science. In addition, Moderna University is also focused on creating strong leaders within the company through management and leadership training. There are four core areas within Moderna University including:

- **Professional development:** Includes on-site training programs for our employees including for example, leadership, tools to improve interpersonal communication, and project management.
- **Digital learning library:** We have built an online library of videos of a variety of scientific material that our employees can access flexibly. This content includes:
  - Presentations by external speakers to scientific seminars conducted in-house;
  - Scientific courses at external universities; and
  - Peer-to-peer video series in which in-house experts provide an introductory view of complex topics they tackle within their teams.
- **Learning management system:** We have deployed a digital system to track and administer training programs for each of our employees. Training content is developed digitally and offered to our employees.
New hire orientation: This program is designed to onboard all new employees. During this training program, new employees meet with the management team and senior functional leaders to learn about the Company and functional activities.

Our systems to support our people
We have implemented the Workday system to provide an integrated platform to support employee benefits, payroll, and performance management. In addition, as described in the previous section, we have deployed a digital learning management system to deploy various training programs.
CORPORATE SOCIAL RESPONSIBILITY

In pursuit of our mission to deliver on the promise of mRNA science to create a new generation of transformative medicines for patients, we have scaled our operations, invested in research, and hired top-tier talent. As we continue to mature, we believe it is important to develop long-term programs that underscore our commitment to corporate social responsibility, or CSR.

As we continue to realize the promise of mRNA, our CSR efforts are driven by the beliefs that:

- With the potential of our science comes a responsibility to the many patients our technology could help, regardless of whether they have a disease shared by millions, or one that is unique to them alone.
- We have a responsibility to our employees to provide fulfilling careers that provide purpose and reward.
- We have a responsibility to do our part to ensure the sustainability of the planet, and we will consider our impact on the environment in the decisions that we make.
- We can and should use our expertise and resources to give back to the communities where we operate.
- We must hold ourselves to the highest ethical standards across all areas of our business, and with our stakeholders—both internally and externally—while ensuring we have the governance and practices in place to meet these standards.

We have five focus areas in CSR

1. Medicines for patients

Our central focus is to continue to develop safe and effective mRNA medicines for patients. We believe our mRNA platform and approach, and the infrastructure we are building, will enable us to research, develop, and manufacture medicines in new and potentially groundbreaking ways that could help a single patient with an individualized therapy, or millions of patients with infectious diseases.

We also believe our mRNA platform has the potential to play an important role in supporting those working to meet the needs of underserved populations. We are partnering with government agencies and private organizations to develop solutions to critical global public health challenges and to be able to respond rapidly to future pandemics. This includes our work to develop a novel Zika mRNA vaccine in collaboration with BARDA.

2. Employees

We believe that we will only achieve in our goals if we are able to attract and retain individuals of diverse backgrounds and of all ages, genders, ethnicities, religions, home countries, and sexual orientations. Our success relies on creating an inclusive environment where all of our employees can do their best work, and where each can play a vital role in achieving our goal of bringing new medicines to patients.

Moderna is also committed to our employees’ health, well-being, and job satisfaction, and to ensuring that people find their careers at here filled with purpose. Key employee programs focus on the following areas:

- Intellectual and professional growth;
- Health and wellness;
- Inclusive environment;
- Safety;
- Competitive benefits; and
- Structured human resources policies.
3. Environment

At Moderna, we are building a company that seeks to drive change through what we make and how we make it. With this in mind, we strive to mitigate human impact on the environment where possible and pursue innovative ways to grow our business while minimizing our environmental footprint. We also aim to put Moderna at the forefront of managing the impact of waste from our business and to minimize the natural resources we use, while supporting employees’ efforts and encouraging our peers to do the same.

The recent opening of our manufacturing facility in Norwood, MA represents one milestone in our efforts to integrate our business strategy with our CSR efforts. While our Cambridge team has always worked to limit our environmental footprint, in Norwood we had the opportunity to drive sustainable operations from the outset—from how we produce raw materials to the natural resources we use to support manufacturing. We built the site using materials and technologies that would make the building as sustainable as possible—both in the immediate future, and over the long term. Some examples include:

- reverse osmosis water systems to limit the water we use from the town, while also diverting water into cooling towers to help manage the building’s temperature;
- CO₂ sensors throughout the site to monitor air quality and reduce energy consumed to heat and cool the building;
- 100 percent LED lighting to reduce energy consumption. We are also optimizing the energy performance of our lighting by using sensors to keep lights off unless a room is in use;
- advanced energy metering systems that leverage data to optimize and control energy consumption over time;
- digital tools throughout the site that enable a paperless manufacturing environment;
- electric chargers for vehicles; and
- battery bank at the Norwood facility that will use the electric grid to charge itself during off-peak hours and discharge itself during peak hours. This will allow us to manage our peak electrical consumption, reduce our electrical costs, and reduce load for the utility company during peak hours.

4. Communities in which we operate

We are working to make Moderna an active contributor to the communities in which we operate so that we have a positive impact today and in the decades to come. We know that we hire talented and passionate people who are committed to making a difference in the world beyond our four walls— and many of our employees already contribute their time and expertise to causes and organizations in our region and beyond. As a company, we are proud to support these efforts. This includes providing our people with paid time off to volunteer at the organizations of their choice. Our employees have been a part of numerous campaigns and volunteer opportunities to support our local community, including at the Pine Street Inn, an organization that provides support for homeless men and women in the Boston area.

We will also leverage our collective strengths and expertise for community engagement. We are building on the initiatives that Moderna employees have started by growing our community involvement and engaging our core competencies in innovation and science, technology, engineering, and math. Beyond our impact on medicine and health, we are committed to using our capabilities to help foster the growth of future scientists, innovators, and technologists, particularly among those who may not be regularly exposed to science education and innovation curricula.

5. Corporate governance and ethics

The highest ethical standards are core to our future success—from our clinical trials, the manufacturing process and creating high-quality medicines, to how we conduct ourselves in our relationships with employees, patients, and other stakeholders.
We are developing our governance policies and structures to ensure that we always adhere to the highest standards of business and governance practices. Similarly, we expect each member of our team, and those business partners with which we engage, to meet our standards, comply with local laws and all regulations, and align with our Code of Conduct.
FACILITIES
We have two campuses in Massachusetts. We occupy a multi-building campus in Technology Square near the Kendall Square area in Cambridge, MA in multi-tenanted locations with a mix of offices and research laboratory space totaling 190,712 square feet. Kendall Square is the location of our corporate headquarters, platform, drug discovery, manufacturing process development, and clinical development. Our facilities in Kendall Square are leased and the lease expiry ranges from 2020 to 2027, with the majority of the space being leased through 2027. As per our agreements, we also have the option to extend the leases if needed.

We also have a 200,000 square foot manufacturing facility in Norwood, MA where manufacture of research grade mRNA and cGMP manufacture of clinical supplies commenced in July 2018. This facility is leased through 2032 and we have the option to extend it for two ten-year terms.

COMPETITION
The biotechnology and pharmaceutical industries utilize rapidly advancing technologies and are characterized by intense competition. There is also a strong emphasis on intellectual property and proprietary products.

We believe that mRNA as a medicine coupled with our capabilities across mRNA technology, drug discovery, development and manufacturing provide us with a competitive advantage. However, we will continue to face competition from different sources including major pharmaceutical companies, biotechnology companies, academic institutions, government agencies, and public and private research institutions. For any products that we eventually commercialize, we will not only compete with existing therapies but also compete with new therapies that may become available in the future.

We compete in the segment of pharmaceutical and biotechnology industries. There are additional companies that are working on potential mRNA medicines. Companies with clinical programs with mRNA include BioNTech, CureVac, eTheRNA Immunotherapies, and Translate Bio and those with preclinical programs include Arcturus Therapeutics, Ethris, Genevant Sciences, and GlaxoSmithKline.
GOVERNMENT REGULATION

Government authorities in the United States at the federal, state and local level and in other countries regulate, among other things, the research, development, testing, manufacture, quality control, approval, labeling, packaging, storage, record-keeping, promotion, advertising, distribution, post-approval monitoring and reporting, marketing and export and import of drug and biological products, such as our investigational medicines and any future investigational medicines. Generally, before a new drug or biologic can be marketed, considerable data demonstrating its quality, safety and efficacy must be obtained, organized into a format specific for each regulatory authority, submitted for review and approved by the regulatory authority.

U.S. drug and biological product development

In the United States, the FDA regulates drugs under the Federal Food, Drug, and Cosmetic Act, or FDCA, and its implementing regulations and biologics under the FDCA, the Public Health Service Act, or PHSA, and their implementing regulations. Both drugs and biologics also are subject to other federal, state and local statutes and regulations. The process of obtaining regulatory approvals and the subsequent compliance with applicable federal, state and local statutes and regulations requires the expenditure of substantial time and financial resources. Failure to comply with the applicable U.S. requirements at any time during the product development process, approval process or following approval may subject an applicant to administrative or judicial sanctions. These sanctions could include, among other actions, the FDA’s refusal to approve pending applications, withdrawal of an approval, license revocation, a clinical hold, untitled or warning letters, voluntary or mandatory product recalls, market withdrawals, product seizures, total or partial suspension of production or distribution, injunctions, fines, refusals of government contracts, restitution, disgorgement and civil or criminal penalties. Any agency or judicial enforcement action could have a material adverse effect on us.

Our investigational medicines and any future investigational medicines must be approved by the FDA through a BLA or NDA process before they may be legally marketed in the United States. The process generally involves the following:

- completion of extensive preclinical studies in accordance with applicable regulations, including studies conducted in accordance with GLP requirements;
- submission to the FDA of an IND application, which must become effective before human clinical trials may begin;
- approval by an IRB or independent ethics committee at each clinical trial site before each trial may be initiated;
- performance of adequate and well-controlled human clinical trials in accordance with applicable IND regulations, good clinical practice, or GCP, requirements and other clinical trial-related regulations to establish the safety and efficacy of the investigational product for each proposed indication;
- submission to the FDA of a BLA or an NDA;
- a determination by the FDA within 60 days of its receipt of a BLA or an NDA to accept the filing for review;
- satisfactory completion of one or more FDA pre-approval inspections of the manufacturing facility or facilities where the biologic or drug will be produced to assess compliance with cGMP requirements to assure that the facilities, methods and controls are adequate to preserve the biologic or drug’s identity, strength, quality and purity;
- potential FDA audit of the clinical trial sites that generated the data in support of the BLA or NDA;
- payment of user fees for FDA review of the BLA or NDA; and
- FDA review and approval of the BLA or NDA, including consideration of the views of any FDA advisory committee, prior to any commercial marketing or sale of the biologic or drug in the United States.
The preclinical and clinical testing and approval process requires substantial time, effort and financial resources, and we cannot be certain that any approvals for our investigational medicines and any future investigational medicines will be granted on a timely basis, or at all.

Preclinical studies

Before testing any biological or drug candidate, including our product candidates, in humans, the product candidate must undergo rigorous preclinical testing. Preclinical studies include laboratory evaluation of product chemistry and formulation, as well as in vitro and animal studies to assess the potential for adverse events and in some cases to establish a rationale for therapeutic use. The conduct of preclinical studies is subject to federal regulations and requirements, including GLP regulations for safety/toxicology studies. An IND sponsor must submit the results of the preclinical tests, together with manufacturing information, analytical data, any available clinical data or literature and plans for clinical studies, among other things, to the FDA as part of an IND. An IND is a request for authorization from the FDA to administer an investigational product to humans and must become effective before human clinical trials may begin. Some long-term preclinical testing may continue after the IND is submitted. An IND automatically becomes effective 30 days after receipt by the FDA, unless before that time the FDA raises concerns or questions related to one or more proposed clinical trials and places the trial on clinical hold. In such a case, the IND sponsor and the FDA must resolve any outstanding concerns before the clinical trial can begin. As a result, submission of an IND may not result in the FDA allowing clinical trials to commence.

Clinical trials

The clinical stage of development involves the administration of the investigational product to healthy volunteers or patients under the supervision of qualified investigators, generally physicians not employed by or under the trial sponsor’s control, in accordance with GCP requirements, which include the requirement that all patients provide their informed consent for their participation in any clinical trial. Clinical trials are conducted under protocols detailing, among other things, the objectives of the clinical trial, dosing procedures, subject selection and exclusion criteria and the parameters to be used to monitor subject safety and assess efficacy. Each protocol, and any subsequent amendments to the protocol, must be submitted to the FDA as part of the IND. Furthermore, each clinical trial must be reviewed and approved by an IRB for each institution at which the clinical trial will be conducted to ensure that the risks to individuals participating in the clinical trials are minimized and are reasonable in relation to anticipated benefits. The IRB also approves the informed consent form that must be provided to each clinical trial subject or his or her legal representative and must monitor the clinical trial until completed. There also are requirements governing the reporting of ongoing clinical trials and completed clinical trial results to public registries. Information about certain clinical trials, including clinical trial results, must be submitted within specific timeframes for publication on the www.clinicaltrials.gov website.

Where a gene therapy study is conducted at, or sponsored by, institutions receiving National Institutes of Health, or NIH, funding for recombinant DNA research, prior to the submission of an IND to the FDA, a protocol and related documentation are submitted to and the study is registered with the NIH Office of Science Policy, or OSP, pursuant to the NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules, or NIH Guidelines. Compliance with the NIH Guidelines is mandatory for investigators at institutions receiving NIH funds for research involving recombinant DNA; however, many companies and other institutions not otherwise subject to the NIH Guidelines voluntarily follow them. Pursuant to the NIH Guidelines, research involving recombinant or synthetic nucleic acid molecules must be approved by an institutional biosafety committee, or IBC, a local institutional committee that reviews and oversees basic and clinical research conducted at that institution. The IBC assesses the safety of the research and identifies any potential risk to public health or the environment. The NIH is responsible for convening the Recombinant DNA Advisory Committee, or RAC, a federal advisory committee that discusses protocols that raise novel or particularly important scientific, safety or ethical considerations, at one of its quarterly public meetings. The OSP will notify the FDA of the RAC’s decision regarding the necessity for full public review of a gene therapy protocol. RAC
proceedings and reports are posted to the OSP web site and may be accessed by the public. In August 2018, the NIH published a notice in the Federal Register to seek public comment on its proposal to amend the NIH Guidelines to streamline oversight for human gene transfer clinical research protocols and reduce duplicative reporting requirements while focusing the NIH Guidelines more specifically on biosafety issues associated with research involving recombinant or synthetic nucleic acid molecules. The notice included proposed amendments to eliminate RAC review and reporting requirements to NIH for human gene transfer research protocols and to modify the roles and responsibilities of investigators, institutions, IBCs, the RAC, and the NIH to be consistent with these goals.

A sponsor who wishes to conduct a clinical trial outside of the United States may, but need not, obtain FDA authorization to conduct the clinical trial under an IND. If a foreign clinical trial is not conducted under an IND, the sponsor may submit data from the clinical trial to the FDA in support of a BLA or NDA. The FDA will accept a well-designed and well-conducted foreign clinical study not conducted under an IND if the study was conducted in accordance with GCP requirements, and the FDA is able to validate the data through an onsite inspection if deemed necessary.

Clinical trials generally are conducted in three sequential phases, known as Phase 1, Phase 2 and Phase 3, and may overlap.

- **Phase 1 clinical trials** generally involve a small number of healthy volunteers or disease-affected patients who are initially exposed to a single dose and then multiple doses of the product candidate. The primary purpose of these clinical trials is to assess the metabolism, pharmacologic action, side effect tolerability, and safety of the product candidate.

- **Phase 2 clinical trials** generally involve studies in disease-affected patients to evaluate proof of concept and/or determine the dosing regimen(s) for subsequent investigations. At the same time, safety and further pharmacokinetic and pharmacodynamic information is collected, possible adverse effects and safety risks are identified, and a preliminary evaluation of efficacy is conducted.

- **Phase 3 clinical trials** generally involve a large number of patients at multiple sites and are designed to provide the data necessary to demonstrate the effectiveness of the product for its intended use, its safety in use and to establish the overall benefit/risk relationship of the product, and provide an adequate basis for product labeling.

In August 2018, the FDA released a draft guidance entitled “Expansion Cohorts: Use in First-In-Human Clinical Trials to Expedite Development of Oncology Drugs and Biologics,” which outlines how drug developers can utilize an adaptive trial design commonly referred to as a seamless trial design in early stages of oncology drug development, i.e., the first-in-human clinical trial, to compress the traditional three phases of trials into one continuous trial called an expansion cohort trial. Information to support the design of individual expansion cohorts are included in IND applications and assessed by FDA. Expansion cohort trials can potentially bring efficiency to drug development and reduce developmental costs and time.

Post-approval trials, sometimes referred to as Phase 4 clinical trials, may be conducted after initial marketing approval. These trials are used to gain additional experience from the treatment of patients in the intended therapeutic indication and are commonly intended to generate additional safety data regarding use of the product in a clinical setting. In certain instances, the FDA may mandate the performance of Phase 4 clinical trials as a condition of approval of a BLA or NDA.

Progress reports detailing the results of the clinical trials, among other information, must be submitted at least annually to the FDA and written IND safety reports must be submitted to the FDA and the investigators 15 calendar days after the trial sponsor determines the information qualifies for reporting for serious and unexpected suspected adverse events, findings from other studies or animal or in vitro testing that suggest a significant risk for human subjects and any clinically important increase in the rate of a serious suspected adverse reaction over

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that listed in the protocol or investigator brochure. The sponsor also must notify the FDA of any unexpected fatal or life-threatening suspected adverse reaction as soon as possible but in no case later than seven calendar days after the sponsor’s initial receipt of the information.

Phase 1, Phase 2, Phase 3, and other types of clinical trials may not be completed successfully within any specified period, if at all. The FDA or the sponsor may suspend or terminate a clinical trial at any time on various grounds, including a finding that the patients are being exposed to an unacceptable health risk. Similarly, an IRB can suspend or terminate approval of a clinical trial at its institution if the clinical trial is not being conducted in accordance with the IRB’s requirements or if the drug or biologic has been associated with unexpected serious harm to patients. Additionally, some clinical trials are overseen by an independent group of qualified experts organized by the clinical trial sponsor, known as a data safety monitoring board or committee. This group provides authorization for whether a trial may move forward at designated check points based on access to certain data from the trial. Concurrent with clinical trials, companies usually complete additional animal studies and also must develop additional information about the chemistry and physical characteristics of the drug or biologic as well as finalize a process for manufacturing the product in commercial quantities in accordance with cGMP requirements. The manufacturing process must be capable of consistently producing quality batches of the product and, among other things, companies must develop methods for testing the identity, strength, quality, and purity of the final product. Additionally, appropriate packaging must be selected and tested and stability studies must be conducted to demonstrate that the investigational medicines do not undergo unacceptable deterioration over their shelf life.

FDA review process
Following completion of the clinical trials, data are analyzed to assess whether the investigational product is safe and effective for the proposed indicated use or uses. The results of preclinical studies and clinical trials are then submitted to the FDA as part of a BLA or NDA, along with proposed labeling, chemistry, and manufacturing information to ensure product quality and other relevant data. A BLA is a request for approval to market a biologic for one or more specified indications and must contain proof of the biologic’s safety, purity, and potency. An NDA for a new drug must contain proof of the drug’s safety and efficacy. The marketing application may include both negative and ambiguous results of preclinical studies and clinical trials, as well as positive findings. Data may come from company-sponsored clinical trials intended to test the safety and efficacy of a product’s use or from a number of alternative sources, including studies initiated by investigators. To support marketing approval, the data submitted must be sufficient in quality and quantity to establish the safety and efficacy of the investigational product to the satisfaction of the FDA. FDA approval of a BLA or NDA must be obtained before a biologic or drug may be marketed in the United States.

Under the Prescription Drug User Fee Act, or PDUFA, as amended, each BLA or NDA must be accompanied by a user fee. The FDA adjusts the PDUFA user fees on an annual basis. Fee waivers or reductions are available in certain circumstances, including a waiver of the application fee for the first application filed by a small business. Additionally, no user fees are assessed on BLAs or NDAs for products designated as orphan drugs, unless the product also includes a non-orphan indication.

The FDA reviews all submitted BLAs and NDAs before it accepts them for filing and may request additional information rather than accepting the BLA or NDA for filing. The FDA must make a decision on accepting a BLA or NDA for filing within 60 days of receipt, and such decision could include a refusal to file by the FDA. Once the submission is accepted for filing, the FDA begins an in-depth review of the BLA or NDA. Under the goals and policies agreed to by the FDA under PDUFA, the FDA has 10 months, from the filing date, in which to complete its initial review of an original BLA or NDA and respond to the applicant, and six months from the filing date of an original BLA or NDA designated for priority review. The FDA does not always meet its PDUFA goal dates for standard and priority BLAs and NDAs, and the review process is often extended by FDA requests for additional information or clarification.
Before approving a BLA or NDA, the FDA will conduct a pre-approval inspection of the manufacturing facilities for the new product to determine whether they comply with cGMP requirements. The FDA will not approve the product unless it determines that the manufacturing processes and facilities are in compliance with cGMP requirements and adequate to assure consistent production of the product within required specifications.

The FDA also may audit data from clinical trials to ensure compliance with GCP requirements. Additionally, the FDA may refer applications for novel products or products which present difficult questions of safety or efficacy to an advisory committee, typically a panel that includes clinicians and other experts, for review, evaluation and a recommendation as to whether the application should be approved and under what conditions, if any. The FDA is not bound by recommendations of an advisory committee, but it considers such recommendations when making decisions on approval. The FDA likely will reanalyze the clinical trial data, which could result in extensive discussions between the FDA and the applicant during the review process. After the FDA evaluates a BLA or NDA, it will issue an approval letter or a Complete Response Letter. An approval letter authorizes commercial marketing of the biologic or drug with specific prescribing information for specific indications. A Complete Response Letter indicates that the review cycle of the application is complete, and the application will not be approved in its present form. A Complete Response Letter usually describes all of the specific deficiencies in the BLA or NDA identified by the FDA. The Complete Response Letter may require additional clinical data, additional pivotal Phase 3 clinical trial(s), and/or other significant and time-consuming requirements related to clinical trials, preclinical studies, or manufacturing. If a Complete Response Letter is issued, the applicant may either resubmit the BLA or NDA, addressing all of the deficiencies identified in the letter, or withdraw the application or request an opportunity for a hearing. Even if such data and information are submitted, the FDA may decide that the BLA or NDA does not satisfy the criteria for approval. Data obtained from clinical trials are not always conclusive and the FDA may interpret data differently than we interpret the same data.

Orphan drug designation

Under the Orphan Drug Act, the FDA may grant orphan designation to a drug or biological product intended to treat a rare disease or condition, which is generally a disease or condition that affects fewer than 200,000 individuals in the United States, or more than 200,000 individuals in the United States and for which there is no reasonable expectation that the cost of developing and making the product available in the United States for this type of disease or condition will be recovered from sales of the product.

Orphan drug designation must be requested before submitting a BLA or NDA. After the FDA grants orphan drug designation, the identity of the therapeutic agent and its potential orphan use are disclosed publicly by the FDA. Orphan drug designation on its own does not convey any advantage in or shorten the duration of the regulatory review and approval process.

If a product that has orphan designation subsequently receives the first FDA approval for the disease or condition for which it has such designation, the product is entitled to orphan drug exclusivity, which means that the FDA may not approve any other applications to market the same drug for the same indication for seven years from the date of such approval, except in limited circumstances, such as a showing of clinical superiority to the product with orphan exclusivity by means of greater effectiveness, greater safety, or providing a major contribution to patient care, or in instances of drug supply issues. Competitors, however, may receive approval of either a different product for the same indication or the same product for a different indication; in the latter case, because health care professionals are free to prescribe products for off-label uses, the competitor’s product could be used for the orphan indication despite our orphan exclusivity. Orphan drug exclusivity also could block the approval of one of our products for seven years if a competitor obtains approval before we do for the same drug and same indication, as defined by the FDA, for which we are seeking approval, or if our product is determined to be contained within the scope of the competitor’s product for the same indication or disease. If we pursue marketing approval for an indication broader than the orphan drug designation we have received, we may not be entitled to orphan drug exclusivity. Orphan drug status in the European Union, or EU, has similar, but not identical, requirements and benefits.

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Expedited development and review programs

The FDA has a fast track program that is intended to expedite or facilitate the process for reviewing new drugs and biologics that meet certain criteria. Specifically, new drugs and biologics are eligible for fast track designation if they are intended to treat a serious or life-threatening condition and preclinical or clinical data demonstrate the potential to address unmet medical needs for the condition. Fast track designation applies to both the product and the specific indication for which it is being studied. The sponsor can request the FDA to designate the product for fast track status any time before receiving BLA or NDA approval, but ideally no later than the pre-BLA or pre-NDA meeting. Any product submitted to the FDA for marketing, including under a fast track program, may be eligible for other types of FDA programs intended to expedite development and review, such as priority review and accelerated approval. Any product is eligible for priority review if it treats a serious or life-threatening condition and, if approved, would provide a significant improvement in safety and effectiveness compared to available therapies. The FDA will attempt to direct additional resources to the evaluation of an application for a new drug or biologic designated for priority review in an effort to facilitate the review.

A product may also be eligible for accelerated approval, if it treats a serious or life-threatening condition and generally provides a meaningful advantage over available therapies. In addition, it must demonstrate an effect on a surrogate endpoint that is reasonably likely to predict clinical benefit or on a clinical endpoint that can be measured earlier than irreversible morbidity or mortality, or IMM, that is reasonably likely to predict an effect on IMM or other clinical benefit. As a condition of approval, the FDA may require that a sponsor of a drug or biologic receiving accelerated approval perform adequate and well-controlled post-marketing clinical trials. If the FDA concludes that a drug or biologic shown to be effective can be safely used only if distribution or use is restricted, it will require such post-marketing restrictions, as it deems necessary to assure safe use of the product. If the FDA determines that the conditions of approval are not being met, the FDA can withdraw its accelerated approval for such drug or biologic.

Additionally, a drug or biologic may be eligible for designation as a breakthrough therapy if the product is intended, alone or in combination with one or more other drugs or biologics, to treat a serious or life-threatening condition and preliminary clinical evidence indicates that the product may demonstrate substantial improvement over currently approved therapies on one or more clinically significant endpoints. The benefits of breakthrough therapy designation include the same benefits as fast track designation, plus intensive guidance from the FDA to ensure an efficient drug development program.

Even if a product qualifies for one or more of these programs, the FDA may later decide that the product no longer meets the conditions for qualification or the time period for FDA review or approval may not be shortened. Furthermore, fast track designation, priority review, accelerated approval, and breakthrough therapy designation do not change the standards for approval, but may expedite the development or approval process.

Pediatric information

Under the Pediatric Research Equity Act, a BLA or NDA or supplement to a BLA or NDA must contain data to assess the safety and efficacy of the drug for the claimed indications in all relevant pediatric subpopulations and to support dosing and administration for each pediatric subpopulation for which the product is safe and effective. The FDA may grant deferrals for submission of pediatric data or full or partial waivers. A sponsor who is planning to submit a marketing application for a drug that includes a new active ingredient, new indication, new dosage form, new dosing regimen, or new route of administration must submit an initial Pediatric Study Plan, or PSP, within 60 days of an end-of-Phase 2 meeting or, if there is no such meeting, as early as practicable before the initiation of the Phase 3 or Phase 2/3 study. The initial PSP must include an outline of the pediatric study or studies that the sponsor plans to conduct, including study objectives and design, age groups, relevant endpoints, and statistical approach, or a justification for not including such detailed information, and any request for a deferral of pediatric assessments or a full or partial waiver of the requirement to provide data from pediatric
studies along with supporting information. The FDA and the sponsor must reach an agreement on the PSP. A sponsor can submit amendments to an agreed-upon initial PSP at any time if changes to the pediatric plan need to be considered based on data collected from preclinical studies, early phase clinical trials, and/or other clinical development programs.

Post-marketing requirements

Following approval of a new product, the manufacturer and the approved product are subject to continuing regulation by the FDA, including, among other things, monitoring and record-keeping activities, reporting of adverse experiences, complying with promotion and advertising requirements, which include restrictions on promoting products for unapproved uses or patient populations (known as “off-label use”), and limitations on industry-sponsored scientific and educational activities. Although physicians may prescribe legally available products for off-label uses, manufacturers may not market or promote such uses. Prescription drug and biologic promotional materials must be submitted to the FDA in conjunction with their first use. Further, if there are any modifications to the drug or biologic, including changes in indications, labeling or manufacturing processes or facilities, the applicant may be required to submit and obtain FDA approval of a new BLA or NDA or BLA or NDA supplement, which may require the development of additional data or preclinical studies and clinical trials.

The FDA may also place other conditions on approvals including the requirement for a Risk Evaluation and Mitigation Strategy, or REMS, to assure the safe use of the product. If the FDA concludes a REMS is needed, the sponsor of the BLA or NDA must submit a proposed REMS. The FDA will not approve the BLA or NDA without an approved REMS, if required. A REMS could include medication guides, physician communication plans, or elements to assure safe use, such as restricted distribution methods, patient registries, and other risk minimization tools. Any of these limitations on approval or marketing could restrict the commercial promotion, distribution, prescription or dispensing of products. Product approvals may be withdrawn for non-compliance with regulatory standards, or if problems occur following initial marketing.

FDA regulations require that products be manufactured in specific approved facilities and in accordance with cGMP regulations. In addition to our own manufacturing facilities, we rely, and expect to continue to rely, on third parties for the production of certain clinical and commercial quantities of our products in accordance with cGMP regulations. We, and these manufacturers must comply with cGMP regulations that require, among other things, quality control and quality assurance, the maintenance of records and documentation, and the obligation to investigate and correct any deviations from cGMP. Manufacturers and other entities involved in the manufacture and distribution of approved drugs or biologics are required to register their establishments with the FDA and certain state agencies, and are subject to periodic unannounced inspections by the FDA and certain state agencies for compliance with cGMP requirements and other laws. Accordingly, manufacturers must continue to expend time, money, and effort in the area of production and quality control to maintain cGMP compliance. The discovery of violative conditions, including failure to conform to cGMP regulations, could result in enforcement actions, and the discovery of problems with a product after approval may result in restrictions on a product, manufacturer, or holder of an approved BLA or NDA, including recall.

U.S. patent term restoration and marketing exclusivity

Depending upon the timing, duration, and specifics of FDA approval of our investigational medicines and any future investigational medicines, some of our U.S. patents may be eligible for limited patent term extension under the Drug Price Competition and Patent Term Restoration Act of 1984, commonly referred to as the Hatch-Waxman Amendments. The Hatch-Waxman Amendments permit restoration of the patent term of up to five years as compensation for patent term lost during product development and FDA regulatory review process. Patent term restoration, however, cannot extend the remaining term of a patent beyond a total of 14 years from the product’s approval date. The patent term restoration period is generally one half the time between the effective date of an IND and the submission date of a BLA or NDA, plus the time between the submission date of a BLA or NDA and the approval of that application, except that the review period is reduced by any time
During which the applicant failed to exercise due diligence. Only one patent applicable to an approved drug is eligible for such an extension and the application for the extension must be submitted prior to the expiration of the patent. The USPTO, in consultation with the FDA, reviews and approves the application for any patent term extension or restoration. In the future, we may apply for restoration of patent term for our currently owned or licensed patents to add patent life beyond the current expiration date, depending on the expected length of the clinical trials and other factors involved in the filing of the relevant BLA or NDA.

Marketing exclusivity provisions under the FDCA can also delay the submission or the approval of certain marketing applications. The FDCA provides three years of marketing exclusivity for an NDA, or supplement to an existing NDA, if new clinical investigations, other than bioavailability studies, that were conducted or sponsored by the applicant are deemed by the FDA to be essential to the approval of the application, for example for new indications, dosages, or strengths of an existing drug. This three-year exclusivity covers only the modification for which the drug received approval on the basis of the new clinical investigations and does not prohibit the FDA from approving abbreviated new drug applications, or ANDAs, for drugs containing the active agent for the original indication or condition of use. The FDCA also provides a five-year period of non-patent marketing exclusivity within the United States to the first applicant to obtain approval of an NDA for a new chemical entity. A drug is a new chemical entity if the FDA has not previously approved any other new drug containing the same active moiety, which is the molecule or ion responsible for the action of the drug substance. During the exclusivity period, the FDA may not accept for review an ANDA or a 505(b)(2) NDA submitted by another company for another drug based on the same active moiety, regardless of whether the drug is intended for the same indication as the original innovator drug or for another indication, where the applicant does not own or have a legal right of reference to all the data required for approval. However, an application may be submitted after four years if it contains a certification of patent invalidity or non-infringement to one of the patents listed with the FDA by the innovator NDA holder. Three-year and five-year exclusivity will not delay the submission or approval of a full NDA. However, an applicant submitting a full NDA would be required to conduct or obtain a right of reference to all of the nonclinical studies and adequate and well-controlled clinical trials necessary to demonstrate safety and efficacy.

An abbreviated approval pathway for biological products shown to be similar to, or interchangeable with, an FDA-licensed reference biological product was created by the Biologics Price Competition and Innovation Act of 2009, or BPCI Act. This amendment to the PHSA, in part, attempts to minimize duplicative testing. Biosimilarity, which requires that the biological product be highly similar to the reference product notwithstanding minor differences in clinically inactive components and that there be no clinically meaningful differences between the product and the reference product in terms of safety, purity, and potency, can be shown through analytical studies, animal studies, and a clinical trial or trials. Interchangeability requires that a biological product be biosimilar to the reference product and that the product can be expected to produce the same clinical results as the reference product in any given patient and, for products administered multiple times to an individual, that the product and the reference product may be alternated or switched after one has been previously administered without increasing safety risks or risks of diminished efficacy relative to exclusive use of the reference biological product without such alternation or switch.

A reference biological product is granted 12 years of data exclusivity from the time of first licensure of the product and the FDA will not accept an application for a biosimilar or interchangeable product based on the reference biological product until four years after the date of first licensure of the reference product. “First licensure” typically means the initial date the particular product at issue was licensed in the United States. Date of first licensure does not include the date of licensure of (and a new period of exclusivity is not available for) a biological product if the licensure is for a supplement for the biological product or for a subsequent application by the same sponsor or manufacturer of the biological product (or licensor, predecessor in interest, or other related entity) for a change (not including a modification to the structure of the biological product) that results in a new indication, route of administration, dosing schedule, dosage form, delivery system, delivery device or strength, or for a modification to the structure of the biological product that does not result in a change in safety, purity, or potency.
Pediatric exclusivity is another type of regulatory market exclusivity in the United States. Pediatric exclusivity, if granted, adds six months to existing regulatory exclusivity periods. This six month exclusivity may be granted based on the voluntary completion of a pediatric trial in accordance with an FDA issued “Written Request” for such a trial.

European Union drug development
In the EU, our future products also may be subject to extensive regulatory requirements. As in the United States, medicinal products can be marketed only if a marketing authorization from the competent regulatory agencies has been obtained.

Similar to the United States, the various phases of preclinical and clinical research in the European Union are subject to significant regulatory controls. Although the EU Clinical Trials Directive 2001/20/EC has sought to harmonize the EU clinical trials regulatory framework, setting out common rules for the control and authorization of clinical trials in the EU, the EU Member States have transposed and applied the provisions of the Directive differently. This has led to significant variations in the member state regimes. Under the current regime, before a clinical trial can be initiated it must be approved in each of the EU countries where the trial is to be conducted by two distinct bodies: the National Competent Authority, or NCA, and one or more Ethics Committees, or ECs. Under the current regime all suspected unexpected serious adverse reactions to the investigated drug that occur during the clinical trial have to be reported to the NCA and ECs of the Member State where they occurred.

The EU clinical trials legislation currently is undergoing a transition process mainly aimed at harmonizing and streamlining clinical trial authorization, simplifying adverse event reporting procedures, improving the supervision of clinical trials, and increasing their transparency. Recently enacted Clinical Trials Regulation EU No 536/2014 ensures that the rules for conducting clinical trials in the EU will be identical.

Pediatric investigation plan
An application for marketing authorization of a medicinal product for human use which is not yet authorized in the European Union shall be considered valid only if it includes a Pediatric Investigational Plan, or PIP, according to Regulation (EC) No. 1901/2006. The PIP or the application for waiver shall be submitted with a request for agreement, except in duly justified cases, early during the product development phase and not later than upon completion of the human pharmacokinetic studies in healthy subjects. The end of Phase 1 pharmacokinetic studies can coincide with the initial tolerability studies, or the initiation of the adult Phase 2 studies (proof-of-concept studies); in any case, submission of the PIP cannot be after initiation of pivotal trials or confirmatory (Phase 3) trials.

The Pediatric Committee, a scientific committee established at the Community level, shall assess the content of any PIP, waivers, and deferrals for a medicinal product submitted to it in accordance with the regulation on medicinal products for pediatric use and formulate an opinion thereon.

European Union drug review and approval
In the European Economic Area, or EEA, which is comprised of the 28 Member States of the EU (including Norway and excluding Croatia), Iceland and Liechtenstein, medicinal products can only be commercialized after obtaining a Marketing Authorization, or MA. There are two types of marketing authorizations.

The Community MA is issued by the European Commission through the Centralized Procedure, based on the opinion of the Committee for Medicinal Products for Human Use, or CHMP, of the EMA, and is valid throughout the entire territory of the EEA. The Centralized Procedure is mandatory for certain types of products, such as biotechnology medicinal products, orphan medicinal products, advanced therapy medicines such as gene
therapy, somatic cell therapy or tissue engineered medicines, and medicinal products containing a new active substance indicated for the treatment of HIV, AIDS, cancer, neurodegenerative disorders, diabetes, autoimmune, and other immune dysfunctions and viral diseases. The Centralized Procedure is optional for products containing a new active substance not yet authorized in the EEA, or for products that constitute a significant therapeutic, scientific, or technical innovation or which are in the interest of public health in the EU.

National MAs, which are issued by the competent authorities of the Member States of the EEA and only cover their respective territory, are available for products not falling within the mandatory scope of the Centralized Procedure. Where a product has already been authorized for marketing in a Member State of the EEA, this National MA can be recognized in another Member State through the Mutual Recognition Procedure. If the product has not received a National MA in any Member State at the time of application, it can be approved simultaneously in various Member States through the Decentralized Procedure. Under the Decentralized Procedure an identical dossier is submitted to the competent authorities of each of the Member States in which the MA is sought, one of which is selected by the applicant as the Reference Member State, or RMS. The competent authority of the RMS prepares a draft assessment report, a draft summary of the product characteristics, or SPC, and a draft of the labeling and package leaflet, which are sent to the other Member States (referred to as the Member States Concerned) for their approval. If the Member States Concerned raise no objections, based on a potential serious risk to public health, to the assessment, SPC, labeling, or packaging proposed by the RMS, the product is subsequently granted a national MA in all the Member States (i.e., in the RMS and the Member States Concerned).

Under the above described procedures, before granting the MA, the EMA or the competent authorities of the Member States of the EEA make an assessment of the risk benefit balance of the product on the basis of scientific criteria concerning its quality, safety, and efficacy.

European Union exclusivity

In the EU, new products authorized for marketing (i.e., reference products) qualify for eight years of data exclusivity and an additional two years of market exclusivity upon marketing authorization. The data exclusivity, if granted, prevents regulatory authorities in the EU from referencing the innovator’s data to assess a generic or biosimilar application for eight years, after which a generic or biosimilar marketing application can be submitted, and the innovator’s data may be referenced, but not approved for two years. The overall 10-year period will be extended to a maximum of 11 years if, during the first eight years of those 10 years, the marketing authorization holder obtains an authorization for one or more new therapeutic indications which, during the scientific evaluation prior to their authorization, are determined to bring a significant clinical benefit in comparison with currently approved therapies.

European Union orphan designation and exclusivity

In the EU, the EMA’s Committee for Orphan Medicinal Products grants orphan drug designation to promote the development of products that are intended for the diagnosis, prevention, or treatment of life threatening or chronically debilitating conditions affecting not more than five in 10,000 persons in the EU community (or where it is unlikely that the development of the medicine would generate sufficient return to justify the investment) and for which no satisfactory method of diagnosis, prevention, or treatment has been authorized (or, if a method exists, the product would be a significant benefit to those affected).

In the EU, orphan drug designation entitles a party to financial incentives such as reduction of fees or fee waivers and 10 years of market exclusivity is granted following medicinal product approval. This period may be reduced to six years if the orphan drug designation criteria are no longer met, including where it is shown that the product is sufficiently profitable not to justify maintenance of market exclusivity. Orphan drug designation must be requested before submitting an application for marketing approval. Orphan drug designation does not convey any advantage in, or shorten the duration of, the regulatory review and approval process.
European data collection

The collection and use of personal health data in the European Union is governed by the provisions of the Data Protection Directive, and as of May 2018 the General Data Protection Regulation, or GDPR. This directive imposes several requirements relating to the consent of the individuals to whom the personal data relates, the information provided to the individuals, notification of data processing obligations to the competent national data protection authorities, and the security and confidentiality of the personal data. The Data Protection Directive and GDPR also impose strict rules on the transfer of personal data out of the EU to the United States. Failure to comply with the requirements of the Data Protection Directive, the GDPR, and the related national data protection laws of the EU Member States may result in fines and other administrative penalties. The GDPR introduces new data protection requirements in the EU and substantial fines for breaches of the data protection rules. The GDPR regulations may impose additional responsibility and liability in relation to personal data that we process and we may be required to put in place additional mechanisms ensuring compliance with the new data protection rules. This may be onerous and adversely affect our business, financial condition, results of operations, and prospects.

European Union drug marketing

Much like the Anti Kickback Statute prohibition in the United States, the provision of benefits or advantages to physicians to induce or encourage the prescription, recommendation, endorsement, purchase, supply, order, or use of medicinal products is also prohibited in the EU. The provision of benefits or advantages to physicians is governed by the national anti bribery laws of European Union Member States, such as the U.K. Bribery Act 2010. Infringement of these laws could result in substantial fines and imprisonment.

Payments made to physicians in certain EU Member States must be publicly disclosed. Moreover, agreements with physicians often must be the subject of prior notification and approval by the physician’s employer, his or her competent professional organization, and/or the regulatory authorities of the individual EU Member States. These requirements are provided in the national laws, industry codes, or professional codes of conduct, applicable in the EU Member States. Failure to comply with these requirements could result in reputational risk, public reprimands, administrative penalties, fines, or imprisonment.

Rest of the world regulation

For other countries outside of the EU and the United States, such as countries in Eastern Europe, Latin America, Middle East, or Asia, the requirements governing the conduct of clinical trials, product licensing, pricing, and reimbursement vary from country to country. Additionally, the clinical trials must be conducted in accordance with GCP requirements and the applicable regulatory requirements and the ethical principles that have their origin in the Declaration of Helsinki.

If we fail to comply with applicable foreign regulatory requirements, we may be subject to, among other things, fines, suspension or withdrawal of regulatory approvals, product recalls, seizure of products, operating restrictions, or criminal prosecution.

Other healthcare laws

Healthcare providers, physicians, and third party payors will play a primary role in the recommendation and prescription of any products for which we obtain marketing approval. Our future arrangements with third party payors, healthcare providers, and physicians may expose us to broadly applicable fraud and abuse and other healthcare laws and regulations that may constrain the business or financial arrangements and relationships through which we market, sell, and distribute any drugs for which we obtain marketing approval. In the United States, these laws include, without limitation, state and federal anti-kickback, false claims, physician
transparency, and patient data privacy and security laws and regulations, including but not limited to those described below.

- The Anti-Kickback Statue, or AKS, makes it illegal for any person, including a prescription drug manufacturer (or a party acting on its behalf), to knowingly and willfully solicit, receive, offer, or pay any remuneration, directly or indirectly, in cash or in kind, that is intended to induce or reward referrals, including the purchase, recommendation, order or prescription of a particular drug, for which payment may be made under a federal healthcare program, such as Medicare or Medicaid. Violations of this law are punishable by up to five years in prison, criminal fines, administrative civil money penalties, and exclusion from participation in federal healthcare programs. In addition, a person or entity does not need to have actual knowledge of the statute or specific intent to violate it.

- The federal False Claims Act imposes civil penalties, including through civil whistleblower or qui tam actions, against individuals or entities (including manufacturers) for, among other things, knowingly presenting, or causing to be presented, false or fraudulent claims for payment by a federal healthcare program or making a false statement or record material to payment of a false claim or avoiding, decreasing, or concealing an obligation to pay money to the federal government. The government may deem manufacturers to have “caused” the submission of false or fraudulent claims by, for example, providing inaccurate billing or coding information to customers or promoting a product off-label. Claims which include items or services resulting from a violation of the federal Anti-Kickback Statue are false or fraudulent claims for purposes of the False Claims Act. Our future marketing and activities relating to the reporting of wholesaler or estimated retail prices for our products, the reporting of prices used to calculate Medicaid rebate information, and other information affecting federal, state, and third-party reimbursement for our products, and the sale and marketing of our product and any future investigational medicines, are subject to scrutiny under this law.

- Health Insurance Portability and Accountability Act of 1996, or HIPAA, imposes criminal and civil liability for knowingly and willfully executing a scheme, or attempting to execute a scheme, to defraud any healthcare benefit program, including private payors, or falsifying, concealing, or covering up a material fact or making any materially false statements in connection with the delivery of or payment for healthcare benefits, items or services.

- HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act of 2009, or HITECH, and their respective implementing regulations, impose, among other things, specified requirements on covered entities and their business associates relating to the privacy and security of individually identifiable health information, including mandatory contractual terms and required implementation of technical safeguards of such information. HITECH also created new tiers of civil monetary penalties, amended HIPAA to make civil and criminal penalties directly applicable to business associates, and gave state Attorneys General new authority to file civil actions for damages or injunctions in federal courts to enforce the federal HIPAA laws and seek attorneys’ fees and costs associated with pursuing federal civil actions.

- The Physician Payments Sunshine Act, enacted as part of Act, the ACA, imposed new annual reporting requirements for certain manufacturers of drugs, devices, biologics, and medical supplies for which payment is available under Medicare, Medicaid, or the Children’s Health Insurance Program, for certain payments and “transfers of value” provided to physicians and teaching hospitals, as well as ownership and investment interests held by physicians and their immediate family members.

- Analogous state and foreign fraud and abuse laws and regulations, such as state anti-kickback and false claims laws, which may be broader in scope and apply regardless of payor impose a variety of obligations on. Such laws are enforced by various state agencies and through private actions. Some state laws require pharmaceutical companies to comply with the pharmaceutical industry’s voluntary compliance guidelines and the relevant federal government compliance guidance, require drug manufacturers to report information related to payments and other transfers of value to physicians and other healthcare providers, and restrict marketing practices or require disclosure of marketing
outcomes. State and foreign laws also govern the privacy and security of health information in some circumstances. Such data privacy and security laws may differ from each other in significant ways and often are not pre-empted by HIPAA, thus complicating compliance efforts.

The scope and enforcement of each of these laws is uncertain and subject to rapid change in the current environment of healthcare reform, especially in light of the lack of applicable precedent and regulations. Federal and state enforcement bodies have recently increased their scrutiny of interactions between healthcare companies and healthcare providers, which has led to a number of investigations, prosecutions, convictions, and settlements in the healthcare industry. It is possible that governmental authorities will conclude that our business practices do not comply with current or future statutes, regulations, or case law involving applicable fraud and abuse or other healthcare laws and regulations. If our operations are found to be in violation of any of these laws or any other related governmental regulations that may apply to us, we may be subject to significant civil, criminal, and administrative penalties, damages, fines, imprisonment, disgorgement, exclusion of drugs from government funded healthcare programs, such as Medicare and Medicaid, reputational harm, additional oversight, and reporting obligations if we become subject to a corporate integrity agreement or similar settlement to resolve allegations of non-compliance with these laws and the curtailment or restructuring of our operations. If any of the physicians or other healthcare providers or entities with whom we expect to do business is found to be not in compliance with applicable laws, they may be subject to similar actions, penalties, and sanctions. Ensuring business arrangements comply with applicable healthcare laws, as well as responding to possible investigations by government authorities, can be time- and resource-consuming and can divert a company’s attention from the business.

Current and future healthcare reform legislation

In the United States and foreign jurisdictions, there have been a number of legislative and regulatory changes and proposed changes regarding the healthcare system that could prevent or delay marketing approval of our investigational medicines, restrict or regulate post-approval activities, and affect our ability to profitably sell any investigational medicines for which we obtain marketing approval. We expect that current laws, as well as other healthcare reform measures that may be adopted in the future, may result in more rigorous coverage criteria and in additional downward pressure on the price that we, or any strategic collaborators, may receive for any approved products.

The ACA, for example, contains provisions that subject biological products to potential competition by lower-cost biosimilars and may reduce the profitability of drug products through increased rebates for drugs reimbursed by Medicaid programs, extension of Medicaid rebates to Medicaid managed care plans, mandatory discounts for certain Medicare Part D beneficiaries and, annual fees based on pharmaceutical companies’ share of sales to federal health care programs. With the current presidential administration and Congress, there may be additional administrative or legislative changes, including modification, repeal, or replacement of all, or certain provisions of, the ACA, which may impact reimbursement for drugs and biologics. On January 20, 2017, an Executive Order was signed directing federal agencies with authorities and responsibilities under the ACA to waive, defer, grant exemptions from, or delay the implementation of any provision of the ACA that would impose a fiscal or regulatory burden on states, individuals, healthcare providers, health insurers, or manufacturers of pharmaceuticals or medical devices. On October 13, 2017, an Executive Order was signed terminating the cost-sharing subsidies that reimburse insurers under the ACA. Several state Attorneys General filed suit to stop the administration from terminating the subsidies, but their request for a restraining order was denied by a federal judge in California on October 25, 2017. In addition, the Centers for Medicare & Medicaid Services, or CMS, has recently proposed regulations that would give states greater flexibility in setting benchmarks for insurers in the individual and small group marketplaces, which may have the effect of relaxing the essential health benefits required under the ACA for plans sold through such marketplaces. Further, each chamber of Congress has put forth multiple bills this year designed to repeal or replace portions of the ACA. While Congress has not passed repeal legislation, the Tax Reform Act includes a provision repealing, effective January 1, 2019, the tax-based shared responsibility payment imposed by the ACA on certain individuals who fail to maintain
qualifying health coverage for all or part of a year that is commonly referred to as the “individual mandate.” Congress may consider other legislation to repeal and replace elements of the ACA. Litigation and legislation over the ACA are likely to continue, with unpredictable and uncertain results.

Additionally, other federal health reform measures have been proposed and adopted in the United States since the ACA was enacted:

• The Budget Control Act of 2011, among other things, created measures for spending reductions by Congress. A Joint Select Committee on Deficit Reduction, tasked with recommending a targeted deficit reduction of at least $1.2 trillion for the years 2013 through 2021, was unable to reach required goals, thereby triggering the legislation’s automatic reduction to several government programs. These changes included aggregate reductions to Medicare payments to providers of up to 2% per fiscal year, which went into effect in April 2013 and will remain in effect through 2025 unless additional Congressional action is taken.

• The American Taxpayer Relief Act of 2012, among other things, reduced Medicare payments to several providers, and increased the statute of limitations period for the government to recover overpayments to providers from three to five years.

• The Middle Class Tax Relief and Job Creation Act of 2012 required that the CMS reduce the Medicare clinical laboratory fee schedule by 2% in 2013, which served as a base for 2014 and subsequent years. In addition, effective January 1, 2014, CMS also began bundling the Medicare payments for certain laboratory tests ordered while a patient received services in a hospital outpatient setting.

Further, there has been heightened governmental scrutiny over the manner in which manufacturers set prices for their marketed products, which have resulted in several recent Congressional inquiries and proposed bills designed to, among other things, bring more transparency to product pricing, review the relationship between pricing and manufacturer patient programs, and reform government program reimbursement methodologies for products. In addition, the federal government, state legislatures, and foreign governments have shown significant interest in implementing cost containment programs, including price-controls, restrictions on reimbursement, and requirements for substitution of generic products for branded prescription drugs to limit the growth of government paid health care costs. For example, the federal government has passed legislation requiring pharmaceutical manufacturers to provide rebates and discounts to certain entities and governmental payors to participate in federal healthcare programs. Individual states in the United States have also become increasingly aggressive in passing legislation and implementing regulations designed to control pharmaceutical and biological product pricing, including price or patient reimbursement constraints, discounts, restrictions on certain product access and marketing cost disclosure and transparency measures, and, in some cases, designed to encourage importation, from other countries and bulk purchasing.

Packaging and distribution in the United States

If our products are made available to authorized users of the Federal Supply Schedule of the General Services Administration additional laws and requirements apply. Products must meet applicable child-resistant packaging requirements under the U.S. Poison Prevention Packaging Act. Manufacturing, sales, promotion, and other activities also are potentially subject to federal and state consumer protection and unfair competition laws.

The distribution of pharmaceutical products is subject to additional requirements and regulations, including extensive record-keeping, licensing, storage, and security requirements intended to prevent the unauthorized sale of pharmaceutical products.

The failure to comply with any of these laws or regulatory requirements subjects firms to possible legal or regulatory action. Depending on the circumstances, failure to meet applicable regulatory requirements can result in criminal prosecution, fines or other penalties, injunctions, exclusion from federal healthcare programs,
requests for recall, seizure of products, total or partial suspension of production, denial or withdrawal of product approvals, or refusal to allow a firm to enter into supply contracts, including government contracts. Any action against us for violation of these laws, even if we successfully defend against it, could cause us to incur significant legal expenses and divert our management’s attention from the operation of our business. Prohibitions or restrictions on sales or withdrawal of future products marketed by us could materially affect our business in an adverse way.

Changes in regulations, statutes, or the interpretation of existing regulations could impact our business in the future by requiring, for example: (i) changes to our manufacturing arrangements; (ii) additions or modifications to product labeling; (iii) the recall or discontinuation of our products; or (iv) additional record-keeping requirements. If any such changes were to be imposed, they could adversely affect the operation of our business.

Other U.S. environmental, health, and safety laws and regulations
We may be subject to numerous environmental, health, and safety laws and regulations, including those governing laboratory procedures and the handling, use, storage, treatment, and disposal of hazardous materials and wastes. From time to time and in the future, our operations may involve the use of hazardous and flammable materials, including chemicals and biological materials, and may also produce hazardous waste products. Even if we contract with third parties for the disposal of these materials and waste products, we cannot completely eliminate the risk of contamination or injury resulting from these materials. In the event of contamination or injury resulting from the use or disposal of our hazardous materials, we could be held liable for any resulting damages, and any liability could exceed our resources. We also could incur significant costs associated with civil or criminal fines and penalties for failure to comply with such laws and regulations.

We maintain workers’ compensation insurance to cover us for costs and expenses we may incur due to injuries to our employees, but this insurance may not provide adequate coverage against potential liabilities. However, we do not maintain insurance for environmental liability or toxic tort claims that may be asserted against us.

In addition, we may incur substantial costs in order to comply with current or future environmental, health, and safety laws and regulations. Current or future environmental laws and regulations may impair our research, development or production efforts. In addition, failure to comply with these laws and regulations may result in substantial fines, penalties or other sanctions.

LEGAL PROCEEDINGS
We are not currently a party to any material legal proceedings.
**Executives and directors**

The following table sets forth the name, age (as of October 31, 2018) and position of each of our executives and directors.

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<tr>
<th>Name</th>
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<td><strong>Executives:</strong></td>
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<tr>
<td>Stéphane Bancel(1)</td>
<td>46</td>
<td>Chief Executive Officer and Director</td>
</tr>
<tr>
<td>Juan Andres(1)</td>
<td>54</td>
<td>Chief Technical Operations and Quality Officer</td>
</tr>
<tr>
<td>Marcello Damiani</td>
<td>48</td>
<td>Chief Digital Officer</td>
</tr>
<tr>
<td>Annie Seibold Drapeau</td>
<td>52</td>
<td>Chief Human Resources Officer</td>
</tr>
<tr>
<td>Lori Henderson, J.D.(1)</td>
<td>56</td>
<td>General Counsel and Corporate Secretary</td>
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<tr>
<td>Stephen Hoge, M.D.(1)</td>
<td>42</td>
<td>President</td>
</tr>
<tr>
<td>Lorence Kim, M.D.(1)</td>
<td>44</td>
<td>Chief Financial Officer</td>
</tr>
<tr>
<td>John Mendlein, Ph.D., J.D.(1)</td>
<td>59</td>
<td>President, Corporate and Product Strategy</td>
</tr>
<tr>
<td>Megan Pace</td>
<td>45</td>
<td>Chief Corporate Affairs Officer</td>
</tr>
<tr>
<td>Tal Zaks, M.D., Ph.D.(1)</td>
<td>53</td>
<td>Chief Medical Officer</td>
</tr>
<tr>
<td><strong>Non-Executive Directors:</strong></td>
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<tr>
<td>Noubar B. Afeyan, Ph.D.(4)(5)</td>
<td>56</td>
<td>Chairman, Director</td>
</tr>
<tr>
<td>Stephen Berenson(2)(3)</td>
<td>58</td>
<td>Director</td>
</tr>
<tr>
<td>Peter Barton Hurt, LLM.(5)</td>
<td>83</td>
<td>Director</td>
</tr>
<tr>
<td>Robert Langer, Sc.D.(4)</td>
<td>70</td>
<td>Director</td>
</tr>
<tr>
<td>Elizabeth Nabel, M.D.(4)(5)</td>
<td>66</td>
<td>Director</td>
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<tr>
<td>Israel Ruiz(2)(3)</td>
<td>47</td>
<td>Director</td>
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<tr>
<td>Paul Sagan(2)(3)</td>
<td>59</td>
<td>Director</td>
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<tr>
<td>Moncef Slaoui, Ph.D.(5)</td>
<td>59</td>
<td>Director</td>
</tr>
</tbody>
</table>

(1) Executive officer  
(2) Member of the audit committee  
(3) Member of the compensation and talent committee  
(4) Member of the nominating and corporate governance committee  
(5) Member of the product development committee

**Executive team**

Stéphane Bancel has served as our Chief Executive Officer since October 2011 and a member of our board of directors since March 2011. Before joining the Company, Mr. Bancel served for five years as Chief Executive Officer of the French diagnostics company bioMérieux SA (Euronext: BIM). From July 2000 to March 2006, he served in various roles at Eli Lilly and Company (NYSE: LLY), including as Managing Director, Belgium and as Executive Director, Global Manufacturing Strategy and Supply Chain. Prior to Lilly, Mr. Bancel served as Asia-Pacific Sales and Marketing Director for bioMérieux. Mr. Bancel currently serves on the board of directors of Qiagen N.V. (NYSE: QGEN) and previously served on the board of directors of BI Medicine, Inc. (OTCMKTS: BGMD) and Syros Pharmaceuticals, Inc. (Nasdaq: SYRS). He is currently a Venture Partner at Flagship Pioneering and a trustee of the Museum of Science in Boston. Mr. Bancel holds a Master of Engineering degree from École Centrale Paris (ECP), a Master of Science in chemical engineering from the University of Minnesota, and an M.B.A. from Harvard Business School. We believe that Mr. Bancel is qualified to serve on our board of directors because of his extensive leadership experience in the healthcare industry and experience as a director of public and private companies.

Juan Andres has served as our Chief Technical Operations and Quality Officer since August 2017. Prior to Moderna, Mr. Andres worked at Novartis AG (NYSE: NVS), or Novartis, from 2005 to 2017, in various roles of
increasing responsibility including serving as Global Head, Technical Operations (Manufacturing and Supply Chain), Global Head of Quality, and
Global Head of Technical Research and Development. From 1987 to 1996, Mr. Andres served in various manufacturing, production, and quality
roles at Eli Lilly and Company (NYSE: LLY), including as Vice President, Pharmaceutical Manufacturing. Mr. Andres obtained a degree in pharmacy
at the Universidad de Alcalá in Spain.

Marcello Damiani, has served as our Chief Digital Officer since May 2015. From 2009 to 2015, Mr. Damiani held senior roles at bioMérieux (BIM-FP),
including Senior Vice President and Group Chief Information Officer. Mr. Damiani holds an M.S. degree in Information Systems Architecture from the
University of Toulouse, France and completed an international Executive M.B.A. program through TRIUM, an alliance of the London School of
Economics, the New York University Stern Business School, and the HEC Paris School of Management, France.

Annie Seibold Drapeau, has served as our Chief Human Resources Officer since October 2016. From April 2015 to October 2016, Ms. Drapeau served
as an Operating Partner at Bain Capital Private Equity. From 2010 to 2015, Ms. Drapeau held senior roles at Iron Mountain (NYSE: IRM), including
Executive Vice President of Strategy and Talent. Ms. Drapeau holds a B.S. in chemical engineering from Bucknell University and an M.B.A. from the
Amos Tuck School at Dartmouth College.

Lori Henderson, J.D., has served as our General Counsel and Corporate Secretary since April 2018. From 2011 to 2018, Ms. Henderson served at
Albany Molecular Research Inc., or AMRI, first as Vice President, General Counsel and Corporate Secretary until 2014 and then as Senior Vice
President, General Counsel and Head of Business Development. Prior to her time at AMRI, Ms. Henderson worked as a corporate attorney at Goodwin
Procter LLP and as a General Counsel at other corporations. She received her J.D. from the George Washington University Law School and her B.A. in
Business and Economics from Gordon College.

Stephen Hoge, M.D., joined the Company in January 2013, and has served as our President since February 2015. From 2010 to 2012, Dr. Hoge was a
Partner at McKinsey & Company and a leader in the firm’s healthcare practice. From 2005 to 2010, he served in roles of increasing responsibility at
McKinsey & Company. From 2004 to 2005, Dr. Hoge was a resident physician at New York University/Bellevue Hospital. Dr. Hoge serves on the board
directors of Axcella Health, Inc., a private biotechnology company. He received an M.D. from the University of California, San Francisco and a B.A.
in neuroscience from Amherst College.

Lorence Kim, M.D., has served as our Chief Financial Officer since April 2014. From July 2000 to April 2014, Dr. Kim held a number of positions at
Goldman, Sachs & Co., most recently as Managing Director and co-head of biotechnology investment banking. Dr. Kim has served on the board of
directors of Seres Therapeutics, Inc. (Nasdaq: MCRB) since 2014. He received an A.B. in Biochemical Sciences from Harvard University, an M.B.A. in
Healthcare Management from the Wharton School of the University of Pennsylvania, and an M.D. from the University of Pennsylvania School of
Medicine.

John Mendlein, Ph.D., J.D., has served as our President, Corporate and Product Strategy since January 2018. From March 2012 to June 2018,
Dr. Mendlein served as a member of our board of directors. From 1996 until 2017, he held different senior executive and board roles, including
Executive Chairman, Chief Executive Officer and General Counsel, of various biotechnology companies, including Affinium Pharmaceuticals (acquired by Debiopharm Group); Adnexus Therapeutics (acquired by BMS (NYSE: BMY)); aTyr Pharma, Inc. (Nasdaq: LIFE), or aTyr; Aurora Biosciences (acquired by Vertex (Nasdaq: VRTX)); and Fate Therapeutics (Nasdaq: FATE), or Fate. From 2011 to 2017, he also served as aTyr’s Chief
Executive Officer. He started his biotechnology career at Smith Kline and French (now GlaxoSmithKline (NYSE: GSK)). He currently serves as a
Director on the board of directors of aTyr and is Vice Chairman of the Board of Fate. Dr. Mendlein is the author or inventor on over 200 publications
and patents. Dr. Mendlein holds a Ph.D. in physiology and biophysics from the University of California, Los Angeles, a J.D. from the University of
California, Hastings College of the Law, and a B.S. in biology from the University of Miami.

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Megan Pace has served as our Chief Corporate Affairs Officer since April 2018. From February 2015 to December 2017, Ms. Pace held senior positions at Agios Pharmaceuticals (Nasdaq: AGIO), including Senior Vice President, Strategic Operations and PKR Program Executive. From May 2010 to January 2015, she held senior positions at Vertex Pharmaceuticals (Nasdaq: VRTX), including Senior Vice President of Corporate Communications. Prior to Vertex, Ms. Pace was Senior Director of Public Affairs at Genentech. Ms. Pace received a B.A. from the College of Charleston.

Tal Zaks, M.D., Ph.D., has served as our Chief Medical Officer since March 2015. Prior to joining Moderna, Dr. Zaks served in senior development positions at Sanofi (NYSE: SNY) from 2010 to 2015, including Senior Vice President and Head of Global Oncology. From July 2008 to May 2010, he served as Vice President of Clinical Research, Oncology at Cephalon. Prior to this, Dr. Zaks spent four years at GlaxoSmithKline (NYSE: GSK) as Director, Clinical Development and Translational Medicine and three years at the National Cancer Institute as a Postdoctoral Fellow. He is currently Associate Professor of Medicine at the University of Pennsylvania and serves on the board of directors of Adapimmune Therapeutics plc (Nasdaq: ADAP). Dr. Zaks received his M.D. and Ph.D. from the Ben Gurion University in Israel and conducted post-doctoral research at the U.S. National Institutes of Health. He completed his clinical training in internal medicine at Temple University Hospital followed by a fellowship in medical oncology at the University of Pennsylvania.

Non-executive directors

Noubar B. Afeyan, Ph.D., is a cofounder and has served on our board of directors since incorporation, and has served as a chairman of our board of directors since February 2012. In 1999, Dr. Afeyan founded Flagship Pioneering and serves as its Senior Managing Partner and Chief Executive Officer. Since May 2014, Dr. Afeyan has served on the board of directors of Evelo Biosciences, Inc. (Nasdaq: EVLO), since 2013, on the board of Rubius Therapeutics, Inc. (Nasdaq: RUBY) and since October 2010, on the board of Seres Therapeutics, Inc. (Nasdaq: MCRB). He has previously served on the boards of numerous privately and publicly held companies, including BIND Therapeutics, Inc., BG Medicine, Inc. and Eleven Biotherapeutics, Inc. He received a Ph.D. in biochemical engineering from the Massachusetts Institute of Technology and a B.S. in chemical engineering from McGill University. Dr. Afeyan is currently a visiting lecturer of business administration at Harvard Business School and was previously a senior lecturer at the Massachusetts Institute of Technology’s Sloan School of Management where he taught courses on technology-entrepreneurship, innovation and leadership. We believe that Dr. Afeyan’s significant experience co-founding, leading and investing in numerous biotechnology companies make him qualified to serve on our board of directors.

Stephen Berenson has served as a member of our board of directors since October 2017. Mr. Berenson is a Managing Partner at Flagship Pioneering. Prior to that, Mr. Berenson spent 33 years as an investment banker at J.P. Morgan. During his last twelve years at J.P. Morgan, Mr. Berenson was Vice Chairman of Investment Banking and focused on providing high-touch strategic advice and complex transaction execution to leading companies across all industries globally. He was Co-founder of J.P. Morgan’s Global Strategic Advisory Council and Co-founder of the firm’s Board Initiative. Mr. Berenson also serves on the board of directors of CiBO Technologies, Inc. Mr. Berenson received an S.B. in mathematics from the Massachusetts Institute of Technology. We believe that Mr. Berenson is qualified to serve on our board of directors because of his experience in the banking and investment industries.

Peter Barton Hutt, LL.M., has served as a member of our board of directors since March 2012. Mr. Hutt has practiced law at Covington & Burling LLP, specializing in food and drug law, since 1960 (except for the period from 1971 to 1975). From 1971 to 1975, he was Chief Counsel for the U.S. Food and Drug Administration. Mr. Hutt is a member of the board of directors of Flex Pharma, Inc. (Nasdaq: FLKS), Q Therapeutics, Inc. (Nasdaq: QCEL), Concert Pharmaceuticals, Inc. (Nasdaq: CNCE) and Immunomedics, Inc. (Nasdaq: IMMU), each of which is a public biotechnology company, as well as numerous private companies. During the last five years, Mr. Hutt also served as a member of the board of directors of BIND Therapeutics, Inc. (Nasdaq: BIND), Seres Therapeutics, Inc. (Nasdaq: MCRB), Xoma Ltd. (Nasdaq: XOMA), DBV Technologies SA (Nasdaq: 300)
we believe that Mr. Hutt is qualified to serve on our board of directors because of his extensive knowledge of regulatory and legal issues related to drug development and his service on numerous boards of directors.

Robert Langer, Sc.D., has served as a member of our board of directors since December 2010. Dr. Langer has been an Institute Professor at the Massachusetts Institute of Technology, or MIT, since 2005, and prior to that was a Professor at MIT since 1977. Dr. Langer currently serves on the board of directors of Rubius Therapeutics, Inc. (Nasdaq: RUBY), Kala Pharmaceuticals, Inc. (Nasdaq: KALA), and the UK public company Puretech Health plc (LON: PRTC), and previously served on the board of directors of public companies Momenta Pharmaceuticals, Inc. (Nasdaq: MNTA), Wyeth (NYSE: WYE), Fibrocell Science, Inc. (Nasdaq: FCSC) and Millipore Corp. Dr. Langer also served as a member of the Science Board to the Food and Drug Administration from 1995 to 2002, including his service as chairman from 1999 to 2002. Dr. Langer received his B.S. from Cornell University and his Sc.D. from MIT, both in Chemical Engineering. We believe that Dr. Langer is qualified to serve on our board of directors because of his pioneering academic work, extensive medical and scientific knowledge and experience, and his previous service on public company boards of directors.

Elizabeth Nabel, M.D., has served as a member of our board of directors since December 2015. Dr. Nabel has served as President of Harvard University-affiliated Brigham Health, which includes Brigham and Women’s Hospital, Brigham and Women’s Faulkner Hospital, and the Brigham and Women’s Physician Organization, since 2010. Dr. Nabel has also been a Professor of Medicine at Harvard Medical School since 2010. Prior to that, Dr. Nabel held a variety of roles, including Director, at the National Heart, Lung and Blood Institute at the National Institutes of Health, a federal agency funding research, training and education programs to promote the prevention and treatment of heart, lung and blood diseases, from 1999 to 2009. She is an elected member of the National Academy of Medicine of the National Academy of Sciences. Dr. Nabel currently serves on the board of directors of Medtronic Plc (NYSE: MDT). We believe that Dr. Nabel is qualified to serve on our board of directors because of her extensive experience in the health care field, including senior positions with a number of research universities and organizations.

Israel Ruiz has served as a member of our board of directors since February 2017. Mr. Ruiz has been the Executive Vice President and Treasurer at Massachusetts Institute of Technology, or MIT, since 2011. In this role, Mr. Ruiz oversees all principal administrative and financial functions of MIT. Prior to his current role, Mr. Ruiz served as the Vice President for Finance for MIT from 2007 to 2011 and as a principal for MIT’s Office of Budget and Financial Planning from 2001 to 2007. He currently serves on the board of directors of Fortive Corporation (NYSE: FTV). Mr. Ruiz received a degree in industrial and mechanical engineering from the Polytechnic University of Catalonia and a master’s degree from the MIT Sloan School of Management. We believe that Mr. Ruiz is qualified to serve on our board of directors because of his deep financial and accounting experience as the chief financial officer of MIT.

Paul Sagan has served as a member of our board of directors since June 2018. Mr. Sagan has been a Managing Director at General Catalyst Partners, a venture capital firm, since January 2018, and previously served there as an Executive In Residence (XIR) since January 2014. Mr. Sagan was a director of EMC from December 2007 until the acquisition by Dell, Inc. in September 2016. From April 2005 to January 2013, Mr. Sagan served as Chief Executive Officer at Akamai Technologies, Inc. (Nasdaq: AKAM) and was President from May 1999 to September 2010 and from October 2011 to December 2012. Mr. Sagan currently serves on the board of directors of Akamai and VMware, Inc. (Nasdaq: VMW). Mr. Sagan received his BS from the Medill School of Journalism at Northwestern University. We believe that Mr. Sagan is qualified to serve on our board of directors because of his experience and leadership in both in the technology and venture capital fields.

Moncef Slaoui, Ph.D., has served as a member of our board of directors since July 2017. Dr. Slaoui joined GlaxoSmithKline Plc (NYSE: GSK), or GSK, in 1988, where he engineered the development of a robust
vaccines pipeline. He then led worldwide business development for pharmaceutical products before his appointment to lead research and development in 2006. He assumed overall responsibility for GSK’s Oncology Business in 2010, for GSK Vaccines in 2011, and for all Global Franchises in 2012. Dr. Slaoui is Chairman of the Board of Directors of Galvani Bioelectronics, a company launched in November 2016 that GSK jointly owns with Verily Life Sciences. Dr. Slaoui has advised the U.S. President’s Council of Advisors on Science and Technology, was a member of the Board of the Agency for Science, Technology, & Research until January 2011, the PhRMA Foundation Board from 2008 to 2016 and the Advisory Committee to the Director of the National Institutes of Health from 2011 to 2016. Dr. Slaoui previously served on the board of directors of Intellia Therapeutics Inc. (Nasdaq: NTLA). Dr. Slaoui is also a former Professor of Immunology at the University of Mons, Belgium. Dr. Slaoui received a Ph.D. in Molecular Biology and Immunology from Université Libre de Bruxelles. We believe that Dr. Slaoui is qualified to serve on our board of directors because of his vast experience in the pharmaceutical industry and various leadership positions.

Scientific advisory board

We have established a Scientific Advisory Board, or SAB, comprised of a world-class team of experts that advises on our science and platform. Our SAB members as of October 31, 2018 include:

**Jack Szostak, Ph.D.,** Moderna Scientific Advisory Board Chairman, 2009 Nobel Laureate in Physiology or Medicine, Member of the National Academy of Sciences, Howard Hughes Medical Institute Investigator, Professor of Genetics at Harvard Medical School, and Alex Rich Distinguished Investigator, Department of Molecular Biology and the Center for Computational and Integrative Biology at Massachusetts General Hospital;

**Ulrich H. von Andrian, M.D.,** Mallinckrodt Professor of Immunopathology at Harvard Medical School;

**Michael Diamond, M.D., Ph.D.,** Herbert S. Gasser Professor, Departments of Medicine, Molecular Microbiology, Pathology & Immunology, and Associate Director, Center for Human Immunology and Immunotherapy Programs at Washington University School of Medicine;

**Ron Eydelott, D.V.M., D.A.C.V.P.,** President, Nonclinical Development Consulting Services;

**Colin R. Gardner, Ph.D.,** President, Pharmavue LLC;

**Rachel Green, Ph.D.,** Member of the National Academy of Medicine, Professor of Molecular Biology and Genetics, Johns Hopkins University School of Medicine, Howard Hughes Medical Institute Investigator;

**Paula T. Hammond, Ph.D.,** Member of the National Academy of Medicine and National Academy of Engineering, David H. Koch Chair Professor of Engineering at the Massachusetts Institute of Technology, and the Head of the Department of Chemical Engineering;

**Robert Langer, Sc.D.,** Co-Founder of Moderna; Member of the National Academy of Sciences, National Academy of Engineering, National Academy of Medicine, and National Academy of Inventors, David H. Koch Institute Professor at the Massachusetts Institute of Technology;

**Sander G. Mills, Ph.D.,** Senior Consultant in medicinal chemistry and drug discovery; and

**Ralph Weissleder, M.D., Ph.D.,** Member of the National Academy of Medicine; Thrall Professor of Radiology and Professor of Systems Biology, Harvard Medical School.

Composition of our board of directors

Our board consists of nine members, each of whom are members pursuant to the board composition provisions of our certificate of incorporation and agreements with our stockholders. These board composition provisions will
terminate upon the completion of this offering. Upon the termination of these provisions, there will be no further contractual obligations regarding the election of our directors. Our nominating and corporate governance committee and our board of directors may therefore consider a broad range of factors relating to the qualifications and background of nominees. Our nominating and corporate governance committee’s and our board of directors’ priority in selecting board members is identification of persons who will further the interests of our stockholders through their established record of professional accomplishment, the ability to contribute positively to the collaborative culture among board members, knowledge of our business, understanding of the competitive landscape, professional and personal experiences, and expertise relevant to our growth strategy. Our directors hold office until their successors have been elected and qualified or until the earlier of their resignation or removal. Our amended and restated certificate of incorporation that will become effective upon the closing of this offering and amended and restated bylaws that will become effective upon the effectiveness of the registration statement of which this prospectus is a part, also provide that our directors may be removed only for cause by the affirmative vote of the holders of at least two-thirds of the votes that all our stockholders would be entitled to cast in an annual election of directors, and that any vacancy on our board of directors, including a vacancy resulting from an enlargement of our board of directors, may be filled only by vote of a majority of our directors then in office.

**Director independence**

Our board of directors has determined that all members of the board of directors, except Mr. Bancel, our Chief Executive Officer, are independent directors, including for purposes of the rules of the Nasdaq Global Select Market and the SEC. In making such independence determination, our board of directors considered the relationships that each non-employee director has with us and all other facts and circumstances that our board of directors deemed relevant in determining their independence, including the beneficial ownership of our capital stock by each non-employee director. In considering the independence of the directors listed above, our board of directors considered the association of our directors with the holders of more than 5% of our common stock. Upon the completion of this offering, we expect that the composition and functioning of our board of directors and each of our committees will comply with all applicable requirements of the Nasdaq Global Select Market and the rules and regulations of the SEC. There are no family relationships among any of our directors or executive officers. Mr. Bancel is not an independent director under these rules because he is an executive officer of the Company.

**Staggered board**

In accordance with the terms of our amended and restated certificate of incorporation that will become effective upon the closing of this offering and amended and restated bylaws that will become effective upon the effectiveness of the registration statement of which this prospectus is a part, our board of directors will be divided into three staggered classes of directors and each will be assigned to one of the three classes. At each annual meeting of the stockholders, a class of directors will be elected for a three-year term to succeed the directors of the same class whose terms are then expiring. The terms of the directors will expire upon the election and qualification of successor directors at the annual meeting of stockholders to be held during the years for Class I directors, for Class II directors and for Class III directors.

- Our Class I directors will be Noubar B. Afeyan, Stéphane Bancel, and Peter Barton Hutt;
- Our Class II directors will be Stephen Berenson, Israel Ruiz, and Paul Sagan; and
- Our Class III directors will be Robert Langer, Elizabeth Nabel, and Moncef Slaoui.

Our amended and restated certificate of incorporation that will become effective upon the closing of this offering and amended and restated by-laws that will become effective upon the effectiveness of the registration statement of which this prospectus is a part provide that the number of our directors shall be fixed from time to time by a resolution of the majority of our board of directors.

The division of our board of directors into three classes with staggered three-year terms may delay or prevent stockholder efforts to effect a change of our management or a change in control.
Board leadership structure and board’s role in risk oversight

Currently, the role of chairman of the board of directors is separated from the role of Chief Executive Officer. Our Chief Executive Officer is responsible for recommending strategic decisions and capital allocation to the board of directors and to ensure the execution of the recommended plans. The chairman of the board of directors is responsible for leading the board of directors in its fundamental role of providing advice to and independent oversight of management. Our board of directors recognizes the time, effort, and energy that the Chief Executive Officer is required to devote to his position in the current business environment, as well as the commitment required to serve as our chairman, particularly as the board of directors’ oversight responsibilities continue to grow. While our amended and restated by-laws and corporate governance guidelines will not require that our chairman and Chief Executive Officer positions be separate, our board of directors believes that having separate positions is the appropriate leadership structure for us at this time and demonstrates our commitment to good corporate governance.

Risk is inherent with every business, and how well a business manages risk can ultimately determine its success. We face a number of risks, including the four risks more fully discussed in the section entitled “Business” appearing elsewhere in this prospectus. Management is responsible for the day-to-day management of risks we face, while our board of directors, as a whole and through its committees, has responsibility for the oversight of risk management. In its risk oversight role, our board of directors has the responsibility to satisfy itself that the risk management processes designed and implemented by management are adequate and functioning as designed.

The role of the board of directors in overseeing the management of our risks is conducted primarily through committees of the board of directors, as disclosed in the descriptions of each of the committees below and in the charters of each of the committees. The full board of directors (or the appropriate board committee in the case of risks that are under the purview of a particular committee) discusses with management our major risk exposures, their potential impact on us, and the steps we take to manage them. When a board committee is responsible for evaluating and overseeing the management of a particular risk or risks, the chairman of the relevant committee reports on the discussion to the full board of directors during the committee reports portion of the next board meeting. This enables the board of directors and its committees to coordinate the risk oversight role, particularly with respect to risk interrelationships.
Committees of our board of directors

Our board of directors has established an audit committee, a compensation and talent committee, a nominating and corporate governance committee and a product development committee, each of which will operate pursuant to a charter to be adopted by our board of directors and will be effective upon the effectiveness of the registration statement of which this prospectus is a part. The board of directors may also establish other committees from time to time to assist the Company and the board of directors. Upon the effectiveness of the registration statement of which this prospectus is a part, the composition and functioning of all of our committees will comply with all applicable requirements of the Sarbanes-Oxley Act of 2002, Nasdaq and SEC rules and regulations, if applicable. Upon our listing on Nasdaq, each committee’s charter will be available on our website at www.modernatx.com. The reference to our website address does not constitute incorporation by reference of the information contained at or available through our website, and you should not consider it to be part of this prospectus.

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<tr>
<th>Audit</th>
<th>Compensation &amp; Talent</th>
<th>Nominating &amp; Corporate Governance</th>
<th>Product Development</th>
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<tr>
<td>Noubar B. Afeyan, Ph.D.</td>
<td>Member</td>
<td>Chair</td>
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<tr>
<td>Moncef Slaoui, Ph.D.</td>
<td>Member</td>
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<td>Chair</td>
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Audit committee

Mr. Berenson, Mr. Sagan, and Mr. Ruiz serve on the audit committee, which is chaired by Mr. Ruiz. Our board of directors has determined that each are “independent” for audit committee purposes as that term is defined by the rules of the SEC and Nasdaq, and that each has sufficient knowledge in financial and auditing matters to serve on the audit committee. Our board of directors has designated Mr. Ruiz as an “audit committee financial expert,” as defined under the applicable rules of the SEC. The audit committee’s responsibilities include:

- appointing, approving the compensation of, and assessing the independence of our independent registered public accounting firm;
- pre-approving auditing and permissible non-audit services, and the terms of such services, to be provided by our independent registered public accounting firm;
- reviewing the overall audit plan with our independent registered public accounting firm and members of management responsible for preparing our financial statements;
- reviewing and discussing with management and our independent registered public accounting firm our annual and quarterly financial statements and related disclosures as well as critical accounting policies and practices used by us;
- coordinating the oversight and reviewing the adequacy of our internal control over financial reporting;
- establishing policies and procedures for the receipt and retention of accounting-related complaints and concerns;
- recommending, based upon the audit committee’s review and discussions with management and our independent registered public accounting firm, whether our audited financial statements shall be included in our Annual Report on Form 10-K;
- monitoring the integrity of our financial statements and our compliance with legal and regulatory requirements as they relate to our financial statements and accounting matters;
preparing the audit committee report required by SEC rules to be included in our annual proxy statement;
• reviewing all related person transactions for potential conflict of interest situations and approving all such transactions; and
• reviewing quarterly earnings releases.

Compensation and talent committee
Mr. Berenson, Mr. Sagan, and Mr. Ruiz serve on the compensation and talent committee, which is chaired by Mr. Berenson. Our board of directors has determined that each member of the compensation and talent committee is “independent” as defined in the applicable Nasdaq rules. The compensation and talent committee’s responsibilities include:
• annually reviewing and recommending to the board of directors the corporate goals and objectives relevant to the compensation of our Chief Executive Officer;
• evaluating the performance of our Chief Executive Officer in light of such corporate goals and objectives and based on such evaluation: (i) recommending to the board of directors the cash compensation of our Chief Executive Officer, and (ii) reviewing and approving grants and awards to our Chief Executive Officer under equity-based plans;
• reviewing and recommending to the board of directors the cash compensation of our other executive officers;
• reviewing and establishing our overall management compensation, philosophy and policy;
• overseeing and administering our compensation and similar plans;
• reviewing and approving the retention or termination of any consulting firm or outside advisor to assist in the evaluation of compensation matters and evaluating and assessing potential and current compensation advisors in accordance with the independence standards identified in the applicable Nasdaq rules;
• retaining and approving the compensation of any compensation advisors;
• reviewing and approving our policies and procedures for the grant of equity-based awards;
• reviewing and recommending to the board of directors the compensation of our directors; and
• preparing the compensation committee report required by SEC rules, if and when required, to be included in our annual proxy statement.

Nominating and corporate governance committee
Dr. Afeyan, Dr. Langer, and Dr. Nabel serve on the nominating and corporate governance committee, which is chaired by Dr. Afeyan. Our board of directors has determined that each member of the nominating and corporate governance committee is “independent” as defined in the applicable Nasdaq rules. The nominating and corporate governance committee’s responsibilities include:
• developing and recommending to the board of directors criteria for board and committee membership;
• establishing procedures for identifying and evaluating board of director candidates, including nominees recommended by stockholders;
• reviewing the composition of the board of directors to ensure that it is composed of members containing the appropriate skills and expertise to advise us;
• identifying individuals qualified to become members of the board of directors;
• recommending to the board of directors the persons to be nominated for election as directors and to each of the board’s committees;
reviewing and recommending to the board of directors appropriate corporate governance guidelines; and

overseeing the evaluation of our board of directors.

Product development committee

Dr. Afeyan, Mr. Hutt, Dr. Nabel, and Dr. Slaoui serve on the product development committee, which is chaired by Dr. Slaoui. The product development committee’s responsibilities include:

• assessing our product development strategy;

• reviewing product development plans for the pipeline; and

• evaluating recommendations made by management related to the further preclinical and clinical development of certain of the Company’s programs.

Compensation committee interlocks and insider participation

None of the members of our compensation committee has at any time during the prior three years been one of our officers or employees. None of our executive officers currently serves, or in the past fiscal year has served, as a member of the board of directors or compensation committee of any entity that has one or more executive officers serving on our board of directors or compensation committee.

Corporate governance

Prior to the effectiveness of the registration statement of which this prospectus is a part, we will adopt a written code of business conduct and ethics that applies to our directors, officers, and employees, including our principal executive officer, principal financial officer, principal accounting officer, or controller, or persons performing similar functions. Following the effectiveness of the registration statement of which this prospectus is a part, a current copy of this code will be posted on the Corporate Governance section of our website, which is located at www.modernatx.com. The information on our website is deemed not to be incorporated in this prospectus or to be a part of this prospectus. If we make any substantive amendments to, or grant any waivers from, the code of business conduct and ethics for any officer or director, we will disclose the nature of such amendment or waiver on our website or in a current report on Form 8-K.

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EXECUTIVE COMPENSATION

Overview

The following discussion contains forward-looking statements that are based on our current plans and expectations regarding our future compensation programs. The actual amount and form of compensation that we pay and the compensation policies and practices that we adopt in the future may differ materially from the currently-planned programs that are summarized in this discussion.

The compensation provided to our named executive officers for the fiscal year ended December 31, 2017 is detailed in the 2017 Summary Compensation Table and accompanying footnotes and narrative that follow.

Our named executive officers for the fiscal year ended December 31, 2017, which consisted of our Chief Executive Officer and our two most highly-compensated executive officers other than our Chief Executive Officer, were:

- Mr. Stéphane Bancel, our Chief Executive Officer;
- Dr. Stephen Hoge, our President; and
- Dr. Lorence Kim, our Chief Financial Officer.

2017 Summary Compensation Table

The following table provides information regarding the total compensation awarded to, earned by, and paid to our named executive officers for services rendered to us in all capacities for the fiscal year ended December 31, 2017.

<table>
<thead>
<tr>
<th>Name and Principal Position</th>
<th>Year</th>
<th>Salary ($)</th>
<th>Bonus ($) (^{(1)})</th>
<th>Stock Awards ($) (^{(2)})</th>
<th>Option Awards ($) (^{(3)})</th>
<th>All Other Compensation ($)</th>
<th>Total ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stéphane Bancel, Chief Executive Officer</td>
<td>2017</td>
<td>$650,769</td>
<td>$1,500,000</td>
<td>—</td>
<td>$4,648,000</td>
<td>$10,420 (^{(4)})</td>
<td>$6,809,189</td>
</tr>
<tr>
<td>Stephen Hoge, President</td>
<td>2017</td>
<td>$542,308</td>
<td>$4,400,000 (^{(5)})</td>
<td>—</td>
<td>$19,000,000</td>
<td>$9,669 (^{(6)})</td>
<td>$23,951,977</td>
</tr>
<tr>
<td>Lorence Kim, Chief Financial Officer</td>
<td>2017</td>
<td>$521,154</td>
<td>$1,000,000</td>
<td>$5,470,000</td>
<td>$2,158,000</td>
<td>$166,633 (^{(7)})</td>
<td>$9,315,787</td>
</tr>
</tbody>
</table>

\(^{(1)}\) The amounts reported represent annual discretionary bonuses earned by our named executive officers for the 2017 fiscal year, based on the achievement of Company and individual performance objectives.

\(^{(2)}\) The amount reported represents the aggregate grant date fair value of the restricted stock units awarded to Dr. Kim during the 2017 fiscal year, calculated in accordance with Financial Accounting Standards Board, or FASB, Accounting Standards Codification, or ASC, Topic 718. Such grant date fair value does not take into account any estimated forfeitures. The assumptions used in calculating the grant date fair value of the restricted stock units reported in this column are set forth in Note 10 to our Consolidated Financial Statements included elsewhere in this prospectus. The amount reported in this column reflects the accounting cost for these restricted stock units and does not correspond to the actual economic value that may be received by Dr. Kim upon the vesting/settlement of the restricted stock units or any sale of the underlying shares of common stock.

\(^{(3)}\) The amounts reported represent the aggregate grant date fair value of the stock options awarded to the named executive officers during the 2017 fiscal year, calculated in accordance with FASB ASC Topic 718. Such grant date fair values do not take into account any estimated forfeitures. The assumptions used in calculating the grant date fair value of the stock options reported in this column are set forth in Note 10 to our Consolidated Financial Statements included elsewhere in this prospectus. The amounts reported in this column reflect the accounting cost for these stock options and do not correspond to the actual economic value.
value that may be received by the named executive officers upon the exercise of the stock options or any sale of the underlying shares of common stock.

(4) The amount reported represents $8,100 for matching contributions made by the Company under its 401(k) plan, $1,480 for gift cards, $600 for parking reimbursements, and $240 for tax-gross ups paid by the Company for parking reimbursements and gift card amounts.

(5) In addition to the annual discretionary bonus described in footnote 1 above, Dr. Hoge was paid a $4 million lump sum cash bonus in 2017, which is subject to repayment on the terms and conditions described in the Narrative to Summary Compensation Table below.

(6) The amount reported represents $8,100 for matching contributions made by the Company under its 401(k) plan, $740 for gift cards, $600 for parking reimbursements and $229 for tax-gross ups paid by the Company for parking reimbursements and gift card amounts.

(7) The amount reported represents $8,100 for matching contributions made by the Company under its 401(k) plan, $740 for gift cards, $108,227 for commuting expense reimbursements, $600 for parking reimbursements and $48,966 for tax-gross ups paid by the Company for parking and commuting reimbursements and gift card amounts.

Narrative to Summary Compensation Table

Base salaries
From January 1, 2017 until February 25, 2017, the annual base salaries for Mr. Bancel, Dr. Hoge and Dr. Kim were $600,000, $500,000 and $500,000, respectively. Effective as of February 26, 2017, the annual base salaries for Mr. Bancel, Dr. Hoge and Dr. Kim were increased to $660,000, $550,000 and $525,000, respectively.

Bonuses
Annual discretionary bonuses
During the fiscal year ended December 31, 2017, our named executive officers were eligible to participate in the Company’s short-term incentive program, pursuant to which each was eligible to earn an annual discretionary bonus based on the achievement of certain Company and individual performance objectives. For the fiscal year ended December 31, 2017, the target annual bonuses for Mr. Bancel, Dr. Hoge and Dr. Kim were equal to 60%, 50% and 50%, respectively, of the applicable named executive officer’s annual base salary, however, each named executive officer earned more than his target annual bonus for such fiscal year, based on his individual performance during such fiscal year. The amounts earned under this program with respect to the fiscal year ended December 31, 2017 are reported under the “Bonus” column in the Summary Compensation Table above.

Dr. Hoge bonus
In October 2017, we entered into a bonus agreement with Dr. Hoge. Pursuant to the agreement, Dr. Hoge was paid a $4 million lump sum cash bonus, subject to vesting in substantially equal annual installments over six years from October 18, 2017 until October 18, 2023. If Dr. Hoge’s employment is terminated by the Company for any reason or he resigns from the Company for any reason, in either case, prior to October 3, 2023, then he will be required to repay to the Company the portion of the bonus which remains unvested as of the date of such termination, either in cash or in vested shares of the Company’s common stock.

Equity compensation
During the fiscal year ended December 31, 2017, we granted options to purchase shares of our common stock to each of our named executive officers and restricted stock units to one of our named executive officers, as described in more detail in the “Outstanding equity awards at fiscal 2017 year-end” table.
Executive employment arrangements

We initially entered into an offer letter with each of the named executive officers in connection with his employment with us, which set forth the terms and conditions of his employment.

In June 2018, we adopted a new executive severance plan, or the Executive Severance Plan, in which our named executive officers participate, as further described below. The Executive Severance Plan was amended and restated in November 2018 and provides for certain payments and benefits in the event of certain qualifying terminations of employment, including an involuntary termination of employment in connection with a change in control of the Company, and replaces the severance provisions in the named executive officers’ offer letters, if any.

Amended and Restated Executive Severance Plan

The Amended and Restated Executive Severance Plan provides that upon a termination of employment by us other than for “cause” (as defined in the Amended and Restated Executive Severance Plan), death or “disability” (as defined in the Amended and Restated Executive Severance Plan), or upon a resignation by an eligible participant for “good reason” (as defined in the Amended and Restated Executive Severance Plan), in either case outside of the “change in control period” (i.e., the period beginning on the date of a “change in control” (as defined in the Amended and Restated Executive Severance Plan) and ending on the one-year anniversary of the change in control), the participant will be entitled to receive, subject to the execution and delivery of a separation agreement and release containing, among other provisions, an effective release of claims in favor of the Company and reaffirmation of the “restrictive covenants agreement” (as defined in the Amended and Restated Executive Severance Plan), (i) a severance amount equal to 12 months of the participant’s annual base salary in effect immediately prior to such termination, payable over 12 months, (ii) an amount equal to the participant’s annual target bonus in effect immediately prior to such termination, multiplied by (B) a fraction with a numerator equal to the number of full weeks elapsed in the then-current fiscal year prior to the date of termination and with a denominator equal to 52, payable over 12 months and (iii) up to 12 monthly cash payments equal to the monthly employer contribution that we would have made to provide health insurance for the applicable participant if he or she had remained employed by us, based on the premiums as of the date of termination.

The Amended and Restated Executive Severance Plan also provides that upon a termination of employment by us other than for cause, death or disability or upon a resignation by an eligible participant for good reason, in either case within the change in control period, the participant will be entitled to receive, in lieu of the payments and benefits described above and subject to the execution and delivery of an a separation agreement and release containing, among other provisions, an effective release of claims in favor of the Company and reaffirmation of the restrictive covenants agreement, (i) a lump sum cash severance amount equal to 150% of the participant’s annual base salary in effect immediately prior to such termination (or the participant’s annual base salary in effect immediately prior to the change in control, if higher), (ii) a lump sum amount equal to 150% of the participant’s annual target bonus in effect immediately prior to such termination (or the participant’s annual target bonus in effect immediately prior to the change in control, if higher) (the “Applicable Bonus”), (iii) a lump sum amount equal to (A) the participant’s Applicable Bonus multiplied by (B) a fraction with a numerator equal to the number of full weeks elapsed in the then-current fiscal year prior to the date of termination and with a denominator equal to 52, (iv) a lump sum amount equal to the monthly employer contribution that we would have made to provide health insurance for the participant if he or she had remained employed by us for 18 months following the date of termination, based on the premiums as of the date of termination, and (v) for all outstanding and unvested equity awards of the Company that are subject to time-based vesting held by the named executive officer, full accelerated vesting of such awards.

The payments and benefits provided under the Amended and Restated Executive Severance Plan in connection with a change in control may not be eligible for a federal income tax deduction by us pursuant to Section 280G of the Internal Revenue Code. These payments and benefits may also subject an eligible participant, including the
named executive officers, to an excise tax under Section 4999 of the Internal Revenue Code. If the payments or benefits payable to an eligible participant in connection with a change in control would be subject to the excise tax imposed under Section 4999 of the Internal Revenue Code, then those payments or benefits will be reduced if such reduction would result in a greater net after-tax benefit to the applicable participant.

**Offer letters in place for named executive officers**

**Stéphane Bancel**

On February 23, 2011, we entered into an offer letter with Mr. Bancel, who currently serves as our Chief Executive Officer. The offer letter set forth Mr. Bancel’s initial annual base salary, initial target annual bonus and initial equity award grants. Mr. Bancel is subject to our standard non-competition, non-solicitation, confidentiality, and assignment agreement, which provides for a perpetual post-termination confidentiality covenant as well as post-termination non-competition and non-solicitation of customers, employees and consultants covenants for one year following termination.

In addition, in June 2018, we entered into a letter agreement with Mr. Bancel, which was amended on November 4, 2018. Pursuant to the letter agreement, as amended, the Company has agreed to grant Mr. Bancel an option to purchase 10,000,000 shares of the Company’s common stock (subject to adjustment in the event of a stock split, stock consolidation or similar event prior to grant), contingent on, and effective immediately following, the time the registration statement of which this prospectus is a part is declared effective by the SEC, or the IPO Effective Date, subject to Mr. Bancel’s continuous employment with the Company through such date and the IPO Effective Date occurring no later than December 31, 2019. If our initial public offering does not close within five business days after the IPO Effective Date, then the option grant will be forfeited at such time. The option will have a per share exercise price equal to the “Price to the Public” (or equivalent) set forth on the cover page of the final prospectus included in the registration statement, which will be the fair market value of a share of the Company’s common stock on the grant date of the option. The “Vesting Commencement Date” for the option is June 13, 2018. The option will be divided into two tranches. One-half of the shares subject to the option, or the Tranche 1 Portion, will vest on the fifth anniversary of the Vesting Commencement Date, generally subject to Mr. Bancel’s continued employment with the Company through such date, and the remaining one-half of the shares subject to the option, or the Tranche 2 Portion, will vest in accordance with the following schedule: 25% of the shares subject to the Tranche 2 Portion will vest on the second anniversary of the Vesting Commencement Date and the remaining shares subject to the Tranche 2 Portion will vest in equal quarterly installments thereafter for the next three years, generally subject to Mr. Bancel’s continued employment with the Company through each applicable vesting date. The option will be subject to the terms, conditions, definitions and provisions of the 2018 Stock Plan, and the applicable stock option agreement thereunder. Our board of directors has elected to make this option grant to recognize Mr. Bancel’s continuing leadership of the Company in its mission to create a new category of transformative medicines based on mRNA. The board of directors believes that setting the exercise price for this option grant at the price of the shares sold to the public in our initial public offering will further align on a going-forward basis the economic interests of our Chief Executive Officer and our stockholders, including those purchasing shares in our initial public offering.

**Stephen Hoge**

On November 26, 2012, we entered into an offer letter with Dr. Hoge, who currently serves as our President. The offer letter provides for Dr. Hoge’s at-will employment and set forth his initial annual base salary, initial target annual bonus and an initial equity award grant, as well as his eligibility to participate in our benefit plans generally. Dr. Hoge is subject to our standard non-competition, non-solicitation, confidentiality, and assignment agreement, which provides for a perpetual post-termination confidentiality covenant as well as post-termination non-competition and non-solicitation of customers, employees and consultants covenants for one year following termination.
On February 20, 2014, we entered into an offer letter with Dr. Kim, who currently serves as our Chief Financial Officer. The offer letter provides for Dr. Kim’s at-will employment and set forth his initial annual base salary, initial target annual bonus and an initial equity award grant, as well as his eligibility to participate in our benefit plans generally. Dr. Kim is subject to our standard non-competition, non-solicitation, confidentiality, and assignment agreement, which provides for a perpetual post-termination confidentiality covenant as well as post-termination non-competition and non-solicitation of customers, employees and consultants covenants for one year following termination.

Outstanding equity awards at fiscal 2017 year-end

The following table sets forth information regarding outstanding equity awards held by our named executive officers as of December 31, 2017:

<table>
<thead>
<tr>
<th>Name</th>
<th>Grant Date(2)</th>
<th>Vesting Commencement Date</th>
<th>Option Awards(3)</th>
<th>Stock Awards(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stephane Bancel</td>
<td>8/19/13</td>
<td>4/25/13</td>
<td>10,000,000(5)</td>
<td>472,837(3)</td>
</tr>
<tr>
<td></td>
<td>2/23/16</td>
<td>2/23/16</td>
<td>656,250(5)</td>
<td>3,063,984</td>
</tr>
<tr>
<td></td>
<td>8/10/16</td>
<td>4/24/14</td>
<td>1,065,138(5)</td>
<td>8/10/2026</td>
</tr>
<tr>
<td></td>
<td>4/24/14</td>
<td>4/24/14</td>
<td>1,52,162(5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8/10/16</td>
<td>4/9/15</td>
<td>263,400(5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4/9/15</td>
<td></td>
<td>158,040(5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2/23/17</td>
<td>2/22/17</td>
<td>1,400,000(5)</td>
<td></td>
</tr>
<tr>
<td>Stephen Hoge</td>
<td>8/19/13</td>
<td>4/25/13</td>
<td>2,000,000(4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2/23/16</td>
<td>2/23/16</td>
<td>350,000(5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8/10/16</td>
<td>4/24/14</td>
<td>426,055(5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4/24/14</td>
<td></td>
<td>60,865(5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8/10/16</td>
<td>4/9/15</td>
<td>131,700(5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4/9/15</td>
<td></td>
<td>79,020(5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2/23/17</td>
<td>2/22/17</td>
<td>1,000,000(5)</td>
<td></td>
</tr>
<tr>
<td>Lorence Kim</td>
<td>8/10/16</td>
<td>4/21/14</td>
<td>511,266(5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4/21/14</td>
<td></td>
<td>73,038(5)</td>
<td></td>
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<tr>
<td></td>
<td>8/10/16</td>
<td>4/9/15</td>
<td>131,700(5)</td>
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<td>4/9/15</td>
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<td></td>
<td>8/10/16</td>
<td>11/18/15</td>
<td>702,400(5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12/11/15</td>
<td>11/18/15</td>
<td>650,000(5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2/23/17</td>
<td>2/22/17</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6/14/17</td>
<td>11/18/15</td>
<td>1,000,000(7)</td>
<td></td>
</tr>
</tbody>
</table>

(1) Each equity award is subject to the terms of our 2016 Stock Option and Grant Plan, as amended from time to time, or the 2016 Plan. Each equity award is also subject to the acceleration of vesting provisions in the Executive Severance Plan.

(2) For equity awards granted prior to the 2016 Reorganization, the grant date listed is the original grant date of the equity award (i.e., the grant date of unit options or incentive units as applicable in Moderna LLC).

(3) The amount represents the number of shares of restricted stock or unvested restricted stock units multiplied by the value of a share of our common stock on December 31, 2017, which was $6.48. Unless otherwise specified, all stock awards listed in the table are restricted stock awards.

(4) The shares subject to the option are fully vested.

(5) 25% of the shares subject to the equity award vest on the first anniversary of the vesting commencement date and the remaining 75% vest in 12 equal quarterly installments thereafter, generally subject to the...
named executive officer’s continuous service relationship with the Company through each applicable vesting date.

(6) 2,000,000 of the shares subject to the option vest over four years in accordance with the following schedule: 25% of such shares vest on the first anniversary of the vesting commencement date and the remaining 75% of such shares vest in 12 equal quarterly installments thereafter, generally subject to the named executive officer’s continuous service relationship with the Company through each applicable vesting date. 1,000,000 of the shares subject to the option vest over five years in accordance with the following schedule: 25% of such shares vest on the second anniversary of the vesting commencement date and the remaining 75% of such shares vest in 12 equal quarterly installments thereafter, generally subject to the named executive officer’s continuous service relationship with the Company through each applicable vesting date. 1,000,000 of the shares subject to the option vest over six years in accordance with the following schedule: 25% of such shares vest on the third anniversary of the vesting commencement date and the remaining 75% of such shares vest in 12 equal quarterly installments thereafter, generally subject to the named executive officer’s continuous service relationship with the Company through each applicable vesting date.

(7) 500,000 restricted stock units, or IPO RSUs, vest upon the consummation of this offering, subject to the named executive officer’s continuous employment with the Company through such date and the remaining 500,000 restricted stock units, or Service RSUs, vest upon the satisfaction of time-based criteria. For the Service RSUs, 50% of such Service RSUs vest on the second anniversary of the vesting commencement date and the remaining 50% of the Service RSUs vest in eight equal quarterly installments thereafter, generally subject to the named executive officer’s continuous employment with the Company through each applicable vesting date. The IPO RSUs will be settled on the date which is 360 days following the consummation of this offering. The Service RSUs will be settled as soon as practicable following each applicable vesting date (but in no event later than two and a half months following the end of the year in which any Service RSU vesting date occurs); provided, that with respect to Service RSUs that vest prior to the consummation of this offering, as well as during the 360 day period following the consummation of this offering, such Service RSUs will be settled on the date which is 360 days following the consummation of this offering (and at the same time as the IPO RSUs are settled).

Employee benefits and equity compensation plans

2018 Stock option and incentive plan

In connection with this offering, our board of directors, upon the recommendation of the compensation and talent committee of the board of directors, or the compensation committee, is expected to adopt the 2018 Stock Plan, which will be subsequently approved by our stockholders. The 2018 Stock Plan is expected to become effective on the date immediately prior to the date on which the registration statement of which this prospectus is part is declared effective by the SEC. The 2018 Stock Plan is expected to replace our 2016 Plan, as our board of directors has determined not to make additional awards under the 2016 Plan following the closing of this offering. The 2018 Stock Plan will provide flexibility to our compensation committee to use various equity-based incentive awards as compensation tools to motivate our workforce.

We will initially reserve shares of our common stock, or the Initial Limit, for the issuance of awards under the 2018 Stock Plan. The 2018 Stock Plan will provide that the number of shares reserved and available for issuance under the plan will automatically increase each January 1, beginning on January 1, 2019, by 4% of the outstanding number of shares of our common stock on the immediately preceding December 31, or such lesser number of shares as determined by our compensation committee. This number is referred to herein as the Annual Increase. This number will be subject to adjustment in the event of a stock split, stock dividend or other change in our capitalization.

The shares we issue under the 2018 Stock Plan will be authorized but unissued shares or shares that we reacquire. The shares of common stock underlying any awards that are forfeited, cancelled, held back upon exercise or settlement of an award to satisfy the exercise price or tax withholding, reacquired by us prior to vesting, satisfied without any issuance of stock, expire or are otherwise terminated (other than by exercise) under the 2018 Stock Plan will be treated as shares that have not been reserved for issuance under the 2018 Stock Plan.
The maximum aggregate number of shares that may be issued in the form of incentive stock options may not exceed the Initial Limit cumulatively increased on January 1, 2019, and on each January 1 thereafter by the lesser of (i) the Annual Increase for such year or (ii) shares of common stock.

The grant date fair value of all awards made under our 2018 Stock Plan and all other cash compensation paid by us to any non-employee director in any calendar year may not exceed $1,500,000 for the first year of service and $1,000,000 for each year of service thereafter.

The 2018 Stock Plan will permit the granting of both options to purchase common stock intended to qualify as incentive stock options under Section 422 of the Internal Revenue Code and options that do not so qualify. The option exercise price of each option will be determined by our compensation committee but may not be less than 100% of the fair market value of our common stock on the date of grant. The term of each option will be fixed by our compensation committee and may not exceed ten years from the date of grant. Our compensation committee will determine at what time or times each option may be exercised.

Our compensation committee may award stock appreciation rights subject to such conditions and restrictions as it may determine. Stock appreciation rights entitle the recipient to shares of common stock or cash, equal to the value of the appreciation in our stock price over the exercise price. The exercise price of each stock appreciation right may not be less than 100% of the fair market value of the common stock on the date of grant. The term of each stock appreciation right will be fixed by our compensation committee and may not exceed ten years from the date of grant. Our compensation committee will determine at what time or times each stock appreciation right may be exercised.

Our compensation committee will be permitted to award restricted shares of common stock and restricted stock units to participants subject to such conditions and restrictions as it may determine. These conditions and restrictions may include the achievement of certain performance goals and/or continued employment or service relationship with us through a specified vesting period. Our compensation committee will also be permitted to grant shares of common stock that are free from any restrictions under the 2018 Stock Plan. Unrestricted stock may be granted to participants in recognition of past services or other valid consideration and may be issued in lieu of cash compensation due to such participant.

Our compensation committee will be permitted to grant cash bonuses under the 2018 Stock Plan to participants, subject to the achievement of certain performance goals.

The 2018 Stock Plan will provide that upon the effectiveness of a “sale event,” as defined in the 2018 Stock Plan, an acquirer or successor entity may assume, continue or substitute outstanding awards under the 2018 Stock Plan. To the extent that awards granted under our 2018 Stock Plan are not assumed or continued or substituted by the successor entity, except as may be otherwise provided in the relevant award certificate, all awards with time-based vesting, conditions or restrictions will become fully vested and nonforfeitable as of the effective time of the sale event, and all awards with conditions and restrictions relating to the attainment of performance goals may become vested and nonforfeitable in connection with a sale event in the compensation committee’s discretion or to the extent specified in the relevant award certificate. Upon the effective time of the sale event, all
outstanding awards granted under the 2018 Stock Plan will terminate to the extent not assumed, continued or substituted for. In the event of such
termination, individuals holding options and stock appreciation rights will be permitted to exercise such options and stock appreciation rights (to the
extent exercisable) within a specified period of time prior to the sale event. In addition, in connection with the termination of the 2018 Stock Plan
upon a sale event, we may make or provide for a payment, in cash or in kind, to participants holding vested and exercisable options and stock
appreciation rights equal to the difference between the per share cash consideration payable to stockholders in the sale event and the exercise price of
the options or stock appreciation rights and we may make or provide for a payment, in cash or in kind, to participants holding other vested awards.

Our board of directors will be permitted to amend or discontinue the 2018 Stock Plan and our compensation committee will be permitted to amend the
exercise price of options and amend or cancel outstanding awards for purposes of satisfying changes in law or any other lawful purpose but no such
action may adversely affect rights under an award without the holder’s consent. Certain amendments to the 2018 Stock Plan will require the approval
of our stockholders.

No awards will be granted under the 2018 Stock Plan after the date that is 10 years from the date of stockholder approval. No awards under the 2018
Stock Plan have been made prior to the date of this prospectus.

2016 Stock Option and Grant Plan

The 2016 Plan was approved by our board of directors and our stockholders on August 9, 2016. As of December 31, 2017, we reserved an aggregate of
105,271,240 shares of our common stock for the issuance of options and other equity awards under the 2016 Plan. This number is subject to adjustment
in the event of a stock split, stock dividend, or other change in our capitalization. As of December 31, 2017, options to purchase 73,431,414 shares of
our common stock at a weighted average exercise price of $4.27 per share, 2,357,029 shares of restricted stock, and 1,000,000 restricted stock units
were outstanding under the 2016 Plan and 11,125,718 shares remained available for future issuance under the 2016 Plan. Following this offering, we
will not grant any further awards under our 2016 Plan, but all outstanding awards under the 2016 Plan will continue to be governed by their existing
terms.

The shares we have issued under the 2016 Plan were authorized but unissued shares or shares we reacquired. The shares of common stock underlying
any awards that are forfeited, canceled, reacquired by us prior to vesting, satisfied without the issuance of stock, or otherwise terminated (other than by
exercise) and the shares of common stock that are withheld upon exercise of a stock option or settlement of an award to cover the exercise price or tax
withholding, are currently added back to the shares of common stock available for issuance under the 2016 Plan. Following this offering, such shares
will be added to the shares of common stock available for issuance under the 2018 Stock Plan.

The 2016 Plan is currently administered by the compensation committee. The plan administrator has the authority to interpret and administer our 2016
Plan and any agreement thereunder and to determine the terms of awards, including the recipients, the number of shares subject to each award, the
exercise price, if any, the vesting schedule applicable to the awards together with any vesting acceleration and the terms of the award agreement for use
under our 2016 Plan. The plan administrator is specifically authorized to exercise its discretion to reduce the exercise price of outstanding stock
options or effect the repricing of stock options through cancellation and re-grants.

The 2016 Plan permits us to make grants of incentive stock options to our employees and any of our subsidiary corporations’ employees, and grants of
non-qualified stock options, restricted stock awards, and restricted stock units to the officers, employees, directors, and consultants of the company and our subsidiary corporations.

The 2016 Plan permits the granting of (i) stock options to purchase common stock intended to qualify as incentive stock options under Section 422 of
the Internal Revenue Code and (ii) stock options that do not so
The option exercise price per share of our common stock underlying each stock option was determined by our board or directors or a committee appointed by the board of directors, and must have been at least equal to 100% of the fair market value of a share of our common stock on the date of grant. In the case of an incentive stock option granted to a participant who, at the time of grant of such stock option, owned stock representing more than 10% of the voting power of all classes of stock of the Company, or a 10% owner, the exercise price per share of our common stock underlying each such stock option must have been at least equal to 110% of the fair market value of a share of our common stock on the date of grant. The term of each stock option may not have exceeded 10 years from the date of grant (or five years for a 10% owner). The exercise price of a stock option (i) may be made in cash, (ii) if an initial public offering of the Company has occurred, may be made through a broker-assisted arrangement, (iii) if permitted by the board of directors or a committee appointed by the board of directors (the “Committee”) and an initial public offering of the company has occurred, may be made through the delivery of shares of our common stock owned by the participant or, (iv) if permitted by the Committee, may be made through a net exercise arrangement for non-qualified stock options. After a participant’s termination of service (other than a termination for cause), the participant generally may exercise his or her stock options, to the extent vested as of such date of termination, for three months after termination or such longer period of time as specified in the applicable stock option agreement; provided, that if the termination is due to death or disability, the stock option generally will remain exercisable, to the extent vested as of such date of termination, until the one-year anniversary of such termination. However, in no event may a stock option be exercised later than the expiration of its term.

The 2016 Plan permits the granting of shares of restricted stock. Restricted stock awards are grants of shares of our common stock that are subject to various restrictions, including restrictions on transferability and forfeitures provisions. Shares of restricted stock will vest, and the restrictions on such shares will lapse, in accordance with terms and conditions established by the administrator.

The 2016 Plan permits the granting of shares of unrestricted stock. Unrestricted stock awards may be granted to participants in recognition of past services or for other valid consideration and may be issued in lieu of cash compensation due to such participant.

The 2016 Plan permits the granting of restricted stock units. A restricted stock unit is an award that covers a number of shares of our common stock that may be settled upon vesting in cash or by the issuance of the underlying shares. The administrator determines the terms and conditions of restricted stock units, including the number of units granted, the vesting criteria (which may include accomplishing specified performance criteria or continued service to us), and the form and timing of payment.

The 2016 Plan generally does not allow for the transfer or assignment of awards, other than, at the discretion of the plan administrator, by will or the laws of descent and distribution, pursuant to a domestic relations order, by gift to an immediate family member, or by instrument to an inter vivos or testamentary trust in which the award is passed to beneficiaries upon the death of the participant.

The 2016 Plan provides that upon the occurrence of a “sale event” as defined in the 2016 Plan, awards may be assumed, substituted for new awards of a successor entity, or otherwise continued or terminated at the effective time of such sale event. In the event that outstanding equity awards will be terminated, such equity awards will become fully vested as of the consummation of the sale event. In the case of the termination of outstanding stock options, such stock options may be exercised to the extent then exercisable within a period of time prior to the consummation of the sale event. In the case of forfeiture of restricted stock, such awards may be repurchased by us for a price per share equal to the original per share purchase price paid by the participant for the shares. We may also make or provide for a cash payment to holders of vested and exercisable stock options, in exchange for the cancellation thereof, equal to, for each share of our common stock underlying such stock option, the difference between the per share cash consideration in the sale event and the per share exercise price. We may make or provide for a cash payment to holders of restricted stock and restricted stock unit awards, in exchange for the cancellation thereof, in an amount equal to the product of the per share cash consideration in the sale event and the number of shares subject to each such award.

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Our board of directors may amend, suspend, or terminate the 2016 Plan at any time, subject to stockholder approval where such approval is required by applicable law. The board of directors may also amend, modify, or terminate any outstanding award, including the exercise price of such award, provided that no amendment to an award may adversely affect any of the rights of a participant under any awards previously granted without his or her consent. We will not make any further grants under the 2016 Plan following this offering.

2018 Employee Stock Purchase Plan

Our ESPP was adopted by our board of directors and approved by our stockholders in November 2018 and will become effective on the date immediately prior to the date on which the registration statement of which this prospectus is part is declared effective by the SEC. The ESPP initially reserves and authorizes the issuance of up to a total of shares of common stock to participating employees. The ESPP provides that the number of shares reserved and available for issuance will automatically increase each January 1, beginning on January 1, 2020, by the least of shares of our common stock, 1% of the outstanding number of shares of our common stock on the immediately preceding December 31, or such lesser number of shares as determined by our compensation committee. This number will be subject to adjustment in the event of a stock split, stock dividend or other change in our capitalization.

All employees whose customary employment is for more than 20 hours per week and who have completed at least 30 days of employment will be eligible to participate in the ESPP. Any employee who owns 5% or more of the total combined voting power or value of all classes of stock will not be eligible to purchase shares under the ESPP.

We will make one or more offerings, consisting of one or more purchase periods, each year to our employees to purchase shares under the ESPP. Offerings will usually begin every six months and will continue for six-month periods, referred to as offering periods. Each eligible employee may elect to participate in any offering by submitting an enrollment form at least 15 business days before the relevant offering date.

Each employee who is a participant in the ESPP may purchase shares by authorizing contributions of between 1% and 50% of his or her compensation during an offering period. Unless the participating employee has previously withdrawn from the offering, his or her accumulated contributions will be used to purchase shares on the last business day of the purchase period at a price equal to 85% of the fair market value of the shares on the first business day of the offering period or the last business day of the purchase period, whichever is lower, provided that no more than shares of common stock (or a lesser number as established by the plan administrator in advance of the purchase period) may be purchased by any one employee during each purchase period. Under applicable tax rules, an employee may purchase no more than $25,000 worth of shares of common stock, valued at the start of the offering period, under the ESPP for each calendar year in which a purchase right is outstanding.

The accumulated contributions of any employee who is not a participant on the last day of a purchase period will be refunded. An employee’s rights under the ESPP terminate upon voluntary withdrawal from the plan or when the employee ceases employment with us for any reason.

The ESPP may be terminated or amended by our board of directors at any time, but will automatically terminate on the 10-year anniversary of this offering. An amendment that increases the number of shares of common stock that are authorized under the ESPP and certain other amendments will require the approval of our stockholders. The plan administrator may adopt subplans under the ESPP for employees of our non-U.S. subsidiaries.

Senior Executive Cash Incentive Bonus Plan

In October 2018, our board of directors adopted the Senior Executive Cash Incentive Bonus Plan, or the Bonus Plan. The Bonus Plan provides for cash bonus payments based upon the attainment of performance targets.
established by our compensation committee. The payment targets will be related to financial and operational measures or objectives with respect to our company, or corporate performance goals, as well as individual performance objectives.

Our compensation committee may select corporate performance goals from among the following: developmental, publication, clinical or regulatory milestones; cash flow (including, but not limited to, operating cash flow and free cash flow); revenue; corporate revenue; earnings before interest, taxes, depreciation and amortization; net income (loss) (either before or after interest, taxes, depreciation and/or amortization); changes in the market price of our common stock; economic value-added; acquisitions, licenses or strategic transactions; financing or other capital raising transactions; operating income (loss); return on capital, assets, equity, or investment; stockholder returns; return on sales; total shareholder return; gross or net profit levels; productivity; expense efficiency; margins; operating efficiency; customer satisfaction; working capital; earnings (loss) per share of our common stock; bookings, new bookings or renewals; sales or market shares; number of prescriptions or prescribing physicians; coverage decisions; leadership development, employee retention, and recruiting and other human resources matters; operating income and/or net annual recurring revenue, any of which may be measured in absolute terms, as compared to any incremental increase, in terms of growth, or as compared to results of a peer group.

Each executive officer who is selected to participate in the Bonus Plan will have a target bonus opportunity set for each performance period. The bonus formulas will be adopted in each performance period by the compensation committee and communicated to each executive. The corporate performance goals will be measured at the end of each performance period after our financial reports have been published or such other appropriate time as the compensation committee determines. If the corporate performance goals and individual performance objectives are met, payments will be made as soon as practicable following the end of each performance period, but not later than 74 days after the end of the fiscal year in which such performance period ends. Subject to the rights contained in any agreement between the executive officer and us, an executive officer must be employed by us on the bonus payment date to be eligible to receive a bonus payment. The Bonus Plan also permits the compensation committee to approve additional bonuses to executive officers in its sole discretion.

401(k) plan

We maintain a tax-qualified retirement plan that provides eligible U.S. employees with an opportunity to save for retirement on a tax-advantaged basis. Plan participants are able to defer eligible compensation subject to applicable annual Internal Revenue Code limits. We provide a matching contribution of 50% of employee contributions up to 6% of compensation, which is 100% vested when contributed. The 401(k) plan is intended to be qualified under Section 401(a) of the Internal Revenue Code with the 401(k) plan’s related trust intended to be tax exempt under Section 501(a) of the Internal Revenue Code. As a tax-qualified retirement plan, contributions to the 401(k) plan and earnings on those contributions are not taxable to the employees until distributed from the 401(k) plan.
DIRECTOR COMPENSATION

Non-employee director compensation program

During the fiscal year ended December 31, 2017, we provided compensation to our non-employee directors in the form of cash retainers and equity awards as set forth below, with cash retainers prorated for partial years of service:

<table>
<thead>
<tr>
<th>Compensation Type</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Retainer for service on the board of directors</td>
<td>$50,000</td>
</tr>
<tr>
<td>Additional Annual Retainer for Non-Executive Chairman of the board of directors</td>
<td>$25,000</td>
</tr>
<tr>
<td>Additional Annual Retainer for Committee Membership (other than Chair)</td>
<td>$5,000</td>
</tr>
<tr>
<td>Additional Annual Retainer for Committee Membership (Chair)</td>
<td>$10,000</td>
</tr>
</tbody>
</table>

Upon initial election to our board of directors, each non-employee director was generally granted an option to purchase 92,000 shares of our common stock, or the Initial Grant. In addition, for each year thereafter, each non-employee director who continued as a member of the board of directors was granted an option to purchase 92,000 shares of our common stock, or the Annual Grant. The Initial Grant and the Annual Grant each vest in full on the first anniversary of their respective grant dates, subject to continued service as a director through such date. All of the foregoing options were granted with a per share exercise price equal to the fair market value of a share of our common stock on the date of grant and with a term of ten years.

Employee directors received no additional compensation for their service as a director.

We reimbursed all reasonable out-of-pocket expenses incurred by directors for their attendance at meetings of our board of directors or any committee thereof.

We have adopted a non-employee director compensation policy which will become effective immediately prior to the completion of this offering, pursuant to which our non-employee directors will be eligible to receive the following cash retainers (which will be prorated for partial years of service) and equity awards:

<table>
<thead>
<tr>
<th>Compensation Type</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Retainer for service on the board of directors</td>
<td>$50,000</td>
</tr>
<tr>
<td>Additional Annual Retainer for Non-Executive Chairman of the board of directors</td>
<td>$30,000</td>
</tr>
<tr>
<td>Additional Annual Retainer for service as Chairperson of the Audit Committee</td>
<td>$20,000</td>
</tr>
<tr>
<td>Additional Annual Retainer for service as member of the Audit Committee (other than Chairperson)</td>
<td>$10,000</td>
</tr>
<tr>
<td>Additional Annual Retainer for service as Chairperson of the Compensation &amp; Talent Committee</td>
<td>$15,000</td>
</tr>
<tr>
<td>Additional Annual Retainer for service as member of the Compensation &amp; Talent Committee (other than Chairperson)</td>
<td>$7,500</td>
</tr>
<tr>
<td>Additional Annual Retainer for service as Chairperson of the Nominating and Corporate Governance Committee</td>
<td>$10,000</td>
</tr>
<tr>
<td>Additional Annual Retainer for service as member of the Nominating and Corporate Governance Committee (other than Chairperson)</td>
<td>$5,000</td>
</tr>
<tr>
<td>Additional Annual Retainer for service as Chairperson of the Product Development Committee</td>
<td>$15,000</td>
</tr>
<tr>
<td>Additional Annual Retainer for service as member of the Product Development Committee (other than Chairperson)</td>
<td>$7,500</td>
</tr>
</tbody>
</table>

Our policy will provide that, upon initial election to our board of directors, each non-employee director will be granted an option with a grant date fair value of $355,000, or a Post-IPO Initial Grant, an exercise price per share equal to the closing price of a share of our common stock on the date of grant and a term of ten years, that vests in full on the one-year anniversary of the grant date, subject to the non-employee director’s continuous service as our director through such date. On the date of each of our annual meetings of stockholders following the completion of this offering, each non-employee director who continues as a member of the board of directors will...
be granted an option with a grant date fair value of $355,000, or a Post-IPO Annual Grant, an exercise price per share equal to the closing price of a share of our common stock on the date of grant and a term of ten years, that vests in full on the earlier of (i) the one-year anniversary of the grant date or (ii) the next annual meeting of stockholders, subject to the non-employee director’s continuous service as our director through each applicable vesting date. If a new non-employee director joins our board of directors on a date other than the date of our annual meeting of stockholders, then such non-employee director will be granted a pro-rata portion of the Post-IPO Annual Grant based on the time between such director’s appointment and our next annual meeting of stockholders. The Post-IPO Initial Grants and Post-IPO Annual Grants are subject to full accelerated vesting upon a “sale event,” as defined in the 2018 Stock Plan.

The policy also provides the amount of, pursuant to the 2018 Stock Plan, the aggregate amount of compensation, including both the grant date fair value of equity compensation and cash compensation, paid to any non-employee director in a calendar year will not exceed $1,500,000 for the first year of service and $1,000,000 for each year of service thereafter (or such other limits as may be set forth in the 2018 Stock Plan or any similar provision of a successor plan).

Employee directors will receive no additional compensation for their service as a director.

We will reimburse all reasonable out-of-pocket expenses incurred by directors for their attendance at meetings of our board of directors or any committee thereof.

### Non-employee director compensation table

The following table provides information regarding the total compensation that was earned by or paid to each of our non-employee directors during the fiscal year ended December 31, 2017. Mr. Bancel, who is our Chief Executive Officer, did not receive any additional compensation for his service as a director. The compensation received by Mr. Bancel, as a named executive officer of the Company, is presented in “Executive Compensation—2017 Summary Compensation Table” above.

<table>
<thead>
<tr>
<th>Name</th>
<th>Fees Earned or Paid in Cash ($)</th>
<th>Option Awards ($)</th>
<th>All Other Compensation ($)</th>
<th>Total ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noubar B. Afeyan, Ph.D.(2)</td>
<td>$105,000</td>
<td>$292,560</td>
<td>—</td>
<td>$397,560</td>
</tr>
<tr>
<td>Lee Babiss(3)</td>
<td>$ 53,750</td>
<td>$292,560(4)</td>
<td>—</td>
<td>$346,310</td>
</tr>
<tr>
<td>Stephen Berenson(5)</td>
<td>$ 15,720</td>
<td>$355,120</td>
<td>—</td>
<td>$370,840</td>
</tr>
<tr>
<td>Peter Barton Hutt LL.M.(6)</td>
<td>$ 55,000</td>
<td>$292,560</td>
<td>—</td>
<td>$347,560</td>
</tr>
<tr>
<td>Robert Langer, Sc.D.(7)</td>
<td>$ 60,000</td>
<td>$292,560</td>
<td>$ 20,000(8)</td>
<td>$372,560</td>
</tr>
<tr>
<td>John Mendlein, Ph.D.(9)</td>
<td>$ 70,000</td>
<td>$292,560</td>
<td>—</td>
<td>$362,560</td>
</tr>
<tr>
<td>Elizabeth Nabel, M.D.(10)</td>
<td>$ 55,000</td>
<td>$292,560</td>
<td>—</td>
<td>$347,560</td>
</tr>
<tr>
<td>Israel Ruiz(11)</td>
<td>$ 58,139</td>
<td>$292,560</td>
<td>—</td>
<td>$350,699</td>
</tr>
<tr>
<td>Moncef Slaoui, Ph.D.(12)</td>
<td>$ 21,332</td>
<td>$345,000</td>
<td>—</td>
<td>$366,332</td>
</tr>
<tr>
<td>Henri A. Termeer(13)</td>
<td>$ 60,000</td>
<td>$292,560</td>
<td>—</td>
<td>$352,560</td>
</tr>
</tbody>
</table>

(1) The amounts reported represent the aggregate grant date fair value of the stock options awarded to the non-employee directors in the fiscal year ended December 31, 2017, calculated in accordance with FASB ASC Topic 718. Such grant date fair values do not take into account any estimated forfeitures. The assumptions used in calculating the grant date fair value of the stock options reported in this column are set forth in Note 10 to our Consolidated Financial Statements included elsewhere in this prospectus. The amounts reported in this column reflect the accounting cost for these stock options and do not correspond to the actual economic value that may be received by the non-employee directors upon the exercise of the stock options or any sale of the underlying shares of common stock.
As of December 31, 2017, Dr. Afeyan held outstanding options to purchase a total of 92,000 shares of our common stock.

Mr. Babiss resigned from our board of directors on September 1, 2017 and transitioned into the role of a consultant to the Company as of such date. Pursuant to a consulting agreement by and between the Company and Mr. Babiss, dated as of September 1, 2017, Mr. Babiss will provide advice and counsel to our Chief Executive Officer, from time to time and upon request from our Chief Executive Officer, in exchange for continued vesting of certain options held by Mr. Babiss as of such date as well as an extension of the post-termination exercise period for certain options held by Mr. Babiss as of such date until the earlier of (i) the original expiration date applicable to such options or (ii) the first anniversary of the Company’s next financing round. As of December 31, 2017, Mr. Babiss held outstanding options to purchase a total of 894,000 shares of our common stock.

Mr. Babiss was granted an option on February 23, 2017, with a grant date fair value equal to $292,560, computed in accordance with FASB ASC Topic 718 for such option amendments. On September 1, 2017, as described in footnote 3 above, this option, as well as two other options previously granted to Mr. Babiss on August 10, 2016, were amended to extend their post-termination exercise periods. There was no incremental value required to be recorded in accordance with FASB ASC Topic 718 for the option amendments.

Mr. Berenson was elected to our board of directors on October 10, 2017. As of December 31, 2017, Mr. Berenson held options to purchase a total of 92,000 shares of our common stock.

As of December 31, 2017, Mr. Hutt held options to purchase a total of 1,914,194 shares of our common stock.

As of December 31, 2017, Dr. Langer held options to purchase a total of 372,280 shares of our common stock and 18,135 shares of restricted stock.

The amount reported represents $20,000 in consulting fees for Dr. Langer’s service as a member of our Scientific Advisory Board, or SAB, pursuant to a Scientific Advisory Board Member Agreement by and between the Company and Dr. Langer, dated as of September 19, 2014. Under such agreement, Dr. Langer is provided with a quarterly consulting fee of $5,000 in exchange for his attendance at SAB meetings and guidance in the field of research, development and commercialization of products involving the use of RNA agnostics and/or modified nucleic acids to alter cellular physiology.

Dr. Mendlein resigned from our board of directors on June 13, 2018. As of December 31, 2017, Dr. Mendlein held outstanding options to purchase a total of 164,194 shares of our common stock.

Mr. Ruiz was elected to our board of directors on February 7, 2017. As of December 31, 2017, Mr. Ruiz held outstanding options to purchase a total of 92,000 shares of our common stock.

Dr. Slouai was elected to our board of directors on July 27, 2017. As of December 31, 2017, Dr. Slouai held options to purchase a total of 92,000 shares of our common stock.

Mr. Termeer passed away on May 12, 2017. As of December 31, 2017, Mr. Termeer’s estate held options to purchase a total of 914,194 shares of our common stock.

Effective as of June 13, 2018, Paul Sagan was elected to our board of directors to fill the vacancy created upon the resignation of Dr. Mendlein on such date. Upon appointment, Mr. Sagan received an Initial Grant and is entitled to cash compensation for his services as described under “Non-employee director compensation program” above.

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CERTAIN RELATIONSHIPS AND RELATED PARTY TRANSACTIONS

Other than the compensation agreements and other arrangements described under the sections entitled “Executive Compensation” and “Director Compensation” appearing elsewhere this prospectus and the transactions described below, since January 1, 2015, there has not been and there is not currently proposed, any transaction or series of similar transactions to which we were, or will be, a party in which the amount involved exceeded, or will exceed, $120,000 and in which any director, executive officer, holder of five percent or more of any class of our capital stock or any member of the immediate family of, or entities affiliated with, any of the foregoing persons, had, or will have, a direct or indirect material interest.

Private placements of securities

Series G preferred stock financing

On January 30, 2018 and on February 15, 2018, respectively, the Company entered into Series G Preferred Stock Purchase Agreements, pursuant to which we issued and sold an aggregate of 55,666,004 shares of our Series G preferred stock at a price per share of $10.06, for an aggregate purchase price of $560 million. The following table sets forth the number of shares of our Series G preferred stock that we issued to our 5% stockholders and their affiliates in this transaction:

<table>
<thead>
<tr>
<th>Name</th>
<th>Shares of Series G Preferred Stock</th>
<th>Total Purchase Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCHA LLC (1)</td>
<td>50,000</td>
<td>$ 503,000.00</td>
</tr>
</tbody>
</table>

(1) Stéphane Bancel, our Chief Executive Officer and one of our directors, is the managing member of OCHA LLC, which is a family investment vehicle that has no operations.

Series F preferred stock financing

On August 10, 2016, the Company entered into a Series F Preferred Stock Purchase Agreement pursuant to which we issued and sold an aggregate of 54,001,241 shares of our Series F preferred stock at a price per share of $8.78, for an aggregate purchase price of $474 million. The following table sets forth the number of shares of our Series F preferred stock that we issued to our 5% stockholders and their affiliates in this transaction:

<table>
<thead>
<tr>
<th>Name</th>
<th>Shares of Series F Preferred Stock</th>
<th>Total Purchase Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>AstraZeneca and affiliated entities</td>
<td>15,945,330</td>
<td>$ 139,999,997.40</td>
</tr>
<tr>
<td>Boston Biotech Ventures LLC (1)</td>
<td>10,000</td>
<td>$ 87,800.00</td>
</tr>
</tbody>
</table>

(1) Stéphane Bancel, our Chief Executive Officer and one of our directors, is the managing member of Boston Biotech Ventures LLC, an investment vehicle with no operations.

Corporate reorganization

In August 2016, we engaged in a corporate reorganization, a description of which is set forth in the section entitled “Reorganization” appearing elsewhere in this prospectus.

Agreements with our stockholders

In connection with our preferred stock financings, we entered into an investor rights agreement, a right of first refusal and co-sale agreement, and voting agreement, in each case, with the purchasers of our preferred stock and certain holders of our common stock. Our second amended and restated right of first refusal and co-sale agreement.

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agreement, or ROFR Agreement, provides for rights of first refusal and co-sale and drag along rights in respect of sales by certain holders of our capital stock. Our second amended and restated voting agreement, as amended, or Voting Agreement, contains provisions with respect to the election of our board of directors and its composition. The rights under each of the ROFR Agreement and Voting Agreement will terminate upon the closing of this offering.

Our second amended and restated investors’ rights agreement, or Investor Rights Agreement, provides certain holders of our preferred stock with a participation right to purchase their pro rata share of new securities that we may propose to sell and issue, subject to certain exceptions. Such participation right will terminate upon the closing of this offering. The Investor Rights Agreement further provides certain holders of our capital stock with the right to demand that we file a registration statement, subject to certain limitations, and to request that their shares be covered by a registration statement that we are otherwise filing. See the section titled “Description of Capital Stock—Registration rights” appearing elsewhere in this prospectus, for additional information regarding such registration rights.

Collaboration Agreement

In August 2016, October 2017, and April 2018, we, AstraZeneca PLC and AstraZeneca AB, or, collectively with their affiliates, AstraZeneca, is a greater than 5% stockholder, entered into collaboration and license agreements, each described in the section of this prospectus captioned “Business—Third-Party Strategic Alliances.” We and AstraZeneca also entered into an amended and restated participation agreement in August 2016. Under the amended and restated participation agreement, AstraZeneca agreed, among other things, to certain lock-up obligations and restrictions on certain acquisitions of our equity interests.

Indemnification Agreements

We have entered into agreements to indemnify our directors and executive officers. These agreements will, among other things, require us to indemnify these individuals for certain expenses (including attorneys’ fees), judgments, fines and settlement amounts reasonably incurred by such person in any action or proceeding, including any action by or in our right, on account of any services undertaken by such person on behalf of our Company or that person’s status as a member of our board of directors to the maximum extent allowed under Delaware law.

Policies for approval of related party transactions

Our board of directors reviews and approves transactions with directors, officers and holders of five percent or more of our voting securities and their affiliates, each a related party. Prior to this offering, the material facts as to the related party’s relationship or interest in the transaction are disclosed to our board of directors prior to their consideration of such transaction, and the transaction is not considered approved by our board of directors unless a majority of the directors who are not interested in the transaction approve the transaction. Further, when stockholders are entitled to vote on a transaction with a related party, the material facts of the related party’s relationship or interest in the transaction are disclosed to the stockholders, who must approve the transaction in good faith.

In connection with this offering, we have adopted a written related party transactions policy that such transactions must be approved by our audit committee. This policy will become effective on the date on which the registration statement of which this prospectus is part is declared effective by the SEC.
PRINCIPAL STOCKHOLDERS

The following table sets forth certain information known to us regarding beneficial ownership of our capital stock as of October 31, 2018, as adjusted to reflect the sale of common stock offered by us in this offering, for:

- each person or group of affiliated persons known by us to be the beneficial owner of more than five percent of our capital stock;
- each of our named executive officers;
- each of our directors; and
- all of our executive officers and directors as a group.

Beneficial ownership is determined in accordance with the rules of the SEC and generally includes voting or investment power with respect to securities. Under those rules, beneficial ownership includes any shares as to which the individual or entity has sole or shared voting power or investment power. Except as noted by footnote, and subject to community property laws where applicable, we believe, based on the information provided to us, that the persons and entities named in the table below have sole voting and investment power with respect to all common stock shown as beneficially owned by them.

The percentage of beneficial ownership prior to this offering in the table below is based on shares of common stock deemed to be outstanding as of assuming the conversion of all outstanding shares of our preferred stock upon the closing of this offering, and assuming an initial public offering price of $ per share, which is the midpoint of the offering range set forth on the cover page of this prospectus, and the percentage of beneficial ownership at this offering in the table below is based on shares of common stock assumed to be outstanding after the closing of the offering. The information in the table below assumes no exercise of the underwriters’ option to purchase additional shares.

<table>
<thead>
<tr>
<th>Name and Address of Beneficial Owner(1)</th>
<th>Shares Beneficially Owned Prior to Offering</th>
<th>Shares Beneficially Owned After Offering</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Named Executive Officers and Directors:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stéphane Bancel, Chief Executive Officer(2)(3)</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Stephen Hoge, M.D., President(4)</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Lorence Kim, M.D., Chief Financial Officer(5)</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Noubar B. Afeyan, Ph.D., Chairman(6)</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Moncef Slaloui, Ph.D., Director(7)</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Peter Barton Hutt, L.L.M., Director(8)</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Robert Langer, Sc.D., Director(9)</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Elizabeth Nabel, M.D., Director(10)</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Israel Ruiz, Director(11)</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Stephen Berenson, Director(12)</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Paul Sagan, Director(13)</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td><strong>All executive officers and directors as a group (15 persons)(14)</strong></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td><strong>Other 5% Stockholders:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flagship Pioneering and affiliated entities(6)</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>AstraZeneca and affiliated entities(15)</td>
<td>%</td>
<td>%</td>
</tr>
</tbody>
</table>

(1) Unless otherwise indicated, the address for each beneficial owner is c/o Moderna, Inc., 200 Technology Square, Cambridge, MA 02139.
(2) The shares reported herein consist of (a) shares held directly by Stéphane Bancel; (b) shares held by OCHA LLC, or OCHA, (c) shares held by Boston Biotech Ventures, LLC, or BBV, (d) shares held by a trust for the benefit of Mr. Bancel’s family and of which the trustee is an independent institution and (e) shares of common stock underlying outstanding stock.
Mr. Bancel is the controlling unit holder and sole managing member of each of OCHA and BBV. Mr. Bancel disclaims beneficial ownership of the shares held in the trust.

(3) OCHA LLC or Boston Biotech Ventures, LLC, entities controlled by Mr. Bancel, purchased preferred shares in each of the Series A, B, C, D, E, F, and G preferred financings, on the same terms and conditions applicable to other investors. The total purchase cost for these preferred shares was approximately $3.9 million. These acquired shares represent approximately 4.6% of the total common shares of the Company outstanding on an as converted basis prior to this offering.

(4) Consists of (a) [number] shares held by Stephen Hoge, (b) [number] shares held by Valhalla LLC, and (c) [number] shares of common stock underlying outstanding stock options that are or will be immediately exercisable within 60 days of .

(5) Consists of (a) [number] shares held by Lorence Kim and (b) [number] shares of common stock underlying outstanding stock options that are or will be immediately exercisable within 60 days of .

(6) Consists of (a) [number] shares of common stock held by Flagship VentureLabs IV, LLC, or VentureLabs IV, (b) [number] shares of common stock held by Flagship Pioneering, Inc., or Flagship Pioneering, (c) [number] shares of common stock held by Flagship Ventures Fund IV, L.P., or Flagship IV, (d) [number] shares of common stock held by Flagship Ventures Fund IV-Rx, L.P., or Flagship IV-Rx, and together with VentureLabs IV, the Flagship Funds, (e) [number] shares of common stock underlying stock options held by Noubar B. Afeyan, Ph.D., and (f) [number] shares of common stock underlying stock options held by the Flagship Funds that are or will be immediately exercisable within 60 days of . Flagship IV is a member of VentureLabs IV and also serves as its manager. The General Partner of each of Flagship IV and Flagship IV-Rx is Flagship Ventures Fund IV General Partner LLC, or Flagship IV GP. The General Partner of each of Flagship IV and Flagship IV-Rx is Flagship Ventures Fund IV General Partner LLC, or Flagship IV GP. The General Partner of each of Flagship IV and Flagship Ventures Fund IV-Rx, L.P. (“Flagship IV-Rx” and together with VentureLabs IV and Flagship IV, the “Flagship Funds”) is Flagship Ventures Fund IV General Partner LLC (“Fund IV GP”). Noubar B. Afeyan, Ph.D. and Edwin M. Kania, Jr. are the managers of Fund IV GP and each of these individuals may be deemed to share voting and investment power with respect to all shares held by the Flagship Funds. Neither Fund IV GP, Dr. Afeyan or Mr. Kania directly own any of the shares held by the Flagship Funds, and each of Fund IV GP, Dr. Afeyan and Mr. Kania disclaims beneficial ownership of such shares except to the extent of his or her pecuniary interest therein. The mailing address of the Flagship Funds is 55 Cambridge Parkway, Suite 800E, Cambridge, MA 02142. Dr. Noubar B. Afeyan, Ph.D. is the CEO of Flagship Pioneering, Inc. (formerly Flagship Ventures Management, Inc.). Dr. Afeyan has voting and investment power over the common stock options held by Flagship Pioneering, Inc. Dr. Afeyan disclaims beneficial ownership of such shares except to the extent of his pecuniary interest therein.

(7) Consists of [number] shares of common stock underlying outstanding stock options that are or will be immediately exercisable within 60 days of .

(8) Consists of [number] shares of common stock underlying outstanding stock options that are or will be immediately exercisable within 60 days of .

(9) Consists of (a) [number] shares held by Robert Langer, (b) [number] shares held by Michael D. Langer Irrevocable Trust u/d/t dated 12/14/95, (c) [number] shares held by Susan K. Langer Irrevocable Trust u/d/t dated 12/14/95, (d) [number] shares held by Samuel A. Langer Irrevocable Trust u/d/t dated 12/14/95, and (e) [number] shares of common stock underlying outstanding stock options that are or will be immediately exercisable within 60 days of .

(10) Consists of (a) [number] shares held by Elizabeth Nabel and (b) [number] shares of common stock underlying outstanding stock options that are or will be immediately exercisable within 60 days of .

(11) Consists of (a) [number] shares held by Israel Ruiz and (b) [number] shares of common stock underlying outstanding stock options that are or will be immediately exercisable within 60 days of .
(12) Consists of (a) shares held by Stephen Berenson and Louise Barzilay, Joint Tenants with Right of Survivorship, and (b) shares of common stock underlying outstanding stock options held by Mr. Berenson that are or will be immediately exercisable within 60 days of.

(13) Consists of (a) shares held by Paul Sagan and (b) shares of common stock underlying outstanding stock options that are or will be immediately exercisable within 60 days of.

(14) Consists of (a) shares held, and (b) shares of common stock underlying outstanding stock options that are or will be immediately exercisable within 60 days of.

(15) Consists of shares held by Zeneca, Inc. The mailing address of Zeneca, Inc. is 1800 Concord Pike, Wilmington, Delaware 19803.
DESCRIPTION OF CAPITAL STOCK

The following descriptions are summaries of the material terms of our amended and restated certificate of incorporation, which will be effective upon the closing of this offering and amended and restated bylaws, which will be effective upon the effectiveness of the registration statement of which this prospectus is a part. The descriptions of the common stock and preferred stock give effect to changes to our capital structure that will occur immediately prior to the completion of this offering. We refer in this section to our amended and restated certificate of incorporation as our certificate of incorporation, and we refer to our amended and restated bylaws as our bylaws.

General

Upon completion of this offering, our authorized capital stock will consist of 1,600,000,000 shares of common stock, par value $0.0001 per share, and 162,000,000 shares of preferred stock, par value $0.0001 per share, all of which shares of preferred stock will be undesignated.

As of , shares of our common stock were outstanding and held by stockholders of record. This amount assumes the conversion of all outstanding shares of our preferred stock into common stock, which will occur immediately prior to the closing of this offering.

Common stock

The holders of our common stock are entitled to one vote for each share held on all matters submitted to a vote of the stockholders. The holders of our common stock do not have any cumulative voting rights. Holders of our common stock are entitled to receive ratably any dividends declared by our board of directors out of funds legally available for that purpose, subject to any preferential dividend rights of any outstanding preferred stock. Our common stock has no preemptive rights, conversion rights or other subscription rights or redemption or sinking fund provisions.

In the event of our liquidation, dissolution or winding up, holders of our common stock will be entitled to share ratably in all assets remaining after payment of all debts and other liabilities and any liquidation preference of any outstanding preferred stock. The shares to be issued by us in this offering will be, when issued and paid for, validly issued, fully paid and non-assessable.

Preferred stock

Immediately prior to the completion of this offering, all outstanding shares of our preferred stock will be converted into shares of our common stock. Upon the consummation of this offering, our board of directors will have the authority, without further action by our stockholders, to issue up to 5,000,000 shares of preferred stock in one or more series and to fix the rights, preferences, privileges and restrictions thereof. These rights, preferences and privileges could include dividend rights, conversion rights, voting rights, terms of redemption, liquidation preferences, sinking fund terms and the number of shares constituting, or the designation of, such series, any or all of which may be greater than the rights of common stock. The issuance of our preferred stock could adversely affect the voting power of holders of common stock and the likelihood that such holders will receive dividend payments and payments upon our liquidation. In addition, the issuance of preferred stock could have the effect of delaying, deferring or preventing a change in control of our Company or other corporate action. Immediately after consummation of this offering, no shares of preferred stock will be outstanding, and we have no present plan to issue any shares of preferred stock.

Registration rights

Upon the completion of this offering, the holders of shares of our common stock, including those issuable upon the conversion of preferred stock, will be entitled to rights with respect to the registration of these
securities under the Securities Act. These rights are provided under the terms of an investor rights agreement between us and the holders of our preferred stock. The investor rights agreement includes demand registration rights, short-form registration rights, and piggyback registration rights. All fees, costs and expenses of underwritten registrations under this agreement will be borne by us and all selling expenses, including underwriting discounts and selling commissions, will be borne by the holders of the shares being registered.

**Demand registration rights**

Beginning 180 days after the completion of this offering, the holders of shares of our common stock, including those issuable upon the conversion of shares of our preferred stock upon closing of this offering, will be entitled to demand registration rights. Under the terms of the investor rights agreement, we will be required, upon the written request of either (i) a majority of holders of these securities or (ii) AstraZeneca and its affiliates that, in either case, would result in an aggregate offering price of at least $5.0 million, to file a registration statement and to use commercially reasonable efforts to effect the registration of all or a portion of these shares for public resale. We are required to effect only two registrations upon the request of a majority of holders and one registration upon the request of AstraZeneca or, its affiliates pursuant to this provision of the investor rights agreement.

**Short-form registration rights**

Upon the completion of this offering, the holders of shares of our common stock, including those issuable upon the conversion of shares of our preferred stock upon closing of this offering, are also entitled to short-form registration rights. Pursuant to the investor rights agreement, if we are eligible to file a registration statement on Form S-3, upon the written request of 20% in interest of these holders to sell registrable securities at an aggregate price of at least $2.5 million, we will be required to use commercially reasonable efforts to effect a registration of such shares. We are required to effect only two registrations in any twelve month period pursuant to this provision of the investor rights agreement.

**Piggyback registration rights**

Upon the completion of this offering, the holders of shares of our common stock, including those issuable upon the conversion of shares of our preferred stock upon closing of this offering, are entitled to piggyback registration rights. If we register any of our securities either for our own account or for the account of other security holders, the holders of these shares are entitled to include their shares in the registration. Subject to certain exceptions contained in the investor rights agreement, we and the underwriters may limit the number of shares included in the underwritten offering to the number of shares which we and the underwriters determine in our sole discretion will not jeopardize the success of the offering.

**Indemnification**

Our investor rights agreement contains customary cross-indemnification provisions, under which we are obligated to indemnify holders of registrable securities in the event of material misstatements or omissions in the registration statement attributable to us, and they are obligated to indemnify us for material misstatements or omissions attributable to them.

**Expiration of registration rights**

The demand registration rights and short-form registration rights granted under the investor rights agreement will terminate on the fifth anniversary of the completion of this offering.

**Anti-takeover effects of our certificate of incorporation and bylaws and Delaware Law**

Our certificate of incorporation and bylaws include a number of provisions that may have the effect of delaying, deferring or preventing another party from acquiring control of us and encouraging persons considering.
unsolicited tender offers or other unilateral takeover proposals to negotiate with our board of directors rather than pursue non-negotiated takeover attempts. These provisions include the items described below.

**Board composition and filling vacancies**
Our certificate of incorporation provides for the division of our board of directors into three classes serving staggered three-year terms, with one class being elected each year. Our certificate of incorporation also provides that directors may be removed only for cause and then only by the affirmative vote of the holders of 66\(\frac{2}{3}\)% or more of the shares then entitled to vote at an election of directors. Furthermore, any vacancy on our board of directors, however occurring, including a vacancy resulting from an increase in the size of our board, may only be filled by the affirmative vote of a majority of our directors then in office even if less than a quorum. The classification of directors, together with the limitations on removal of directors and treatment of vacancies, has the effect of making it more difficult for stockholders to change the composition of our board of directors.

**No written consent of stockholders**
Our certificate of incorporation provides that all stockholder actions are required to be taken by a vote of the stockholders at an annual or special meeting, and that stockholders may not take any action by written consent in lieu of a meeting. This limit may lengthen the amount of time required to take stockholder actions and would prevent the amendment of our bylaws or removal of directors by our stockholders without holding a meeting of stockholders.

**Meetings of stockholders**
Our certificate of incorporation and bylaws provide that only a majority of the members of our board of directors then in office may call special meetings of stockholders and only those matters set forth in the notice of the special meeting may be considered or acted upon at a special meeting of stockholders. Our bylaws limit the business that may be conducted at an annual meeting of stockholders to those matters properly brought before the meeting.

**Advance notice requirements**
Our bylaws establish advance notice procedures with regard to stockholder proposals relating to the nomination of candidates for election as directors or new business to be brought before meetings of our stockholders. These procedures provide that notice of stockholder proposals must be timely given in writing to our corporate secretary prior to the meeting at which the action is to be taken. Generally, to be timely, notice must be received at our principal executive offices not less than 90 days nor more than 120 days prior to the first anniversary date of the annual meeting for the preceding year. Our bylaws specify the requirements as to form and content of all stockholders' notices. These requirements may preclude stockholders from bringing matters before the stockholders at an annual or special meeting.

**Amendment to certificate of incorporation and bylaws**
Any amendment of our certificate of incorporation must first be approved by a majority of our board of directors, and if required by law or our certificate of incorporation, must thereafter be approved by a majority of the outstanding shares entitled to vote on the amendment and a majority of the outstanding shares of each class entitled to vote thereon as a class, except that the amendment of the provisions relating to stockholder action, board composition, and limitation of liability must be approved by not less than two-thirds of the outstanding shares entitled to vote on the amendment, and not less than two-thirds of the outstanding shares of each class entitled to vote thereon as a class. Our bylaws may be amended by the affirmative vote of a majority of the directors then in office, subject to any limitations set forth in the bylaws; and may also be amended by the affirmative vote of a majority of the outstanding shares entitled to vote on the amendment, voting together as a single class, except that the amendment of the provisions relating to notice of stockholder business and
nominations and special meetings must be approved by not less than two-thirds of the outstanding shares entitled to vote on the amendment, and not less than two-thirds of the outstanding shares of each class entitled to vote thereon as a class, or, if our board of directors recommends that the stockholders approve the amendment, by the affirmative vote of the majority of the outstanding shares entitled to vote on the amendment, in each case voting together as a single class.

**Undesignated preferred stock**

Our certificate of incorporation provides for authorized shares of preferred stock. The existence of authorized but unissued shares of preferred stock may enable our board of directors to discourage an attempt to obtain control of us by means of a merger, tender offer, proxy contest or otherwise. For example, if in the due exercise of its fiduciary obligations, our board of directors were to determine that a takeover proposal is not in the best interests of our stockholders, our board of directors could cause shares of preferred stock to be issued without stockholder approval in one or more private offerings or other transactions that might dilute the voting or other rights of the proposed acquirer or insurgent stockholder or stockholder group. In this regard, our certificate of incorporation grants our board of directors broad power to establish the rights and preferences of authorized and unissued shares of preferred stock. The issuance of shares of preferred stock could decrease the amount of earnings and assets available for distribution to holders of shares of common stock. The issuance may also adversely affect the rights and powers, including voting rights, of these holders and may have the effect of delaying, deterring or preventing a change in control of us.

**Section 203 of the Delaware General Corporation Law**

Upon completion of this offering, we will be subject to the provisions of Section 203 of the Delaware General Corporation Law. In general, Section 203 prohibits a publicly held Delaware corporation from engaging in a “business combination” with an “interested stockholder” for a three-year period following the time that this stockholder becomes an interested stockholder, unless the business combination is approved in a prescribed manner. Under Section 203, a business combination between a corporation and an interested stockholder is prohibited unless it satisfies one of the following conditions:

• before the stockholder became interested, our board of directors approved either the business combination or the transaction which resulted in the stockholder becoming an interested stockholder;

• upon consummation of the transaction which resulted in the stockholder becoming an interested stockholder, the interested stockholder owned at least 85% of the voting stock of the corporation outstanding at the time the transaction commenced, excluding for purposes of determining the voting stock outstanding, shares owned by persons who are directors and also officers, and employee stock plans, in some instances, but not the outstanding voting stock owned by the interested stockholder; or

• at or after the time the stockholder became interested, the business combination was approved by our board of directors and authorized at an annual or special meeting of the stockholders by the affirmative vote of at least two-thirds of the outstanding voting stock which is not owned by the interested stockholder.

Section 203 defines a business combination to include:

• any merger or consolidation involving the corporation and the interested stockholder;

• any sale, transfer, lease, pledge or other disposition involving the interested stockholder of 10% or more of the assets of the corporation;

• subject to exceptions, any transaction that results in the issuance or transfer by the corporation of any stock of the corporation to the interested stockholder;

• subject to exceptions, any transaction involving the corporation that has the effect of increasing the proportionate share of the stock of any class or series of the corporation beneficially owned by the interested stockholder; and
the receipt by the interested stockholder of the benefit of any loans, advances, guarantees, pledges, or other financial benefits provided by or through the corporation.

In general, Section 203 defines an interested stockholder as any entity or person beneficially owning 15% or more of the outstanding voting stock of the corporation and any entity or person affiliated with or controlling or controlled by the entity or person.

Nasdaq Global Select Market listing
We have applied to list our common stock on the Nasdaq Global Select Market under the trading symbol “MRNA.”

Transfer agent and registrar
The transfer agent and registrar for our common stock will be .
SHARES ELIGIBLE FOR FUTURE SALE

Prior to this offering, there has been no public market for our shares. Future sales of our common stock in the public market, or the availability of such shares for sale in the public market, could adversely affect market prices prevailing from time to time. As described below, only a limited number of shares will be available for sale shortly after this offering due to contractual and legal restrictions on resale. Nevertheless, sales of our common stock in the public market after such restrictions lapse, or the perception that those sales may occur, could adversely affect the prevailing market price at such time and our ability to raise equity capital in the future.

Based on the number of shares outstanding as of , upon the completion of this offering, shares of our common stock will be outstanding, assuming no exercise of the underwriters’ option to purchase additional shares and no exercise of outstanding options. Of the outstanding shares, all of the shares sold in this offering will be freely tradable, except that any shares held by our affiliates, as that term is defined in Rule 144 under the Securities Act, may only be sold in compliance with the limitations described below, and shares of our common stock are restricted shares of common stock subject to time-based vesting terms.

Rule 144

In general, a person who has beneficially owned restricted stock for at least six months would be entitled to sell their securities provided that (i) such person is not deemed to have been one of our affiliates at the time of, or at any time during the 90 days preceding, a sale and (ii) we are subject to the Securities Exchange Act of 1934, as amended, or the Exchange Act, periodic reporting requirements for at least 90 days before the sale. Persons who have beneficially owned restricted shares for at least six months but who are our affiliates at the time of, or any time during the 90 days preceding, a sale, would be subject to additional restrictions, by which such person would be entitled to sell within any three-month period only a number of securities that does not exceed the greater of either of the following:

- 1% of the number of shares then outstanding, which will equal approximately shares immediately after this offering assuming no exercise of the underwriters’ option to purchase additional shares, based on the number of shares outstanding as of ; or
- the average weekly trading volume of our common stock on the Nasdaq Global Select Market during the four calendar weeks preceding the filing of a notice on Form 144 with respect to the sale;

provided, in each case, that we are subject to the Exchange Act periodic reporting requirements for at least 90 days before the sale. Such sales both by affiliates and by non-affiliates must also comply with the manner of sale, current public information and notice provisions of Rule 144.

Rule 701

Rule 701 under the Securities Act, as in effect on the date of this prospectus, permits resales of shares in reliance upon Rule 144 but without compliance with certain restrictions of Rule 144, including the holding period requirement. Most of our employees, executive officers, or directors who purchased shares under a written compensatory plan or contract may be entitled to rely on the resale provisions of Rule 701, but all holders of Rule 701 shares are required to wait until 90 days after the date of this prospectus before selling their shares. However, substantially all Rule 701 shares are subject to lock-up agreements as described below and under “Underwriting” included elsewhere in this prospectus and will become eligible for sale upon the expiration of the restrictions set forth in those agreements.

Lock-Up Agreements

We, all of our directors and executive officers, and the holders of substantially all of our capital stock and securities convertible into or exchangeable for our capital stock have entered into lock-up agreements with the
underwriters and/or are subject to market standoff agreements or other agreements with us, which prevents them from selling any of our common stock or any securities convertible into or exercisable or exchangeable for common stock for a period of not less than 180 days from the date of this prospectus without the prior written consent of the representatives, subject to certain exceptions. See the section entitled “Underwriting” appearing elsewhere in this prospectus for more information.

Registration rights
Upon completion of this offering, certain holders of our securities will be entitled to various rights with respect to registration of their shares under the Securities Act. Registration of these shares under the Securities Act would result in these shares becoming fully tradable without restriction under the Securities Act immediately upon the effectiveness of the registration. See the section entitled “Description of Capital Stock—Registration rights” appearing elsewhere in this prospectus for more information.

Equity incentive plans
We intend to file one or more registration statements on Form S-8 under the Securities Act to register our shares issued or reserved for issuance under our equity incentive plans. The first such registration statement is expected to be filed soon after the date of this prospectus and will automatically become effective upon filing with the SEC. Accordingly, shares registered under such registration statement will be available for sale in the open market, unless such shares are subject to vesting restrictions with us or the lock-up restrictions described above. As of , we estimate that such registration statement on Form S-8 will cover approximately shares.
The following discussion is a summary of the material U.S. federal income tax considerations applicable to non-U.S. holders (as defined below) with respect to their ownership and disposition of shares of our common stock issued pursuant to this offering. For purposes of this discussion, a non-U.S. holder means a beneficial owner of our common stock that is neither a U.S. person nor an entity nor arrangement treated as a partnership for U.S. federal income tax purposes. A U.S. person is any person that, for U.S. federal income tax purposes, is or is treated as any of the following:

- an individual who is a citizen or resident of the United States;
- a corporation created or organized under the laws of the United States, any state thereof, or the District of Columbia;
- an estate, the income of which is subject to U.S. federal income tax regardless of its source; or
- a trust that (1) is subject to the primary supervision of a U.S. Court and the control of one or more “United States person” (within the meaning of Section 7701(a)(30) of the Code), or (2) has a valid election in effect in effect to be treated as a United States person for U.S. Federal income tax purposes.

This discussion does not address the tax treatment of partnerships or other entities that are pass-through entities for U.S. federal income tax purposes or persons that hold their common stock through partnerships or other pass-through entities. A partner in a partnership or other pass-through entity that will hold our common stock should consult his, her or its own tax advisor regarding the tax consequences of acquiring, holding and disposing of our common stock through a partnership or other pass-through entity, as applicable.

This discussion is based on current provisions of the U.S. Internal Revenue Code of 1986, as amended, which we refer to as the Code, existing and proposed U.S. Treasury Regulations promulgated thereunder, current administrative rulings and judicial decisions, all as in effect as of the date of this prospectus and, all of which are subject to change or to differing interpretation, possibly with retroactive effect. Any such change or differing interpretation could alter the tax consequences to non-U.S. holders described in this prospectus. There can be no assurance that the Internal Revenue Service, which we refer to as the IRS, will not challenge one or more of the tax consequences described herein. We assume in this discussion that a non-U.S. holder holds shares of our common stock as a capital asset, generally property held for investment.

This discussion does not address all aspects of U.S. federal income taxation that may be relevant to a particular non-U.S. holder in light of that non-U.S. holder’s individual circumstances nor does it address any aspects of U.S. state, local or non-U.S. taxes, the alternative minimum tax, the Medicare tax on net investment income or any U.S. federal tax other than the income tax (including, for example, the estate tax). This discussion also does not consider any specific facts or circumstances that may apply to a non-U.S. holder and does not address the special tax rules applicable to particular non-U.S. holders, such as:

- insurance companies;
- tax-exempt or governmental organizations;
- financial institutions;
- brokers or dealers in securities;
- regulated investment companies;
- pension plans;
- “controlled foreign corporations,” “passive foreign investment companies,” and corporations that accumulate earnings to avoid U.S. federal income tax;
This discussion is for general information only and is not tax advice. Accordingly, all prospective non-U.S. holders of our common stock should consult their own tax advisors with respect to the U.S. federal, state, local and non-U.S. tax consequences of the purchase, ownership and disposition of our common stock.

**Distributions on our common stock**

Distributions, if any, on our common stock generally will constitute dividends for U.S. federal income tax purposes to the extent paid from our current or accumulated earnings and profits, as determined under U.S. federal income tax principles. If a distribution exceeds our current and accumulated earnings and profits, the excess will be treated as a tax-free return of the non-U.S. holder’s investment, up to such holder’s tax basis in the common stock. Any remaining excess will be treated as capital gain, subject to the tax treatment described below in “Gain on sale or other taxable disposition of our common stock.” Any such distributions will also be subject to the discussion below under the section titled “Withholding and information reporting requirements—FATCA.”

Subject to the discussion in the following two paragraphs in this section, dividends paid to a non-U.S. holder generally will be subject to withholding of U.S. federal income tax at a 30% rate or such lower rate as may be specified by an applicable income tax treaty between the United States and such holder’s country of residence.

Dividends that are treated as effectively connected with a trade or business conducted by a non-U.S. holder within the United States and, if an applicable income tax treaty so provides, that are attributable to a permanent establishment or a fixed base maintained by the non-U.S. holder within the United States, are generally exempt from the 30% withholding tax if the non-U.S. holder satisfies applicable certification and disclosure requirements. However, such U.S. effectively connected income, net of specified deductions and credits, is taxed at the same graduated U.S. federal income tax rates applicable to United States persons (as defined in the Code). Any U.S. effectively connected income received by a non-U.S. holder that is a corporation may also, under certain circumstances, be subject to an additional “branch profits tax” at a 30% rate or such lower rate as may be specified by an applicable income tax treaty between the United States and such holder’s country of residence.

A non-U.S. holder of our common stock who claims the benefit of an applicable income tax treaty between the United States and such holder’s country of residence generally will be required to provide a properly executed IRS Form W-8BEN or W-8BEN-E (or successor form) to the applicable withholding agent and satisfy applicable certification and other requirements. Non-U.S. holders are urged to consult their tax advisors regarding their entitlement to benefits under a relevant income tax treaty. A non-U.S. holder that is eligible for a reduced rate of U.S. withholding tax under an income tax treaty may obtain a refund or credit of any excess amounts withheld by timely filing a U.S. tax return with the IRS.
Gain on sale or other taxable disposition of our common stock

Subject to the discussion below under “Withholding and information reporting requirements—FATCA,” a non-U.S. holder generally will not be subject to any U.S. federal income tax on any gain realized upon such holder’s sale or other taxable disposition of shares of our common stock unless:

- the gain is effectively connected with the non-U.S. holder’s conduct of a U.S. trade or business and, if an applicable income tax treaty so provides, is attributable to a permanent establishment or a fixed-base maintained by such non-U.S. holder in the United States, in which case the non-U.S. holder generally will be taxed on a net income basis at the graduated U.S. federal income tax rates applicable to United States persons (as defined in the Code) and, if the non-U.S. holder is a foreign corporation, the branch profits tax described above in “Distributions on our common stock” also may apply;

- the non-U.S. holder is a nonresident alien individual who is present in the United States for 183 days or more in the taxable year of the disposition and certain other conditions are met, in which case the non-U.S. holder will be subject to a 30% tax (or such lower rate as may be specified by an applicable income tax treaty between the United States and such holder’s country of residence) on the net gain derived from the disposition, which may be offset by certain U.S. source capital losses of the non-U.S. holder, if any (even though the individual is not considered a resident of the United States), provided that the non-U.S. holder has timely filed U.S. federal income tax returns with respect to such losses; or

- we are, or have been, at any time during the five-year period preceding such sale of other taxable disposition (or the non-U.S. holder’s holding period, if shorter) a “U.S. real property holding corporation,” unless our common stock is regularly traded on an established securities market, within the meaning of the relevant provisions of the code, and the non-U.S. holder holds no more than 5% of our outstanding common stock, directly or indirectly, actually or constructively, during the shorter of the 5-year period ending on the date of the disposition or the period that the non-U.S. holder held our common stock. If we are determined to be a U.S. real property holding corporation and the foregoing exception does not apply, then the non-U.S. holder generally will be taxed on its net gain derived from the disposition at the graduated U.S. federal income tax rates applicable to United States persons (as defined in the Code), except that the branch profits tax generally will not apply. If we are a U.S. real property holding corporation and our common stock is not regularly traded on an established securities market, a non-U.S. holder’s proceeds received on the disposition of shares will also generally be subject to withholding at a rate of 15%. Generally, a corporation is a U.S. real property holding corporation only if the fair market value of its U.S. real property interests equals or exceeds 50% of the sum of the fair market value of its worldwide real property interests plus its other assets used or held for use in a trade or business. Although there can be no assurance, we do not believe that we are, or have been, a U.S. real property holding corporation, or that we are likely to become one in the future. No assurance can be provided that our common stock will be regularly traded on an established securities market for purposes of the rules described above.

Backup withholding and information reporting

We must report annually to the IRS and to each non-U.S. holder the gross amount of the distributions on our common stock paid to such holder and the tax withheld, if any, with respect to such distributions. Non-U.S. holders may have to comply with specific certification procedures to establish that the holder is not a United States person (as defined in the Code) in order to avoid backup withholding at the applicable rate with respect to dividends on our common stock. Dividends paid to non-U.S. holders subject to withholding of U.S. federal income tax, as described above in “Distributions on our common stock,” generally will be exempt from U.S. backup withholding.

Information reporting and backup withholding will generally apply to the proceeds of a disposition of our common stock by a non-U.S. holder effected by or through the U.S. office of any broker, U.S. or foreign, unless the holder certifies its status as a non-U.S. holder and satisfies certain other requirements, or otherwise establishes an exemption. Generally, information reporting and backup withholding will not apply to a payment
of disposition proceeds to a non-U.S. holder where the transaction is effected outside the United States through a non-U.S. office of a broker. However, for information reporting purposes, dispositions effected through a non-U.S. office of a broker with substantial U.S. ownership or operations generally will be treated in a manner similar to dispositions effected through a U.S. office of a broker. Non-U.S. holders should consult their own tax advisors regarding the application of the information reporting and backup withholding rules to them. Copies of information returns may be made available to the tax authorities of the country in which the non-U.S. holder resides or is incorporated under the provisions of a specific treaty or agreement. Backup withholding is not an additional tax. Any amounts withheld under the backup withholding rules from a payment to a non-U.S. holder can be refunded or credited against the non-U.S. holder’s U.S. federal income tax liability, if any, provided that an appropriate claim is filed with the IRS in a timely manner.

Withholding and information reporting requirements—FATCA

The Foreign Account Tax Compliance Act, or FATCA, generally imposes a U.S. federal withholding tax at a rate of 30% on payments of dividends on, or gross proceeds from the sale or other disposition of, our common stock paid to a foreign entity unless (i) if the foreign entity is a “foreign financial institution,” such foreign entity undertakes certain due diligence, reporting, withholding, and certification obligations, (ii) if the foreign entity is not a “foreign financial institution,” such foreign entity identifies certain of its U.S. investors, if any, or (iii) the foreign entity is otherwise exempt under FATCA. Under applicable U.S. Treasury regulations, withholding under FATCA currently applies to payments of dividends on our common stock, but will only apply to payments of gross proceeds from a sale or other disposition of our common stock made after December 31, 2018. Under certain circumstances, a non-U.S. holder may be eligible for refunds or credits of this withholding tax. An intergovernmental agreement between the United States and an applicable foreign country may modify the requirements described in this paragraph. Non-U.S. holders should consult their tax advisors regarding the possible implications of this legislation on their investment in our common stock and the entities through which they hold our common stock, including, without limitation, the process and deadlines for meeting the applicable requirements to prevent the imposition of the 30% withholding tax under FATCA.
Under the terms and subject to the conditions in an underwriting agreement dated the date of this prospectus, the underwriters named below, for whom Morgan Stanley & Co. LLC, Goldman Sachs & Co. LLC and J.P. Morgan Securities LLC are acting as representatives, have severally agreed to purchase, and we have agreed to sell to them, severally, the number of shares indicated below:

<table>
<thead>
<tr>
<th>Name</th>
<th>Number of Shares</th>
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<tbody>
<tr>
<td>Morgan Stanley &amp; Co. LLC</td>
<td></td>
</tr>
<tr>
<td>Goldman Sachs &amp; Co. LLC</td>
<td></td>
</tr>
<tr>
<td>J.P. Morgan Securities LLC</td>
<td></td>
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<tr>
<td>Merrill Lynch, Pierce, Fenner &amp; Smith Incorporated</td>
<td></td>
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<tr>
<td>Barclays Capital Inc.</td>
<td></td>
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<tr>
<td>Piper Jaffray &amp; Co.</td>
<td></td>
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<tr>
<td>Bryan, Garnier &amp; Co Limited</td>
<td></td>
</tr>
<tr>
<td>ODDO BHF SCA</td>
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<tr>
<td>Oppenheimer &amp; Co. Inc.</td>
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<tr>
<td>Needham &amp; Company, LLC</td>
<td></td>
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<tr>
<td>Chardan Capital Markets LLC</td>
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</tbody>
</table>

Total: 338

The underwriters and the representatives are collectively referred to as the “underwriters” and the “representatives,” respectively. The underwriters are offering the shares of common stock subject to their receipt and acceptance of the shares from us and subject to prior sale. The offering of the shares by the underwriters is also subject to the underwriters’ right to reject any order in whole or in part. The underwriting agreement provides that the obligations of the several underwriters to pay for and accept delivery of the shares of common stock offered by this prospectus are subject to the approval of certain legal matters by their counsel and to certain other conditions. The underwriters are obligated to take and pay for all of the shares of common stock offered by this prospectus if any such shares are taken. However, the underwriters are not required to take or pay for the shares covered by the underwriters’ option to purchase additional shares described below.

The underwriters initially propose to offer part of the shares of common stock directly to the public at the offering price listed on the cover page of this prospectus and part to certain dealers at a price that represents a concession not in excess of $1.00 per share under the public offering price. After the initial offering of the shares of common stock, the offering price, and other selling terms may from time to time be varied by the representatives.

We have granted to the underwriters an option, exercisable for 30 days from the date of this prospectus, to purchase up to additional shares of common stock at the public offering price listed on the cover page of this prospectus, less underwriting discounts and commissions. The underwriters may exercise this option solely for the purpose of covering options to purchase additional shares, if any, made in connection with the offering of the shares of common stock offered by this prospectus. To the extent the option is exercised, each underwriter will become obligated, subject to certain conditions, to purchase about the same percentage of the additional shares of common stock as the number listed next to the underwriter’s name in the preceding table bears to the total number of shares of common stock listed next to the names of all underwriters in the preceding table.
The following table shows the per share and total public offering price, underwriting discounts and commissions, and proceeds before expenses to us. These amounts are shown assuming both no exercise and full exercise of the underwriters’ option to purchase up to an additional shares of common stock.

<table>
<thead>
<tr>
<th></th>
<th>Per Share</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public offering price</td>
<td>$</td>
<td>$ $</td>
</tr>
<tr>
<td>Underwriting discounts and commissions:</td>
<td>$</td>
<td>$ $</td>
</tr>
<tr>
<td>Proceeds, before expenses, to us</td>
<td>$</td>
<td>$ $</td>
</tr>
</tbody>
</table>

The estimated offering expenses payable by us, exclusive of the underwriting discounts and commissions, are approximately $ . We have agreed to reimburse the underwriters for expense relating to clearance of this offering with the Financial Industry Regulatory Authority up to $ .

The underwriters have informed us that they do not intend sales to discretionary accounts to exceed 5% of the total number of shares of common stock offered by them.

We have applied to list our common stock on the Nasdaq Global Select Market under the trading symbol “MRNA.”

We, all of our directors and officers, and the holders of substantially all of our capital stock and securities convertible into or exchangeable for our capital stock have entered into lock-up agreements with the underwriters and/or are subject to market standoff agreements or other agreements with us under which they agreed, subject to specific exceptions, that without the prior written consent of the representatives on behalf of the underwriters, we and they will not, during the period ending at least 180 days, or the restricted period, after the date of this prospectus:

- offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, right or warrant to purchase, lend or otherwise transfer or dispose of, directly or indirectly, any shares of common stock or any securities convertible into or exercisable or exchangeable for shares of common stock;
- file any registration statement with the SEC relating to the offering of any shares of common stock or any securities convertible into or exercisable or exchangeable for common stock; or
- enter into any swap or other arrangement that transfers to another, in whole or in part, any of the economic consequences of ownership of the common stock,

whether any such transaction described above is to be settled by delivery of common stock or such other securities, in cash or otherwise. In addition, we and each such person agrees that, without the prior written consent of the representatives on behalf of the underwriters, we or such other person will not, during the restricted period, make any demand for, or exercise any right with respect to, the registration of any shares of common stock or any security convertible into or exercisable or exchangeable for common stock.

The restrictions described in the immediately preceding paragraph do not apply to certain transfers, dispositions or transactions, including:

a) transfers of shares or other securities as a bona fide gift, or to a charitable organization or educational institution in a transaction not involving a disposition for value;

b) transfers or dispositions of shares or other securities to any member of the immediate family of the director or officer or any trust for the direct or indirect benefit of such director or officer or his or her immediate family in a transaction not involving a disposition for value;
c) transfers or dispositions of shares or other securities to any corporation, partnership, limited liability company, or other entity all of the beneficial ownership interests of which are held by the holder or his or her immediate family in a transaction not involving a disposition for value;

d) transfers or dispositions of shares or other securities (x) by will, other testamentary document, or intestate succession to the legal representative, heir, beneficiary, or a member of the immediate family of the holder upon the death of the director or officer, or (y) by operation of law pursuant to orders of a court or regulatory agency, a domestic order, or negotiated divorce settlement;

e) if the holder is an entity, (x) transfers or dispositions of shares or other securities to another corporation, member, partnership, limited liability company, trust, or other entity that is a direct or indirect affiliate (as defined under Rule 12b-2 of the Exchange Act) of the holder, or to an investment fund or other entity that controls or manages, or is under common control with, the holder, or (y) distributions of shares or other securities to partners, members, stockholders, beneficiaries, or other equity holders of the holder;

provided that in the case of any transfer, disposition or distribution pursuant to any of (a)-(e) above, (i) each transferee, donee or distributee shall sign and deliver a lock-up letter to the representatives and (ii) no filing under Section 16(a) of the Exchange Act, reporting a reduction in beneficial ownership of shares of common stock, shall be required or shall be voluntarily made during the restricted period (other than, in the case of a transfer or other disposition pursuant to (d) above, any Form 4 or Form 5 required to be filed under the Exchange Act if the holder is subject to Section 16 reporting with respect to the Company under the Exchange Act and indicating by footnote disclosure or otherwise the nature of the transfer or disposition);

f) transactions relating to shares or other securities acquired in this offering (other than any issuer-directed shares purchased in this offering by an officer or director) or other securities acquired in open market transactions after the completion of the offering of the shares; provided that no filing under Section 16 of Exchange Act Exchange Act, is required or voluntarily made in connection with subsequent sales of the common stock or other securities acquired in such open market transactions;

g) transfers or dispositions of shares or other securities in connection with the conversion of any convertible security into, or the exercise of any option or warrant for, shares (including, in each case, by way of “net” or “cashless” exercise and/or to cover withholding tax obligations in connection with such exercise and any transfer to the Company for the payment of taxes as a result of such vesting or exercise, whether by means of a “net settlement” or otherwise), provided that (i) any such shares received by the holder shall be subject to the terms of such lock-up agreement and (ii) no filing under Section 16(a) of the Exchange Act reporting a reduction in beneficial ownership of shares shall be required or shall be voluntarily made during the restricted period (other than a filing on a Form 4 that reports such disposition under the transaction code “F”);

h) transfers or dispositions of shares of common stock or any security convertible into or exercisable or exchangeable for shares of common stock to the Company pursuant to any contractual arrangement in effect on the date of such lock-up agreement that provides for the repurchase of the holder’s Common Stock or other securities by the Company or in connection with the termination of such holder’s employment with or service to the Company; provided that no filing under Section 16(a) of the Exchange Act reporting a reduction in beneficial ownership of shares of common stock, shall be required or shall be voluntarily made during the restricted period in connection with any such transfer or dispositions (other than any Form 4 or Form 5 required to be filed under the Exchange Act if the holder is subject to Section 16 reporting with respect to the Company under the Exchange Act and indicating by footnote disclosure or otherwise the nature of the transfer or disposition);

i) transfers or dispositions of shares of Common Stock or other securities to a nominee or custodian of a person or entity to whom a disposition or transfer would be permissible under clauses (a) through (h) above;

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the establishment of a trading plan pursuant to Rule 10b5-1 under the Exchange Act for the transfer of shares of common stock; provided that (i) such plan does not provide for the transfer of common stock during the restricted period and (ii) to the extent a public announcement or filing under the Exchange Act, if any, is required or voluntarily made regarding the establishment of such plan, such announcement or filing shall include a statement to the effect that no transfer of common stock may be made under such plan during the restricted period; or

transfers or dispositions of shares or such securities pursuant to a bona fide tender offer for shares of the Company’s capital stock, merger, consolidation or other similar transaction made to all holders of the Company’s securities involving a change of control of the Company (including without limitation, the entering into of any lock-up, voting or similar agreement pursuant to which the holder may agree to transfer, sell, tender or otherwise dispose of shares or other securities in connection with such transaction) that has been approved by the board of directors of the Company; provided that, in the event that such change of control transaction is not consummated, the requirements described in this clause (k) shall not be applicable and the holder’s shares and other securities shall remain subject to the restrictions contained in this letter.

the sale of shares to the underwriters.

The representatives, in their joint discretion, may release the common stock and other securities subject to the lock-up agreements described above in whole or in part at any time.

In order to facilitate the offering of the common stock, the underwriters may engage in transactions that stabilize, maintain or otherwise affect the price of the common stock. Specifically, the underwriters may sell more shares than they are obligated to purchase under the underwriting agreement, creating a short position. A short sale is covered if the short position is no greater than the number of shares available for purchase by the underwriters under their option to purchase additional shares. The underwriters can close out a covered short sale by exercising their option to purchase additional shares or purchasing shares in the open market. In determining the source of shares to close out a covered short sale, the underwriters will consider, among other things, the open market price of shares compared to the price available under their option to purchase additional shares. The underwriters may also sell shares in excess of their option to purchase additional shares, creating a naked short position. The underwriters must close out any naked short position by purchasing shares in the open market. A naked short position is more likely to be created if the underwriters are concerned that there may be downward pressure on the price of the common stock in the open market after pricing that could adversely affect investors who purchase in this offering. As an additional means of facilitating this offering, the underwriters may bid for, and purchase, shares of common stock in the open market to stabilize the price of the common stock. These activities may raise or maintain the market price of the common stock above independent market levels or prevent or retard a decline in the market price of the common stock. The underwriters are not required to engage in these activities and may end any of these activities at any time.

The underwriters may also impose a penalty bid. This occurs when a particular underwriter repays to the underwriters a portion of the underwriting discount received by it because the representatives have repurchased shares sold by or for the account of such underwriter in stabilizing or short covering transactions.

We and the underwriters have agreed to indemnify each other against certain liabilities, including liabilities under the Securities Act.

A prospectus in electronic format may be made available on websites maintained by one or more underwriters, or selling group members, if any, participating in this offering. The representatives may agree to allocate a number of shares of common stock to underwriters for sale to their online brokerage account holders. Internet distributions will be allocated by the representatives to underwriters that may make Internet distributions on the same basis as other allocations.
The underwriters and their respective affiliates are full service financial institutions engaged in various activities, which may include securities trading, commercial and investment banking, financial advisory, investment management, investment research, principal investment, hedging, financing and brokerage activities. Certain of the underwriters and their respective affiliates have, from time to time, performed, and may in the future perform, various financial advisory and investment banking services for us, for which they received or will receive customary fees and expenses, including Goldman Sachs & Co. LLC, J.P. Morgan Securities LLC and Morgan Stanley & Co. LLC who served as placement agents in connection with the issuance of our Series G Preferred Stock.

In addition, in the ordinary course of their various business activities, the underwriters and their respective affiliates may make or hold a broad array of investments and actively trade debt and equity securities (or related derivative securities) and financial instruments (including bank loans) for their own account and for the accounts of their customers and may at any time hold long and short positions in such securities and instruments. Such investment and securities activities may involve our securities and instruments. The underwriters and their respective affiliates may also make investment recommendations or publish or express independent research views in respect of such securities or instruments and may at any time hold, or recommend to clients that they acquire, long or short positions in such securities and instruments.

Sales of shares made outside of the United States may be made by affiliates of the underwriters. In addition, to the extent that the offering by Bryan, Garnier & Co. is within the United States, Bryan, Garnier & Co. will offer and place shares with investors through Bryan Garnier Securities, LLC, its U.S. broker dealer affiliate. The activities of Bryan, Garnier & Co. in the United States will be effected only to the extent permitted by Rule 15a-6 under the Exchange Act.

Oddo BHF SCA is not registered as a broker-dealer under the Exchange Act and will not engage in any offers or sales of our shares within the United States or to U.S. persons except to the extent permitted by Rule 15a-6 under the Exchange Act (and applicable SEC interpretive guidance issued in connection therewith) and other applicable securities laws.

Pricing of the offering

Prior to this offering, there has been no public market for our common stock. The initial public offering price was determined by negotiations between us and the representatives. Among the factors considered in determining the initial public offering price were our future prospects and those of our industry in general, our sales, earnings and certain other financial and operating information in recent periods, and the price-earnings ratios, price-sales ratios, market prices of securities, and certain financial and operating information of companies engaged in activities similar to ours.

Selling restrictions

European Economic Area

In relation to each Member State of the European Economic Area which has implemented the Prospectus Directive (each, a “Relevant Member State”) an offer to the public of any shares of our common stock may not be made in that Relevant Member State, except that an offer to the public in that Relevant Member State of any shares of our common stock may be made at any time under the following exemptions under the Prospectus Directive, if they have been implemented in that Relevant Member State:

(a) to any legal entity which is a qualified investor as defined in the Prospectus Directive;
(b) to fewer than 100 or, if the Relevant Member State has implemented the relevant provision of the 2010 PD Amending Directive, 150, natural or legal persons (other than qualified investors as defined in the Prospectus Directive), as permitted under the Prospectus Directive, subject to obtaining the prior consent of the representatives for any such offer; or
(c) in any other circumstances falling within Article 3(2) of the Prospectus Directive, provided that no such offer of shares of our common stock shall result in a requirement for the publication by us or any underwriter of a prospectus pursuant to Article 3 of the Prospectus Directive.
For the purposes of this provision, the expression an “offer to the public” in relation to any shares of our common stock in any Relevant Member State means the communication in any form and by any means of sufficient information on the terms of the offer and any shares of our common stock to be offered so as to enable an investor to decide to purchase any shares of our common stock, as the same may be varied in that Member State by any measure implementing the Prospectus Directive in that Member State, the expression “Prospectus Directive” means Directive 2003/71/EC (and amendments thereto, including the 2010 PD Amending Directive, to the extent implemented in the Relevant Member State), and includes any relevant implementing measure in the Relevant Member State, and the expression “2010 PD Amending Directive” means Directive 2010/73/EU.

United Kingdom

In addition, in the United Kingdom, this prospectus is being distributed only to, and is directed only at, and any offer subsequently made may only be directed at persons who are “qualified investors” (as defined in the Prospectus Directive) (i) who have professional experience in matters relating to investments falling within Article 19(5) of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005, as amended (the “Order”) and/or (ii) who are high net worth companies (or persons to whom it may otherwise be lawfully communicated) falling within Article 49(2)(a) to (d) of the Order (all such persons together being referred to as “relevant persons”) or otherwise in circumstances which have not resulted and will not result in an offer to the public of the shares in the United Kingdom within the meaning of the Financial Services and Markets Act 2000. Any person in the United Kingdom that is not a relevant person should not act or rely on the information included in this prospectus or use it as basis for taking any action. In the United Kingdom, any investment or investment activity that this prospectus relates to may be made or taken exclusively by relevant persons.

Canada

Our shares may be sold only to purchasers purchasing, or deemed to be purchasing, as principal that are accredited investors, as defined in National Instrument 45-106 Prospectus Exemptions or subsection 73.3(1) of the Securities Act (Ontario), and are permitted clients, as defined in National Instrument 31-103 Registration Requirements, Exemptions and Ongoing Registrant Obligations. Any resale of our shares must be made in accordance with an exemption from, or in a transaction not subject to, the prospectus requirements of applicable securities laws.

Securities legislation in certain provinces or territories of Canada may provide a purchaser with remedies for rescission or damages if this prospectus (including any amendment thereto) contains a misrepresentation, provided that the remedies for rescission or damages are exercised by the purchaser within the time limit prescribed by the securities legislation of the purchaser's province or territory. The purchaser should refer to any applicable provisions of the securities legislation of the purchaser’s province or territory for particulars of these rights or consult with a legal advisor.

Pursuant to section 3A.3 (or, in the case of securities issued or guaranteed by the government of a non-Canadian jurisdiction, section 3A.4) of National Instrument 33-105 Underwriting Conflicts (NI 33-105), the underwriters are not required to comply with the disclosure requirements of NI 33-105 regarding underwriter conflicts of interest in connection with this offering.

Israel

This prospectus does not constitute a prospectus under the Israeli Securities Law, 5728-1968, and has not been filed with or approved by the Israel Securities Authority. In Israel, this prospectus is being distributed only to, and is directed only at, investors listed in the first addendum, or the Addendum, to the Israeli Securities Law, consisting primarily of joint investment in trust funds, provident funds, insurance companies, banks, portfolio managers, investment advisors, members of the Tel Aviv Stock Exchange, underwriters purchasing for their own
account, venture capital funds, and entities with shareholders' equity in excess of NIS 50 million, each as defined in the Addendum (as it may be amended from time to time, collectively referred to as institutional investors). Institutional investors may be required to submit written confirmation that they fall within the scope of the Addendum. In addition, we may distribute and direct this prospectus in Israel, at our sole discretion, to certain other exempt investors or to investors who do not qualify as institutional or exempt investors, provided that the number of such non-qualified investors in Israel shall be no greater than 35 in any 12-month period.

**Switzerland**

The shares may not be publicly offered in Switzerland and will not be listed on the SIX Swiss Exchange, or SIX, or on any other stock exchange or regulated trading facility in Switzerland. This prospectus has been prepared without regard to the disclosure standards for issuance prospectuses under art. 652a or art. 1156 of the Swiss Code of Obligations or the disclosure standards for listing prospectuses under art. 27 ff. of the SIX Listing Rules or the listing rules of any other stock exchange or regulated trading facility in Switzerland. Neither this prospectus nor any other offering or marketing material relating to the shares or the offering may be publicly distributed or otherwise made publicly available in Switzerland. Neither this prospectus nor any other offering or marketing material relating to the offering, us, or the shares have been or will be filed with or approved by any Swiss regulatory authority. In particular, this prospectus will not be filed with, and the offer of shares will not be supervised by, the Swiss Financial Market Supervisory Authority FINMA, or FINMA, and the offer of shares has not been and will not be authorized under the Swiss Federal Act on Collective Investment Schemes, or CISA. The investor protection afforded to acquirers of interests in collective investment schemes under the CISA does not extend to acquirers of shares.

**Dubai International Financial Centre**

This prospectus relates to an Exempt Offer in accordance with the Offered Securities Rules of the Dubai Financial Services Authority, or DFSA. This prospectus is intended for distribution only to persons of a type specified in the Offered Securities Rules of the DFSA. It must not be delivered to, or relied on by, any other person. The DFSA has no responsibility for reviewing or verifying any documents in connection with Exempt Offers. The DFSA has not approved this prospectus nor taken steps to verify the information set forth herein and has no responsibility for the prospectus. The shares to which this prospectus relates may be illiquid and/or subject to restrictions on their resale. Prospective purchasers of the shares offered should conduct their own due diligence on the shares. If you do not understand the contents of this prospectus you should consult an authorized financial advisor.

**United Arab Emirates**

The shares have not been, and are not being, publicly offered, sold, promoted or advertised in the United Arab Emirates (including the Dubai International Financial Centre) other than in compliance with the laws of the United Arab Emirates (and the Dubai International Financial Centre) governing the issue, offering and sale of securities. Further, this prospectus does not constitute a public offer of securities in the United Arab Emirates (including the Dubai International Financial Centre) and is not intended to be a public offer. This prospectus has not been approved by or filed with the Central Bank of the United Arab Emirates, the Securities and Commodities Authority or the Dubai Financial Services Authority.

**Australia**

No placement document, prospectus, product disclosure statement or other disclosure document has been lodged with the Australian Securities and Investments Commission, or ASIC, in relation to the offering. This prospectus does not constitute a prospectus, product disclosure statement or other disclosure document under the Corporations Act 2001, or the Corporations Act, and does not purport to include the information required for a prospectus, product disclosure statement or other disclosure document under the Corporations Act.
Any offer in Australia of the shares may only be made to persons, or the Exempt Investors, who are “sophisticated investors” (within the meaning of section 708(8) of the Corporations Act), “professional investors” (within the meaning of section 708(11) of the Corporations Act) or otherwise pursuant to one or more exemptions contained in section 708 of the Corporations Act so that it is lawful to offer the shares without disclosure to investors under Chapter 6D of the Corporations Act.

The shares applied for by Exempt Investors in Australia must not be offered for sale in Australia in the period of 12 months after the date of allotment under the offering, except in circumstances where disclosure to investors under Chapter 6D of the Corporations Act would not be required pursuant to an exemption under section 708 of the Corporations Act or otherwise or where the offer is pursuant to a disclosure document which complies with Chapter 6D of the Corporations Act. Any person acquiring shares must observe such Australian on-sale restrictions.

This prospectus contains general information only and does not take into account the investment objectives, financial situation or particular needs of any particular person. It does not contain any securities recommendations or financial product advice. Before making an investment decision, investors need to consider whether the information in this prospectus is appropriate for their needs, objectives and circumstances, and, if necessary, seek expert advice on those matters.

**Hong Kong**

The shares have not been offered or sold and will not be offered or sold in Hong Kong, by means of any document, other than (a) to “professional investors” as defined in the Securities and Futures Ordinance (Cap. 571) of Hong Kong and any rules made under that Ordinance; or (b) in other circumstances which do not result in the document being a “prospectus” as defined in the Companies Ordinance (Cap. 32) of Hong Kong or which do not constitute an offer to the public within the meaning of that Ordinance. No advertisement, invitation or document relating to the shares has been or may be issued or has been or may be in the possession of any person for the purposes of issue, whether in Hong Kong or elsewhere, which is directed at, or the contents of which are likely to be accessed or read by, the public of Hong Kong (except if permitted to do so under the securities laws of Hong Kong) other than with respect to the shares which are or are intended to be disposed of only to persons outside Hong Kong or only to “professional investors” as defined in the Securities and Futures Ordinance and any rules made under that Ordinance.

**Japan**

No registration pursuant to Article 4, paragraph 1 of the Financial Instruments and Exchange Law of Japan (Law No. 25 of 1948, as amended), or the “FIEL”, has been made or will be made with respect to the solicitation of the application for the acquisition of our shares.

Accordingly, our shares have not been, directly or indirectly, offered or sold and will not be, directly or indirectly, offered or sold in Japan or to, or for the benefit of, any resident of Japan (which term as used herein means any person resident in Japan, including any corporation or other entity organized under the laws of Japan) or to others for re-offering or re-sale, directly or indirectly, in Japan or to, or for the benefit of, any resident of Japan except pursuant to an exemption from the registration requirements, and otherwise in compliance with, the FIEL and the other applicable laws and regulations of Japan.

**For Qualified Institutional Investors (“QII”)**

Please note that the solicitation for newly-issued or secondary securities (each as described in Paragraph 2, Article 4 of the FIEL) in relation to our shares constitutes either a “QII only private placement” or a “QII only secondary distribution” (each as described in Paragraph 1, Article 23-13 of the FIEL). Disclosure regarding any such solicitation, as is otherwise prescribed in Paragraph 1, Article 4 of the FIEL, has not been made in relation to our shares. Our shares may only be transferred to QIIs.
For Non-QII Investors

Please note that the solicitation for newly-issued or secondary securities (each as described in Paragraph 2, Article 4 of the FIEL) in relation to our shares constitutes either a “small number private placement” or a “small number private secondary distribution” (each as is described in Paragraph 4, Article 23-13 of the FIEL). Disclosure regarding any such solicitation, as is otherwise prescribed in Paragraph 1, Article 4 of the FIEL, has not been made in relation to our shares. Our shares may only be transferred en bloc without subdivision to a single investor.

Singapore

This prospectus has not been registered as a prospectus with the Monetary Authority of Singapore. Accordingly, this prospectus and any other document or material in connection with the offer or sale, or invitation for subscription or purchase, of our shares may not be circulated or distributed, nor may our shares be offered or sold, or be made the subject of an invitation for subscription or purchase, whether directly or indirectly, to persons in Singapore other than (1) to an institutional investor under Section 274 of the Securities and Futures Act, Chapter 289 of Singapore, or the SFA, (2) to a relevant person or any person pursuant to Section 275(1A), and in accordance with the conditions specified in Section 275 of the SFA, or (3) otherwise pursuant to, and in accordance with the conditions of, any other applicable provision of the SFA, in each case subject to compliance with conditions set forth in the SFA.

Where our shares are subscribed or purchased under Section 275 by a relevant person which is: (a) a corporation (which is not an accredited investor as defined in Section 4A of the SFA) the sole business of which is to hold investments and the entire share capital of which is owned by one or more individuals, each of whom is an accredited investor; or (b) a trust (where the trustee is not an accredited investor) whose sole purpose is to hold investments and each beneficiary of the trust is an individual who is an accredited investor; shares, debentures and units of shares and debentures of that corporation or the beneficiaries’ rights and interest (howsoever described) in that trust shall not be transferred within six months after that corporation or that trust has acquired the shares under Section 275 of the SFA, except: (1) to an institutional investor (for corporations under Section 274 of the SFA) or to a relevant person defined in Section 275(2) of the SFA, or to any person pursuant to an offer that is made on terms that such shares, debentures and units of shares and debentures of that corporation or such rights and interest in that trust are acquired at a consideration of not less than $200,000 (or its equivalent in a foreign currency) for each transaction, whether such amount is to be paid for in cash or by exchange of securities or other assets, and further for corporations, in accordance with the conditions, specified in Section 275 of the SFA; (2) where no consideration is or will be given for the transfer; or (3) where the transfer is by operation of law.

Saudi Arabia

This prospectus may not be distributed in the Kingdom of Saudi Arabia except to such persons as are permitted under the Offers of Securities Regulations as issued by the board of the Saudi Arabian Capital Market Authority, or the CMA pursuant to resolution number 2-11-2004 dated 4 October 2004 as amended by resolution number 1-28-2008, as amended, or the CMA Regulations. The CMA does not make any representation as to the accuracy or completeness of this prospectus and expressly disclaims any liability whatsoever for any loss arising from, or incurred in reliance upon, any part of this prospectus. Prospective purchasers of the shares offered hereby should conduct their own due diligence on the accuracy of the information relating to the shares. If you do not understand the contents of this prospectus, you should consult an authorized financial adviser.

China

This prospectus does not constitute a public offer of shares, whether by sale or subscription, in the People’s Republic of China, or the PRC. The shares are not being offered or sold directly or indirectly in the PRC to or for the benefit of, legal or natural persons of the PRC.
Further, no legal or natural persons of the PRC may directly or indirectly purchase any of the shares or any beneficial interest therein without obtaining all prior PRC’s governmental approvals that are required, whether statutorily or otherwise. Persons who come into possession of this prospectus are required by the issuer and its representatives to observe these restrictions.

Korea
The shares have not been and will not be registered under the Financial Investments Services and Capital Markets Act of Korea and the decrees and regulations thereunder (the “FSCMA”), and the shares have been and will be offered in Korea as a private placement under the FSCMA. None of the shares may be offered, sold or delivered directly or indirectly, or offered or sold to any person for re-offering or resale, directly or indirectly, in Korea or to any resident of Korea except pursuant to the applicable laws and regulations of Korea, including the FSCMA and the Foreign Exchange Transaction Law of Korea and the decrees and regulations thereunder, or the FETL. The shares have not been listed on any of securities exchanges in the world including, without limitation, the Korea Exchange in Korea. Furthermore, the purchaser of the shares shall comply with all applicable regulatory requirements (including but not limited to requirements under the FETL) in connection with the purchase of the shares. By the purchase of the shares, the relevant holder thereof will be deemed to represent and warrant that if it is in Korea or is a resident of Korea, it purchased the shares pursuant to the applicable laws and regulations of Korea.

Taiwan
The shares have not been and will not be registered with the Financial Supervisory Commission of Taiwan pursuant to relevant securities laws and regulations and may not be sold, issued or offered within Taiwan through a public offering or in circumstances which constitutes an offer within the meaning of the Securities and Exchange Act of Taiwan that requires a registration or approval of the Financial Supervisory Commission of Taiwan. No person or entity in Taiwan has been authorized to offer, sell, give advice regarding or otherwise intermediate the offering and sale of the shares in Taiwan.
LEGAL MATTERS

The validity of the shares of common stock offered by this prospectus will be passed upon for us by Goodwin Procter LLP, Boston, Massachusetts. Certain legal matters related to this offering will be passed upon for the underwriters by Ropes & Gray LLP, Boston, Massachusetts.

EXPERTS

Ernst & Young LLP, independent registered public accounting firm, has audited our consolidated financial statements at December 31, 2016 and 2017 and for the years then ended, as set forth in their report. We have included our consolidated financial statements in the prospectus and elsewhere in the registration statement in reliance on Ernst & Young LLP’s report, given on their authority as experts in accounting and auditing.

WHERE YOU CAN FIND MORE INFORMATION

We have filed with the SEC a registration statement on Form S-1 (File Number 333- ) under the Securities Act with respect to the common stock we are offering by this prospectus. This prospectus does not contain all of the information included in the registration statement. For further information pertaining to us and our common stock, you should refer to the registration statement and to its exhibits. Whenever we make reference in this prospectus to any of our contracts, agreements or other documents, the references are not necessarily complete, and you should refer to the exhibits attached to the registration statement for copies of the actual contract, agreement or other document.

Upon the completion of the offering, we will be subject to the informational requirements of the Exchange Act and will file annual, quarterly and current reports, proxy statements and other information with the SEC. You can read our SEC filings, including the registration statement, at the SEC’s website at www.sec.gov. We also maintain a website at www.modernatx.com. Upon completion of the offering, you may access, free of charge, our annual reports on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K and amendment to those reported filed or furnished pursuant to Section 13(a) or 15(d) of the Exchange Act as soon as reasonably practicable after such material is electronically filed with, or furnished to, the SEC.
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Consolidated Statements of Comprehensive Loss for the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018 (unaudited)
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Consolidated Statements of Redeemable Convertible Preferred Stock and Stockholders’ (Deficit) Equity for the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2018 (unaudited) actual and pro forma
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REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Stockholders and the Board of Directors of Moderna, Inc.

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of Moderna, Inc. (the Company) as of December 31, 2016 and 2017, the related consolidated statements of operations, comprehensive loss, redeemable convertible preferred stock and stockholders’ (deficit) equity and cash flows for the years then ended, and the related notes (collectively referred to as the “consolidated financial statements”). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company at December 31, 2016 and 2017, and the results of its operations and its cash flows for the years then ended in conformity with U.S. generally accepted accounting principles.

Basis for Opinion

These financial statements are the responsibility of the Company’s management. Our responsibility is to express an opinion on the Company’s financial statements based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB and in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

/s/ Ernst & Young LLP

We have served as the Company’s auditor since 2014.

Boston, MA
August 30, 2018
**MODERNA, INC.**  
**CONSOLIDATED BALANCE SHEETS**  
(In thousands, except share and per share data)

<table>
<thead>
<tr>
<th></th>
<th>September 30, 2016</th>
<th>September 30, 2017</th>
<th>Pro Forma September 30, 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assets</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current assets:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash and cash equivalents</td>
<td>$50,080</td>
<td>$134,859</td>
<td>$167,060</td>
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<tr>
<td>Investments</td>
<td>1,008,058</td>
<td>621,170</td>
<td>905,143</td>
</tr>
<tr>
<td>Accounts receivable</td>
<td>13,356</td>
<td>11,881</td>
<td>9,845</td>
</tr>
<tr>
<td>Accounts receivable from affiliate (Note 14)</td>
<td>167</td>
<td>1,536</td>
<td>1,712</td>
</tr>
<tr>
<td>Prepaid expenses and other current assets</td>
<td>15,491</td>
<td>12,826</td>
<td>33,356</td>
</tr>
<tr>
<td>Restricted cash</td>
<td>—</td>
<td>951</td>
<td>831</td>
</tr>
<tr>
<td><strong>Total current assets</strong></td>
<td>$1,087,152</td>
<td>783,223</td>
<td>1,117,947</td>
</tr>
<tr>
<td>Investments, non-current</td>
<td>236,569</td>
<td>145,851</td>
<td>150,355</td>
</tr>
<tr>
<td>Property and equipment, net</td>
<td>81,207</td>
<td>139,031</td>
<td>206,457</td>
</tr>
<tr>
<td>Restricted cash, non-current</td>
<td>11,480</td>
<td>11,798</td>
<td>11,532</td>
</tr>
<tr>
<td>Other non-current assets</td>
<td>753</td>
<td>4,586</td>
<td>2,869</td>
</tr>
<tr>
<td><strong>Total assets</strong></td>
<td>$1,417,161</td>
<td>$1,084,489</td>
<td>$1,489,160</td>
</tr>
<tr>
<td><strong>Liabilities, Redeemable Convertible Preferred Stock and Stockholders’ (Deficit) Equity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current liabilities:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accounts payable</td>
<td>$28,157</td>
<td>$20,725</td>
<td>$24,356</td>
</tr>
<tr>
<td>Accrued liabilities</td>
<td>25,052</td>
<td>72,715</td>
<td>45,426</td>
</tr>
<tr>
<td>Deferred revenue</td>
<td>107,739</td>
<td>96,739</td>
<td>115,409</td>
</tr>
<tr>
<td>Other current liabilities</td>
<td>1,854</td>
<td>1,282</td>
<td>1,227</td>
</tr>
<tr>
<td><strong>Total current liabilities</strong></td>
<td>162,802</td>
<td>191,461</td>
<td>186,418</td>
</tr>
<tr>
<td>Deferred revenue, non-current</td>
<td>394,250</td>
<td>242,929</td>
<td>187,156</td>
</tr>
<tr>
<td>Deferred lease obligation, non-current</td>
<td>4,654</td>
<td>7,586</td>
<td>9,823</td>
</tr>
<tr>
<td>Construction financing obligation</td>
<td>12,500</td>
<td>15,687</td>
<td>26,892</td>
</tr>
<tr>
<td>Other non-current liabilities</td>
<td>1,104</td>
<td>1,530</td>
<td>2,439</td>
</tr>
<tr>
<td><strong>Total liabilities</strong></td>
<td>575,310</td>
<td>459,193</td>
<td>412,728</td>
</tr>
<tr>
<td>Commitments and contingencies (Note 7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Redeemable convertible preferred stock, par value $0.0001, 448,686,791, 448,686,791 and 508,532,795 shares authorized as of December 31, 2016 and 2017 and September 30, 2018 (unaudited), respectively; 448,686,791, 448,686,791 and 508,532,795 shares issued and outstanding as of December 31, 2016 and 2017 and September 30, 2018 (unaudited), respectively; aggregate liquidation preference of $1,196,038, $1,209,940 and $1,901,214 as of December 31, 2016 and 2017 and September 30, 2018 (unaudited), respectively; no shares issued or outstanding, pro forma as of September 30, 2018 (unaudited)</td>
<td>1,176,661</td>
<td>1,176,661</td>
<td>1,833,561</td>
</tr>
<tr>
<td><strong>Stockholders’ (deficit) equity:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common stock, par value $0.0001; 672,581,112, 696,581,112 and 775,000,000 shares authorized as of December 31, 2016, 2017, and September 30, 2018 (unaudited), respectively; 338,520,883, 142,151,263, and 144,649,816 shares issued and outstanding as of December 31, 2016, 2017, and September 30, 2018 (unaudited), respectively; 659,542,250 shares issued and outstanding, pro forma as of September 30, 2018 (unaudited)</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Additional paid-in capital</td>
<td>31,297</td>
<td>71,671</td>
<td>108,980</td>
</tr>
<tr>
<td><strong>Accumulated other comprehensive loss</strong></td>
<td>(403)</td>
<td>(1,157)</td>
<td>(922)</td>
</tr>
<tr>
<td>Accumulated deficit</td>
<td>(365,718)</td>
<td>(621,893)</td>
<td>(865,201)</td>
</tr>
<tr>
<td><strong>Total stockholders’ (deficit) equity</strong></td>
<td>(334,810)</td>
<td>(551,365)</td>
<td>(757,129)</td>
</tr>
<tr>
<td><strong>Total liabilities, redeemable convertible preferred stock and stockholders’ (deficit) equity</strong></td>
<td>$1,417,161</td>
<td>$1,084,489</td>
<td>$1,489,160</td>
</tr>
</tbody>
</table>

The accompanying notes are an integral part of these consolidated financial statements.

F-3
## MODERNA, INC.
### CONSOLIDATED STATEMENTS OF OPERATIONS
(In thousands, except share and per share data)

<table>
<thead>
<tr>
<th></th>
<th>Year Ended December 31,</th>
<th>Nine Months Ended September 30,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(unaudited)</td>
</tr>
<tr>
<td><strong>Revenue:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration revenue</td>
<td>$ 69,109</td>
<td>$ 146,953</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$ 66,406</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$ 56,530</td>
</tr>
<tr>
<td>Collaboration revenue from affiliate (Note 14)</td>
<td>32,427</td>
<td>30,021</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22,152</td>
</tr>
<tr>
<td></td>
<td></td>
<td>33,166</td>
</tr>
<tr>
<td>Grant revenue</td>
<td>6,860</td>
<td>28,851</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25,363</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9,951</td>
</tr>
<tr>
<td><strong>Total revenue</strong></td>
<td>108,396</td>
<td>205,825</td>
</tr>
<tr>
<td></td>
<td></td>
<td>113,921</td>
</tr>
<tr>
<td></td>
<td></td>
<td>99,647</td>
</tr>
<tr>
<td><strong>Operating expenses:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research and development</td>
<td>274,717</td>
<td>410,459</td>
</tr>
<tr>
<td></td>
<td></td>
<td>292,632</td>
</tr>
<tr>
<td></td>
<td></td>
<td>303,653</td>
</tr>
<tr>
<td>General and administrative</td>
<td>57,450</td>
<td>64,722</td>
</tr>
<tr>
<td></td>
<td></td>
<td>48,817</td>
</tr>
<tr>
<td></td>
<td></td>
<td>56,229</td>
</tr>
<tr>
<td><strong>Total operating expenses</strong></td>
<td>332,167</td>
<td>475,181</td>
</tr>
<tr>
<td></td>
<td></td>
<td>341,449</td>
</tr>
<tr>
<td></td>
<td></td>
<td>359,882</td>
</tr>
<tr>
<td><strong>Loss from operations</strong></td>
<td>(223,771)</td>
<td>(269,356)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(227,528)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(260,235)</td>
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<tr>
<td>Interest income</td>
<td>11,312</td>
<td>15,235</td>
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<tr>
<td></td>
<td></td>
<td>11,452</td>
</tr>
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<td></td>
<td></td>
<td>18,129</td>
</tr>
<tr>
<td>Other (expense) income, net</td>
<td>(2,709)</td>
<td>(1,875)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1,805)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1,044)</td>
</tr>
<tr>
<td><strong>Loss before provision for (benefit from) income taxes</strong></td>
<td>(215,168)</td>
<td>(255,996)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(217,881)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(243,150)</td>
</tr>
<tr>
<td><strong>Provision for (benefit from) income taxes</strong></td>
<td>1,043</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td></td>
<td>158</td>
</tr>
<tr>
<td><strong>Net loss</strong></td>
<td>(216,211)</td>
<td>(255,916)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(217,972)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(243,308)</td>
</tr>
<tr>
<td><strong>Reconciliation of net loss to net loss attributable to common stockholders:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Premium paid on repurchase of preferred stock</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4,127)</td>
</tr>
<tr>
<td>Accretion of redeemable convertible preferred units to redemption value</td>
<td>(8,663)</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative preferred stock dividends</td>
<td>(5,440)</td>
<td>(13,925)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(10,443)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(10,323)</td>
</tr>
<tr>
<td><strong>Net loss attributable to common stockholders</strong></td>
<td>$ (230,314)</td>
<td>$ (269,841)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$ (228,415)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$ (257,758)</td>
</tr>
<tr>
<td><strong>Net loss per share attributable to common stockholders, basic and diluted</strong></td>
<td>$ (1.74)</td>
<td>$ (1.92)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$ (1.63)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$ (1.79)</td>
</tr>
<tr>
<td><strong>Weighted average common shares used in net loss per share attributable to common stockholders, basic and diluted</strong></td>
<td>132,429,389</td>
<td>140,604,647</td>
</tr>
<tr>
<td></td>
<td></td>
<td>140,176,261</td>
</tr>
<tr>
<td></td>
<td></td>
<td>143,634,775</td>
</tr>
<tr>
<td><strong>Pro forma net loss per share attributable to common stockholders, basic and diluted (unaudited) (Note 13)</strong></td>
<td>$ (0.44)</td>
<td>$ (0.38)</td>
</tr>
<tr>
<td><strong>Pro forma weighted average common shares used in pro forma net loss per share attributable to common stockholders, basic and diluted (unaudited) (Note 13)</strong></td>
<td>586,843,476</td>
<td>646,208,186</td>
</tr>
</tbody>
</table>

The accompanying notes are an integral part of these consolidated financial statements.

F-4
MODERNA, INC.
CONSOLIDATED STATEMENTS OF COMPREHENSIVE LOSS
(In thousands)

<table>
<thead>
<tr>
<th></th>
<th>Year Ended December 31,</th>
<th>Nine Months Ended September 30,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td>Net loss</td>
<td>(216,211)</td>
<td>(255,916)</td>
</tr>
<tr>
<td>Other comprehensive income (loss):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unrealized gain (loss) on available-for-sale debt securities</td>
<td>223</td>
<td>(342)</td>
</tr>
<tr>
<td>(Less) plus: amounts recognized for net realized (loss) gain included in net loss</td>
<td>(60)</td>
<td>(412)</td>
</tr>
<tr>
<td>Total other comprehensive income (loss)</td>
<td>163</td>
<td>(754)</td>
</tr>
<tr>
<td>Comprehensive loss</td>
<td>(216,048)</td>
<td>(256,670)</td>
</tr>
</tbody>
</table>

The accompanying notes are an integral part of these consolidated financial statements.

F-5
### MODERNA, INC.

**CONSOLIDATED STATEMENTS OF REDEEMABLE CONVERTIBLE PREFERRED STOCK AND STOCKHOLDERS’ (DEFICIT) EQUITY**

(In thousands, except unit and share data)

<table>
<thead>
<tr>
<th>Redeemable Convertible Preferred Units</th>
<th>Redeemable Convertible Preferred Stock</th>
<th>Common Units</th>
<th>Common Stock</th>
<th>Additional Paid-in Capital</th>
<th>Accumulated Other Comprehensive Loss</th>
<th>Accumulated Deficit</th>
<th>Total Stockholders’ Equity (Deficit)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Units</strong></td>
<td><strong>Amount</strong></td>
<td><strong>Units</strong></td>
<td><strong>Amount</strong></td>
<td><strong>Units</strong></td>
<td><strong>Amount</strong></td>
<td><strong>Units</strong></td>
<td><strong>Amount</strong></td>
</tr>
<tr>
<td><strong>Balance at December 31, 2015</strong></td>
<td>394,685,560</td>
<td>$695,574</td>
<td>—</td>
<td>—</td>
<td>128,885,510</td>
<td>$13</td>
<td>—</td>
</tr>
<tr>
<td>Vesting of restricted common units</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>312,500</td>
</tr>
<tr>
<td>Exercise of options to purchase common units</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>40,000</td>
<td>—</td>
</tr>
<tr>
<td>Acretion of redeemable convertible preferred units</td>
<td>—</td>
<td>8,663</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Distributions to unit holders</td>
<td>—</td>
<td>(1,108)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Exchange of redeemable convertible preferred units and common units for redeemable convertible preferred stock and common stock, respectively, in connection with reorganization</td>
<td>(394,685,560)</td>
<td>(703,129)</td>
<td>394,685,550</td>
<td>703,129</td>
<td>(129,238,010)</td>
<td>(13)</td>
<td>129,154,005</td>
</tr>
<tr>
<td>Issuance of Series F redeemable convertible preferred stock, net of issuance costs of $599</td>
<td>—</td>
<td>—</td>
<td>54,001,241</td>
<td>473,532</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Vesting of restricted common stock</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>9,356,378</td>
</tr>
<tr>
<td>Exercise of options to purchase common stock</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>10,500</td>
<td>—</td>
</tr>
<tr>
<td>Stock-based compensation, adjusted for liability awards reclassification</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Unrealized gain on marketable securities</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Net loss</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Vesting of restricted common stock</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>3,585,597</td>
</tr>
<tr>
<td>Exercise of options to purchase common stock</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>44,783</td>
<td>—</td>
</tr>
<tr>
<td>Redeemable convertible preferred stock issuance costs</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Stock-based compensation</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Unrealized loss on marketable securities</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Net loss</td>
<td>—</td>
<td>—</td>
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<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Redeemable Convertible Preferred Units</th>
<th>Redeemable Convertible Preferred Stock</th>
<th>Common Units</th>
<th>Common Stock</th>
<th>Additional Paid-in Capital</th>
<th>Accumulated Other Comprehensive Loss</th>
<th>Accumulated Deficit</th>
<th>Total Stockholders’ Equity (Deficit)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Units</strong></td>
<td><strong>Amount</strong></td>
<td><strong>Units</strong></td>
<td><strong>Amount</strong></td>
<td><strong>Units</strong></td>
<td><strong>Amount</strong></td>
<td><strong>Units</strong></td>
<td><strong>Amount</strong></td>
</tr>
<tr>
<td>—</td>
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<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Redeemable Convertible Preferred Units</th>
<th>Redeemable Convertible Preferred Stock</th>
<th>Common Units</th>
<th>Common Stock</th>
<th>Additional Paid-in Capital</th>
<th>Accumulated Other Comprehensive Loss</th>
<th>Accumulated Deficit</th>
<th>Total Stockholders’ Equity (Deficit)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Units</strong></td>
<td><strong>Amount</strong></td>
<td><strong>Units</strong></td>
<td><strong>Amount</strong></td>
<td><strong>Units</strong></td>
<td><strong>Amount</strong></td>
<td><strong>Units</strong></td>
<td><strong>Amount</strong></td>
</tr>
<tr>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Balance at December 31, 2017</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
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</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>— — 448,686,791  1,176,661</td>
<td>— — 142,151,263  14  71,671  (1,157)  (621,893)  (551,365)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F-6
<table>
<thead>
<tr>
<th>Event</th>
<th>Redeemable Convertible Preferred Units</th>
<th>Redeemable Convertible Preferred Stock</th>
<th>Common Units</th>
<th>Common Stock</th>
<th>Additional Paid-In Capital</th>
<th>Accumulated Other Comprehensive Loss</th>
<th>Accumulated Deficit</th>
<th>Total Stockholders' Equity (Deficit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vesting of restricted common stock (unaudited)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1,643,999</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Issuance of Series G redeemable convertible preferred stock, net of issuance costs of $10,517 (unaudited)</td>
<td>—</td>
<td>55,666,004</td>
<td>549,413</td>
<td>152</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>152</td>
</tr>
<tr>
<td>Issuance of Series H redeemable convertible preferred stock, net of issuance costs of $474 (unaudited)</td>
<td>—</td>
<td>5,000,000</td>
<td>111,546</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Repurchase of Series D redeemable convertible preferred stock</td>
<td>(269,180)</td>
<td>(704)</td>
<td>—</td>
<td>(2,009)</td>
<td>—</td>
<td>(2,009)</td>
<td>(2,009)</td>
<td>(2,009)</td>
</tr>
<tr>
<td>Repurchase of Series E redeemable convertible preferred stock</td>
<td>(544,100)</td>
<td>(3,355)</td>
<td>—</td>
<td>(2,118)</td>
<td>—</td>
<td>(2,118)</td>
<td>(2,118)</td>
<td>(2,118)</td>
</tr>
<tr>
<td>Exercise of options to purchase common stock, net (unaudited)</td>
<td>—</td>
<td>—</td>
<td>854,554</td>
<td>360</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>360</td>
</tr>
<tr>
<td>Stock-based compensation (unaudited)</td>
<td>—</td>
<td>—</td>
<td>40,924</td>
<td>—</td>
<td>—</td>
<td>40,924</td>
<td>—</td>
<td>40,924</td>
</tr>
<tr>
<td>Unrealized gain on marketable securities (unaudited)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>235</td>
<td>235</td>
</tr>
<tr>
<td>Net loss (unaudited)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>(243,308)</td>
</tr>
<tr>
<td>Balance at September 30, 2018 (unaudited)</td>
<td>—</td>
<td>508,539,515</td>
<td>1,833,561</td>
<td>—</td>
<td>144,649,816</td>
<td>108,980 (922) (865,201)</td>
<td>(757,129)</td>
<td>(243,308) ($1,076,432)</td>
</tr>
<tr>
<td>Conversion of redeemable convertible preferred stock into common stock (unaudited)</td>
<td>—</td>
<td>(508,539,515)</td>
<td>(1,833,561)</td>
<td>—</td>
<td>514,048,684</td>
<td>1,833,509</td>
<td>—</td>
<td>1,833,561</td>
</tr>
<tr>
<td>Vesting of restricted common stock and options, and related stock-based compensation expense for awards with vesting conditions contingent upon an initial public offering (unaudited)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>843,750</td>
<td>—</td>
<td>8,830</td>
<td>—</td>
<td>(8,830)</td>
</tr>
<tr>
<td>Pro forma balance at September 30, 2018 (unaudited)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>$659,542,250 $661,951,319 $ (922) $ (874,031) $ 1,076,432</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
The accompanying notes are an integral part of these consolidated financial statements.

F-7
### MODERNA, INC.

#### CONSOLIDATED STATEMENTS OF CASH FLOWS

**(In thousands)**

<table>
<thead>
<tr>
<th>Year Ended December 31,</th>
<th>Nine Months Ended September 30,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
</tr>
<tr>
<td><strong>Operating activities</strong></td>
<td></td>
</tr>
<tr>
<td>Net loss</td>
<td>$ (216,211)</td>
</tr>
<tr>
<td>Adjustments to reconcile net loss to net cash provided by (used in) operating activities:</td>
<td></td>
</tr>
<tr>
<td>Stock-based compensation</td>
<td>39,360</td>
</tr>
<tr>
<td>Depreciation</td>
<td>15,114</td>
</tr>
<tr>
<td>Amortization of investment premiums and discounts</td>
<td>2,478</td>
</tr>
<tr>
<td>Changes in assets and liabilities:</td>
<td></td>
</tr>
<tr>
<td>Accounts receivable</td>
<td>(8,642)</td>
</tr>
<tr>
<td>Accounts receivable from affiliate (Note 14)</td>
<td>60,979</td>
</tr>
<tr>
<td>Prepaid expenses and other assets</td>
<td>(7,887)</td>
</tr>
<tr>
<td>Accounts payable</td>
<td>5,993</td>
</tr>
<tr>
<td>Accrued liabilities</td>
<td>5,328</td>
</tr>
<tr>
<td>Deferred revenue</td>
<td>164,129</td>
</tr>
<tr>
<td>Deferred lease obligation</td>
<td>3,828</td>
</tr>
<tr>
<td>Other liabilities</td>
<td>1,977</td>
</tr>
<tr>
<td>Deferred income taxes</td>
<td>288</td>
</tr>
<tr>
<td><strong>Net cash provided by (used in) operating activities</strong></td>
<td>$66,734</td>
</tr>
<tr>
<td><strong>Investing activities</strong></td>
<td></td>
</tr>
<tr>
<td>Purchases of marketable securities</td>
<td>(1,415,461)</td>
</tr>
<tr>
<td>Proceeds from maturities of marketable securities</td>
<td>675,200</td>
</tr>
<tr>
<td>Proceeds from sales of marketable securities</td>
<td>133,700</td>
</tr>
<tr>
<td>Purchases of property and equipment</td>
<td>(33,144)</td>
</tr>
<tr>
<td>Increase in restricted cash</td>
<td>(8,902)</td>
</tr>
<tr>
<td><strong>Net cash (used in) provided by investing activities</strong></td>
<td>(648,607)</td>
</tr>
<tr>
<td><strong>Financing activities</strong></td>
<td></td>
</tr>
<tr>
<td>Proceeds from issuance of redeemable convertible preferred stock, net of issuance costs</td>
<td>473,532</td>
</tr>
<tr>
<td>Repurchases of redeemable convertible preferred stock</td>
<td>—</td>
</tr>
<tr>
<td>Distributions to preferred and common unit holders</td>
<td>(633)</td>
</tr>
<tr>
<td>Proceeds from issuance of restricted stock and exercise of stock options</td>
<td>11</td>
</tr>
<tr>
<td>Construction financing obligation</td>
<td>—</td>
</tr>
<tr>
<td><strong>Net cash provided by financing activities</strong></td>
<td>472,910</td>
</tr>
<tr>
<td>Net (decrease) increase in cash and cash equivalents</td>
<td>$ 50,080</td>
</tr>
<tr>
<td><strong>Supplemental cash flow information</strong></td>
<td></td>
</tr>
<tr>
<td>Income taxes paid</td>
<td>$ 905</td>
</tr>
<tr>
<td><strong>Non-cash investing and financing activities</strong></td>
<td></td>
</tr>
<tr>
<td>Issuance costs in accrued liabilities</td>
<td>$ 89</td>
</tr>
<tr>
<td>Purchases of property and equipment included in accounts payable and accrued liabilities</td>
<td>$ 10,014</td>
</tr>
<tr>
<td>Leasehold improvements included in accounts receivable</td>
<td>—</td>
</tr>
<tr>
<td>Construction financing obligation (Note 7)</td>
<td>$ 12,500</td>
</tr>
<tr>
<td>Dividends and accretion of redeemable convertible preferred units</td>
<td>$ 8,663</td>
</tr>
<tr>
<td>Tax distributions to members included in accounts payable and accrued liabilities</td>
<td>$ 1,464</td>
</tr>
</tbody>
</table>

The accompanying notes are an integral part of these consolidated financial statements.

F-8
1. Organization and Description of Business

Moderna, Inc. is a Delaware Corporation, incorporated under the laws of the State of Delaware on July 22, 2016 (collectively, with its consolidated subsidiaries, any of Moderna, Company, we, us or our). In August 2018, we changed our name from Moderna Therapeutics, Inc. to Moderna, Inc. We are the successor in interest to Moderna LLC, a limited liability company formed under the laws of the State of Delaware in 2013. Our principal executive office is located at 200 Technology Square, Cambridge, MA.

We are creating a new category of transformative medicines based on messenger RNA (mRNA), to improve the lives of patients. Since inception, we have incurred significant operating losses, which were $216.2 million, $255.9 million, $218.0 million (unaudited) and $243.3 million (unaudited) for the years ended December 31, 2016 and 2017 and for the nine months ended September 30, 2017 and 2018, respectively. As of December 31, 2017 and September 30, 2018, we had an accumulated deficit of $621.9 million and $865.2 million (unaudited), respectively. We expect to continue to incur significant expenses and operating losses for the foreseeable future. In addition, we anticipate that our expenses will increase significantly in connection with our ongoing activities to support our platform research, drug discovery and clinical development, infrastructure and Research Engine and Early Development engine, digital infrastructure, creation of a portfolio of intellectual property, and administrative support.

We do not expect to generate significant revenue from sales of potential mRNA medicines unless and until we successfully complete clinical development and obtain regulatory approval for one or more of our investigational medicines. If we seek to obtain regulatory approval for any of our investigational medicines, we expect to incur significant commercialization expenses.

As a result, we will need substantial additional funding to support our continued operations and pursue our growth strategy. Until we can generate significant revenue from potential mRNA medicines, if ever, we expect to finance our operations through a combination of public or private equity offerings and debt financings, government funding arrangements, strategic alliances and marketing, distribution and licensing arrangements. We may be unable to raise additional funds or enter into such other agreements on favorable terms, or at all. If we fail to raise capital or enter into such agreements as, and when, needed, we may have to significantly delay, scale back or discontinue the development and commercialization of one or more of our programs. We believe that our cash, cash equivalents, and investments as of September 30, 2018 will be sufficient to enable us to fund our projected operations through at least the next 12 months.

Because of the numerous risks and uncertainties associated with pharmaceutical development, we are unable to predict the timing or amount of increased expenses or when or if we will be able to achieve or maintain profitability. Even if we are able to generate revenues from the sale of our medicines, we may not become profitable. If we fail to become profitable or are unable to sustain profitability on a continuing basis, then we may be unable to continue our operations at planned levels and be forced to reduce our operations.

Reorganization

On August 10, 2016, we completed a series of reorganizational transactions (the 2016 Reorganization). As part of the transactions: (i) each issued and outstanding redeemable convertible preferred unit and common unit of Moderna LLC as of the date of the 2016 Reorganization was exchanged for shares of redeemable convertible preferred stock and common stock, respectively, of Moderna Therapeutics, Inc.; (ii) previously outstanding incentive units of Moderna LLC were exchanged for shares of restricted common stock of Moderna Therapeutics, Inc.; (iii) previously outstanding options to purchase common units of Moderna LLC were
exchanged for options to purchase common stock of Moderna Therapeutics, Inc.; and (iv) for the effects of a ten-for-one forward stock split (Stock Split). If such outstanding units or options were subject to vesting at the time of the 2016 Reorganization, then such shares or options issued by Moderna Therapeutics, Inc. were subject to continued vesting pursuant to the same terms.

The consolidated financial statements as of and for the year ended December 31, 2016, reflect the exchange of common units to common stock, redeemable convertible preferred units to redeemable convertible preferred stock and the incremental compensation expense associated with the modification of certain of our stock-based compensation awards. All unit and per unit data and all share and per share data in the consolidated financial statements have been adjusted for the Stock Split (Note 9).

Common Control Transactions

Effected by the Reorganization, our ownership and control remained substantially the same both before and immediately after the exchange of Moderna LLC membership interests for Moderna Therapeutics, Inc. stock.

Prior to December 28, 2017, we had incorporated several wholly owned subsidiaries, which were limited liability companies that made a “check the box” election to be taxed as a C corporation. On December 28, 2017, ModernaTX, Inc., our wholly owned subsidiary, executed an Agreement and Plan of Merger with these subsidiaries whereby each subsidiary merged into ModernaTX, Inc. with ModernaTX, Inc. being the surviving corporation. As all entities in the merger were wholly owned subsidiaries of Moderna LLC, which was a wholly owned subsidiary of Moderna Inc., the reporting entity, we concluded the merger is outside of the scope of Financial Accounting Standards Board (FASB), Accounting Standards Codification (ASC) Topic 805, Business Combinations and was accounted for at the carrying value of the net assets or equity interests transferred.

2. Summary of Significant Accounting Policies

Basis of Presentation and Principles of Consolidation

Our consolidated financial statements are prepared in accordance with U.S. generally accepted accounting principles (GAAP). Any reference in these notes to applicable guidance is meant to refer to the authoritative accounting principles generally accepted in the United States as found in the ASC and Accounting Standards Update (ASU) of the FASB.

All intercompany transactions and balances have been eliminated in consolidation.

Use of Estimates

Conformity with GAAP requires us to make estimates and judgments that affect the reported amounts and related disclosures in the consolidated financial statements and accompanying notes. We base our estimates and judgments on historical information and other market-specific or various relevant assumptions, including in certain circumstances, future projections, that we believe to be reasonable under the circumstances. Our actual results could differ materially from estimates. Significant estimates relied upon in preparing these financial statements include, among others, those related to fair value of equity awards, revenue recognition, research and development expenses, leases, fair value of financial instruments, useful lives of property and equipment, income taxes, and our valuation allowance on our deferred tax assets.

Unaudited interim financial information

The accompanying consolidated balance sheet as of September 30, 2018 actual and pro forma, the consolidated statements of operations, statements of comprehensive loss and statements of cash flows, for the nine months
ended September 30, 2017 and 2018, respectively, and the statements of redeemable convertible preferred stock and stockholders' (deficit) equity for the nine months ended September 30, 2018 actual and pro forma are unaudited. The interim unaudited financial statements have been prepared on the same basis as the annual audited financial statements, and in our opinion, reflect all adjustments, which include normal recurring adjustments necessary for the fair statement of our financial position as of September 30, 2018, and the results of our operations and comprehensive loss and our cash flows for the nine months ended September 30, 2017 and 2018. The financial data and other information disclosed in these notes related to the nine months ended September 30, 2017 and 2018, respectively, are unaudited. The results for the nine months ended September 30, 2018 are not necessarily indicative of results to be expected for the year ending December 31, 2018, any other interim periods, or any future year or period.

Segment Information

We have determined that our chief executive officer is the chief operating decision maker (CODM). The CODM reviews financial information presented on a consolidated basis. Resource allocation decisions are made by the CODM based on consolidated results. There are no segment managers who are held accountable by the CODM for operations, operating results, and planning for levels or components below the consolidated unit level. As such, we have concluded that we operate as one segment. All our long-lived assets are located in the United States.

Revenue Recognition

Our revenue is primarily generated through collaboration arrangements and grants from government-sponsored and private organizations. Our collaboration arrangements typically contain multiple elements, or deliverables, including licenses, options to obtain development and commercialization rights, research and development services, and obligations to develop and manufacture preclinical and clinical material. Such arrangements provide for various types of payments to us, including upfront payments, funding of research and development activities, funding for the purchase of preclinical and clinical material, technical, development, regulatory and commercial milestone payments, licensing fees, option exercise payments, and royalties based on product sales. We have received grants from various government-sponsored and private organizations for research and related activities. Grant revenue is recognized in the period grant-related activities are performed.

We analyze our collaboration arrangements to assess whether they are within the scope of FASB ASC Topic 808, Collaborative Arrangements (ASC 808) to determine whether such arrangements involve joint operating activities performed by parties that are both active participants in the activities and exposed to significant risks and rewards that are dependent on the commercial success of such activities. For arrangements under the scope of ASC 808, we recognize our allocation of the shared costs incurred with respect to the jointly conducted activities as a component of the related expense in the period incurred. We also consider the guidance in FASB ASC Topic 605-45, Revenue Recognition—Principal Agent Considerations in determining the appropriate treatment for the transactions between us and the strategic collaborator and the transactions between us and other third parties. The classification of transactions under the collaboration arrangements is determined based on the nature and contractual terms of the arrangement along with the nature of the operations of the participants. Any consideration related to activities in which we are considered the principal, which includes being the primary obligor and having the risks and rewards of ownership, are accounted for as gross revenue. We recognize revenue in accordance with FASB ASC Topic 605, Revenue Recognition (ASC 605). Accordingly, revenue is recognized for each unit of accounting when all of the following criteria are met: (i) persuasive evidence of an arrangement exists, (ii) delivery has occurred or services have been rendered, (iii) the seller's price to the buyer is fixed or determinable, and (iv) collectability is reasonably assured. We are often entitled to bill according to contractual terms of our collaboration arrangements and receive payment in advance of satisfying the revenue recognition
Collaboration Revenue

We analyze multiple-element arrangements based on the guidance in FASB ASC Topic 605-25, Revenue Recognition—Multiple-Element Arrangements (ASC 605-25). Accordingly, we evaluate multiple-element arrangements to determine: (i) the deliverables included in the arrangement; and (ii) whether each deliverable in the arrangement meets the criteria to be considered a separate unit of accounting, or should be combined with other deliverables and accounted for as a single unit of accounting. This evaluation involves subjective determinations and requires us to make judgments about the individual deliverables and whether such deliverables are separable from the other aspects of the arrangement. Deliverables are considered separate units of accounting provided that: (i) the delivered item(s) has value to the customer on a standalone basis; and (ii) if the arrangement includes a general right of return relative to the delivered item(s), the delivery or performance of the undelivered item(s) is considered probable and substantially in our control. In assessing whether an item has standalone value, we consider factors such as the research, manufacturing, and commercialization capabilities of the strategic collaborator and the availability of the associated expertise in the general marketplace. In addition, we consider whether the strategic collaborator can use the other deliverable(s) for their intended purpose without the receipt of the remaining element(s), whether the value of the deliverable is dependent on the undelivered item(s) and whether there are other vendors that can provide the undelivered element(s).

We allocate total consideration that is fixed or determinable to each unit of accounting based on the relative selling price of each deliverable. We determine the selling price of a unit of accounting following the hierarchy of evidence prescribed by ASC 605-25. Accordingly, we determine the estimated selling price for units of accounting within each arrangement using vendor-specific objective evidence (VSOE) of selling price, if available, third-party evidence (TPE) of selling price if VSOE is not available, or best estimate of selling price (BESP) if neither VSOE nor TPE is available. We typically use BESP to estimate the selling price, since we generally do not have VSOE or TPE of selling price for our units of accounting. Determining the BESP for a unit of accounting requires significant judgment. In developing the BESP for a unit of accounting, we consider applicable market conditions and relevant entity-specific factors, including factors that were contemplated in negotiating the agreement with the customer and estimated costs.

We recognize arrangement consideration allocated to each unit of accounting when all of the revenue recognition criteria in ASC 605 are satisfied for that particular unit of accounting. In the event that a deliverable does not represent a separate unit of accounting, we recognize revenue from the combined unit of accounting when the last element to be delivered is provided to the customer. If the last element to be delivered is provided over a period of time, revenue is recognized over our contractual or estimated performance period for the undelivered elements, which is typically the term of our research and development obligations or manufacturing obligations. If there is no discernible pattern of performance or objectively measurable performance measures do not exist, then we recognize revenue under the arrangement ratably over the estimated period of performance. Conversely, if the pattern of performance in which the service is provided to the strategic collaborator can be determined and objectively measurable performance measures exist, then we recognize revenue under the arrangement using the proportional performance method.

Our third-party arrangements may include options for our strategic collaborators to acquire development and commercialization rights to mRNA programs or with respect to specific targets or options to receive research and development services or preclinical or clinical materials from us. Options are considered substantive if, at the

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inception of the arrangement, we are at risk as to whether the strategic collaborator will choose to exercise the option. The evaluation of whether an option is substantive requires significant judgment. In determining if the option is substantive, we consider the overall objective of the arrangement, the benefit the third-party might obtain from the arrangement without exercising the option, the likelihood that the option will be exercised, or if the customer is required or compelled through significant incentive to exercise the option. When an option is considered substantive, we do not consider the option or item underlying the option to be a deliverable at inception of the arrangement and the associated option fee is not included in the allocable arrangement consideration, assuming the option is not priced at a significant and incremental discount. Conversely, if we determine that an option is not substantive, we will consider the item underlying the option to be a deliverable at the inception of the arrangement and the associated option exercise fee is included in the allocable arrangement consideration. In addition, if the price of the option includes a significant and incremental discount, then the option is not considered substantive.

At the inception of an arrangement that includes milestone payments, we evaluate whether each milestone is substantive and at risk to both parties on the basis of the contingent nature of the milestone. This evaluation includes an assessment of whether: (i) the consideration is commensurate with either our performance to achieve the milestone or the enhancement of the value of the delivered item(s) as a result of a specific outcome resulting from our performance to achieve the milestone; (ii) the consideration relates solely to past performance; and (iii) the consideration is reasonable relative to all of the deliverables and payment terms within the arrangement. We evaluate factors such as the scientific, clinical, regulatory, commercial, and other risks that must be overcome to achieve the respective milestone and the level of effort and investment required to achieve the respective milestone in making this assessment. There is considerable judgment involved in determining whether a milestone satisfies all of the criteria required to conclude that a milestone is substantive. If milestones are considered substantive, in accordance with FASB ASC Topic 605-28, Revenue Recognition—Milestone Method, revenue from milestone payments is recognized in its entirety upon successful accomplishment of the milestone. Conversely, upon achievement of a milestone that is not considered substantive, the corresponding amount earned is considered additional arrangement consideration and allocated to the identified units of accounting. Amounts allocated to any units of accounting for which performance has been partially completed are recognized, with a cumulative catch-up for the recognized portion of the unit of accounting when the payment is earned. Revenue from commercial milestone payments will be accounted for as royalties and recorded as revenue upon achievement of the milestone, assuming all other revenue recognition criteria are met.

We will recognize royalty revenue in the period of sale of the related product(s), based on the underlying contract terms, provided that the reported sales are reliably measurable and we have no remaining undelivered elements.

Grant Revenue

Our contracts with the U.S. government’s Defense Advanced Research Projects Agency (DARPA), Biomedical Advanced Research (BARDA), and the Bill & Melinda Gates Foundation (Gates Foundation) are contracts, providing for reimbursed costs, which may include overhead and general and administrative costs as well as a related profit margin. We recognize revenue from these contracts as we perform services under the arrangements so long as an agreement has been executed and the fees for the services are fixed or determinable, legally billable, and reasonably assured of collection. Recognized amounts reflect our performance under the agreements. We do not recognize revenue under these agreements for amounts related to contract periods where funding is not yet committed, as fees above committed funding thresholds would not be considered fixed or determinable, or reasonably assured of collection. Revenues and related expenses are presented gross in the consolidated statements of operations as we have determined we are the primary obligor under the arrangements relative to the research and development services we perform as lead technical expert.
We recognize revenue on other grants and awards when all of our obligations under the grant are fulfilled, and present such revenues and related expenses gross in the consolidated financial statements.

Cash and Cash Equivalents
We consider all highly liquid investments with an original maturity of 90 days or less from the date of purchase to be cash equivalents.

Restricted Cash
Restricted cash is composed of amounts held on deposit related to our lease arrangements. The funds are maintained in money market accounts and are recorded at fair value. We classify our restricted cash as either current or non-current based on the terms of the underlying lease arrangement.

Investments
We invest our excess cash balances in marketable debt securities. We classify our investments in marketable debt securities as available-for-sale. We report available-for-sale investments at fair value at each balance sheet date, and include any unrealized holding gains and losses (the adjustment to fair value) in accumulated other comprehensive loss, a component of stockholders’ (deficit) equity. Realized gains and losses are determined using the specific-identification method, and are included in other expense, net in our consolidated statements of operations. Should any adjustment to fair value reflect a decline in the value of the investment, we consider all available evidence to evaluate the extent to which the decline is “other than temporary” and, if so, we recognize the associated unrealized loss through a charge to our consolidated statement of operations. We did not record any impairment charges related to our marketable securities during the years ended December 31, 2016 and 2017 or for the nine months ended September 30, 2017 and 2018 (unaudited). We classify our available-for-sale marketable securities as current or non-current based on each instrument’s underlying effective maturity date and for which we have the intent and ability to hold the investment for a period of greater than 12 months. Marketable securities with maturities of less than 12 months are classified as current and are included in investments in the consolidated balance sheets. Marketable securities with maturities greater than 12 months for which we have the intent and ability to hold the investment for greater than 12 months are classified as non-current and are included in investments, non-current in the consolidated balance sheets.

Accounts Receivable and Allowance for Doubtful Accounts
Accounts receivable are amounts due from strategic collaborators as a result of manufacturing and research and development services provided under collaboration arrangements, or milestones achieved, but not yet paid. We also have accounts receivable amounts due from our grant agreements. To estimate the allowance for doubtful accounts, we make judgments about the creditworthiness of our customers based on ongoing credit evaluation and historical experience. There was no allowance for doubtful accounts at December 31, 2016 and 2017 or at September 30, 2018 (unaudited). There was no bad debt expense for the years ended December 31, 2016 or 2017 or for the nine months ended September 30, 2017 and 2018 (unaudited).

Concentrations of Credit Risk
Financial instruments that subject us to significant concentrations of credit risk consist primarily of cash, cash equivalents, restricted cash, marketable securities, and accounts receivable. Our investment portfolio is comprised of money market funds, marketable debt securities, including U.S. Treasury securities, debt securities
of U.S. government agencies and corporate entities and commercial paper. Our cash management and investment policy limits investment instruments to investment-grade securities with the objective to preserve capital and to maintain liquidity until the funds can be used in business operations. Bank accounts in the United States are insured by the Federal Deposit Insurance Corporation (FDIC) up to $250,000. Our primary operating accounts significantly exceed the FDIC limits.

**Significant Customers**

Our accounts receivable are generally unsecured and are from customers in different countries. We generated 94%, 86%, 78% (unaudited) and 90% (unaudited) of our revenue for the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018, respectively, from strategic collaborators. The remaining 6%, 14%, 22% (unaudited) and 10% (unaudited) of our revenue for the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018, respectively, were generated from grants made by government-sponsored and private organizations.

A significant portion of our revenue to date has been generated from the following entities that accounted for more than 10% of total revenue and accounts receivable for the periods presented:

<table>
<thead>
<tr>
<th></th>
<th>Percentage of Revenue Year Ended December 31</th>
<th>Percentage of Accounts Receivable December 31</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td>Alexion</td>
<td>16%</td>
<td>36%</td>
</tr>
<tr>
<td>Merck</td>
<td>44%</td>
<td>31%</td>
</tr>
<tr>
<td>AstraZeneca</td>
<td>30%</td>
<td>15%</td>
</tr>
<tr>
<td>BARDA</td>
<td>*</td>
<td>10%</td>
</tr>
<tr>
<td>DARPA</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Percentage of Revenue Nine Months Ended September 30</th>
<th>Percentage of Accounts Receivable September 30</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2017 (unaudited)</td>
<td>2018 (unaudited)</td>
</tr>
<tr>
<td>Merck</td>
<td>41%</td>
<td>48%</td>
</tr>
<tr>
<td>AstraZeneca</td>
<td>19%</td>
<td>33%</td>
</tr>
<tr>
<td>Alexion</td>
<td>11%</td>
<td>*</td>
</tr>
<tr>
<td>Vertex</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>BARDA</td>
<td>15%</td>
<td>*</td>
</tr>
<tr>
<td>DARPA</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

* Represents an amount less than 10%

**Fair Value Measurements**

Fair value is defined as the price that would be received from selling an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. When determining the fair value measurements for assets and liabilities, which are required to be recorded at fair value, we consider the principal or most advantageous market in which we would transact and the market-based risk measurements or assumptions that market participants would use in pricing the asset or liability, such as risks inherent in valuation techniques, transfer restrictions and credit risk. FASB ASC Topic 820, *Fair Value Measurement* (ASC 820), establishes a fair value hierarchy for instruments measured at fair value that distinguishes between assumptions.
based on market data (observable inputs) and our assumptions (unobservable inputs). Observable inputs are inputs that market participants would use in pricing the asset or liability based on market data obtained from our independent sources. Unobservable inputs are inputs that reflect our assumptions about the inputs that market participants would use in pricing the asset or liability, and are developed based on the best information available in the circumstances. The following fair value hierarchy is used to classify assets and liabilities based on the observable inputs and unobservable inputs used to value the assets and liabilities:

- **Level 1**: Unadjusted quoted prices in active markets that are accessible at the measurement date for identical, unrestricted assets or liabilities;
- **Level 2**: Quoted prices for similar assets and liabilities in active markets, quoted prices in markets that are not active, or inputs which are observable, either directly or indirectly, for substantially the full term of the asset or liability; or
- **Level 3**: Prices or valuation techniques that require inputs that are both significant to the fair value measurement and unobservable (i.e., supported by little or no market activity).

To the extent that the valuation is based on models or inputs that are less observable or unobservable in the market, the determination of fair value requires more judgment. A financial instrument’s level within the fair value hierarchy is based on the lowest level of any input that is significant to the fair value measurement.

Our cash equivalents and marketable securities are reported at fair value determined using Level 1 and Level 2 inputs (Note 5). We do not have any non-financial assets or liabilities that should be recognized or disclosed at fair value on a recurring basis at December 31, 2016 and 2017 or at September 30, 2018 (unaudited).

As of December 31, 2016 and 2017 and September 30, 2018, we maintain letters of credit of $11.5 million, $12.7 million, and $12.4 million (unaudited), respectively, related to our lease arrangements, which are secured by money market accounts in accordance with certain of our lease agreements. The amounts are recorded at fair value using Level 1 inputs and included as restricted cash in our consolidated balance sheets.

**Construction in Progress**

Construction in progress includes certain build-to-suit lease costs incurred and other direct expenses for our manufacturing facility in Norwood, MA (Norwood), stated at original cost. Construction in progress includes costs incurred under construction contracts including project management services, engineering services, design services and development, construction services and other construction-related fees and services. Once our Norwood manufacturing facility becomes operational, these capitalized costs will be allocated to certain property and equipment categories and will be depreciated over the estimated useful life of the underlying assets. Construction in progress also includes direct costs related to the construction of various property and equipment, including leasehold improvements. Such costs are not depreciated until the asset is completed and placed into service.
Property and Equipment

Property and equipment are stated at cost, net of accumulated depreciation. Depreciation is calculated using the straight-line method over the estimated useful lives of the assets. The estimated useful lives of property and equipment are described below:

<table>
<thead>
<tr>
<th>Description</th>
<th>Estimated Useful Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building</td>
<td>34 years</td>
</tr>
<tr>
<td>Laboratory equipment</td>
<td>5 years</td>
</tr>
<tr>
<td>Leasehold improvements</td>
<td>Lesser of estimated useful life of improvement or remaining life of related lease</td>
</tr>
<tr>
<td>Computer equipment and software</td>
<td>3 years</td>
</tr>
<tr>
<td>Other assets including automobiles, furniture and fixtures</td>
<td>5 years</td>
</tr>
</tbody>
</table>

Expenditures for maintenance and repairs are charged to expense as incurred. Upon retirement or sale, the cost of the assets disposed of, and the related accumulated depreciation, are removed from the accounts, and any resulting gain or loss is recorded to other income (expense), net.

Software Capitalization

We capitalize certain software development costs incurred in connection with obtaining or developing internal-use software including external direct costs of services, and payroll costs for employees directly involved with the software development. Capitalized software costs are included in property and equipment and we begin amortization of those costs when the software will be used to perform the function intended. Capitalized software costs associated with projects are amortized over three years. Costs incurred during the preliminary project stage and post-implementation stage, as well as maintenance and training costs, are expensed as incurred. There were no amounts recorded for internally developed software net of amortization as of December 31, 2017 or September 30, 2018.

Impairment of Long-Lived Assets

We evaluate our long-lived assets, which consist of property and equipment, to determine if facts and circumstances indicate that the carrying amount of assets may not be recoverable. If such facts and circumstances exist, we assess the recoverability of the long-lived assets by comparing the projected future undiscounted net cash flows associated with the related asset or group of assets over their remaining lives against their respective carrying amounts. If such review indicates that such cash flows are not expected to be sufficient to recover the recorded value of the assets, the assets are written down to their estimated fair values based on the expected discounted future cash flows attributable to the assets or based on appraisals. For the years ended December 31, 2016 and 2017 and for the nine months ended September 30, 2018 (unaudited), we have not recorded any impairment expenses.

Leases

Leases are classified at their inception as either operating or capital leases based on the economic substance of the agreement. We recognize rent expense for our operating leases, inclusive of rent escalation provisions and rent holidays, on a straight-line basis over the respective lease term. Additionally, we recognize tenant improvement allowances for our operating leases as a deferred lease obligation and amortize the tenant improvement allowances as a reduction to rent expense on a straight-line basis over the respective lease term. At December 31, 2016 and 2017 and September 30, 2018 (unaudited), no capital leases were recorded in the consolidated balance sheets.
In accordance with the requirements of ASC 840, Leases, if we are deemed to be the owner of a property, we are required to account for the property as a depreciable asset and the related lease agreement must be accounted for as an imputed financing obligation. Significant judgments are required to make this determination, which relate to actions, guarantees, and investments that we make as a lessee that may be actions that only an owner would take. Our Norwood manufacturing facility lease executed in August 2016 was subject to this lease accounting guidance. As we are involved in the construction of our manufacturing facility, including being responsible for costs that did not qualify as normal tenant improvements, we are deemed to be the owner of the building during the construction period. During the Norwood construction period, we capitalized the fair value of the building as of lease commencement as construction in progress along with a corresponding construction financing obligation in the consolidated balance sheets. Construction costs incurred were capitalized in construction in progress including project management services, engineering services, design services and development, construction services and other construction-related fees and services. Once our Norwood manufacturing facility becomes operational, these capitalized costs will be allocated to certain property and equipment categories and will be depreciated over the estimated useful life of the underlying assets. The fair value of the building at lease commencement was determined to be $12.5 million by a third-party valuation specialist primarily using an income capitalization approach. The income capitalization approach was based on rents charged for competitive properties as adjusted for applicable expenses incurred through ownership of the building and is considered a Level 3 fair value measurement (Note 7).

Research and Development Costs

Research and development costs are expensed as incurred. Research and development expenses consist of costs incurred in performing research and development activities, including salaries and benefits, facilities costs, overhead costs, contract services, and other outside costs. The value of goods and services received from contract research organizations and contract manufacturing organizations in the reporting period are estimated based on the level of services performed, and progress in the period in cases when we have not received an invoice from the supplier.

Patent Costs

Costs to secure, defend and maintain patents are expensed as incurred, and are classified as general and administrative expenses due to the uncertainty of future benefits.

Stock-Based Compensation

We issue stock-based awards to employees and non-employees, generally in the form of stock options, restricted stock, or restricted stock units (RSUs). Historically, we had also issued incentive units and unit options to our employees and non-employees. We account for our stock-based compensation awards in accordance with ASC Topic 718, Compensation—Stock Compensation (ASC 718). Most of our stock-based awards have generally been made to employees. The fair value of the non-employees’ awards are subject to re-measurement at each reporting date until the vesting date in accordance with ASC 505-50, Equity-Based Payments to Non-Employees. We measure compensation cost for all equity awards for employees at their grant-date fair value and recognize compensation expense over the requisite service period, which is generally the vesting period, on a straight-line basis. The grant date fair value of stock options is estimated using the Black-Scholes option pricing model, which requires management to make assumptions with respect to the fair value of our common stock on the grant date, including the expected term of the award, the expected volatility of our stock, calculated based on a period of time generally commensurate with the expected term of the award, risk-free interest rates and expected dividend yields of our stock. Historically, for periods prior to this initial public offering, the fair value of the shares of
common stock and common units underlying our stock-based awards were determined on each grant date by our board of directors based on valuation estimates from management considering our most recently available independent third-party valuation of our common stock. Our board of directors also assessed and considered, with input from management, additional objective and subjective factors that we believed were relevant and which may have changed from the date of the most recent valuation through the grant date. The grant date fair value of RSUs is estimated based on the fair value of our underlying common stock. For performance-based stock options, we recognize stock-based compensation expense over the requisite service period using the accelerated attribution method when achievement is probable. We classify stock-based compensation expense in our consolidated statement of operations in the same manner in which the award recipient’s salary and related costs are classified or in which the award recipient’s service payments are classified.

**Redeemable Convertible Preferred Units and Redeemable Convertible Preferred Stock**

We record all redeemable convertible preferred units and redeemable convertible preferred stock at their respective transaction prices on the dates of issuance less issuance costs. Our redeemable convertible preferred units and redeemable convertible preferred stock are classified as temporary equity and excluded from stockholders’ (deficit) equity as the potential redemption of such units or stock is outside our control. We adjusted the carrying value of the redeemable convertible preferred units to the redemption value as the units became redeemable upon the passage of time. Upon the 2016 Reorganization, the redemption rights upon the passage of time were removed and the redeemable convertible preferred stock became redeemable only upon the occurrence of certain contingent events. We do not adjust the carrying value of the redeemable convertible preferred stock to the redemption value until the contingent events are considered to be probable of occurring.

**Income Taxes**

We use an asset and liability approach to account for income taxes. We recognize deferred tax assets and liabilities for the expected future tax consequences of temporary differences between the financial reporting and tax bases of assets and liabilities. These differences are measured using the enacted statutory tax rates that are expected to be in effect for the years in which differences are expected to reverse. Valuation allowances are provided when the expected realization of deferred tax assets does not meet a “more likely than not” criterion. We make estimates and judgments about our future taxable income that are based on assumptions that are consistent with our plans and estimates. Should the actual amounts differ from our estimates, the amount of our valuation allowance could be materially impacted. Changes in these estimates may result in significant increases or decreases to our tax provision in a period in which such estimates are changed, which in turn would affect net income or loss.

We recognize tax benefits from uncertain tax positions if we believe the position is more likely than not to be sustained on examination by the taxing authorities based on the technical merits of the position. We make adjustments to these reserves when facts and circumstances change, such as the closing of a tax audit or the refinement of an estimate. The provision for income taxes includes the effects of any reserves for tax positions that are not more likely than not to be sustained, as well as the related net interest and penalties.

Prior to the 2016 Reorganization, in accordance with the operating agreement of Moderna LLC, to the extent possible without impairing our ability to continue to conduct our business and activities, and in order to permit our members to pay taxes on our taxable income, we were required to make distributions to the members in the amount equal to the estimated tax liability of each member computed as if the member paid U.S. income tax at the highest marginal federal and state rate applicable to an individual, in the event that taxable income is generated for the member. We distributed $1.5 million during 2017 for taxable income generated for 2016.
Net Loss per Share Attributable to Common Stockholders

We apply the two-class method to compute basic and diluted net loss per share attributable to common stockholders when we have issued units or shares that meet the definition of participating securities. The two-class method determines net income (loss) per share for each class of common and participating securities according to dividends declared or accumulated and participation rights in undistributed earnings. The two-class method requires income (loss) available to common stockholders for the period to be allocated between common and participating securities based upon their respective rights to share in the earnings as if all income (loss) for the period had been distributed. During periods of loss, there is no allocation required under the two-class method since the potentially participating securities do not have a contractual obligation to fund our losses.

We calculate basic net loss per share attributable to common stockholders by dividing net loss attributable to common stockholders by the weighted average number of common shares outstanding for the period, without consideration for common stock equivalents. For the year ended December 31, 2016, the weighted average number of common shares outstanding includes the weighted average number of common units outstanding prior to the 2016 Reorganization. For the year ended December 31, 2016, upon the 2016 Reorganization, the weighted average number of common shares outstanding reflects the impact of the exchange of common units and vested incentive units to common stock based on the associated conversion ratio.

We calculate diluted net loss per share attributable to common stockholders by dividing net loss attributable to common stockholders by the weighted average number of common shares outstanding after giving consideration to the dilutive effect of redeemable convertible preferred stock, restricted common stock, restricted stock units and stock options that are outstanding during the period. We have generated a net loss in all periods presented, therefore the basic and diluted net loss per share attributable to common stockholders are the same as the inclusion of the potentially dilutive securities would be anti-dilutive.

Unaudited Pro Forma Information

Upon the closing of our proposed initial public offering (IPO): (i) all of the outstanding shares of convertible preferred stock will automatically convert into shares of common stock; (ii) a portion of the performance-based restricted stock unit award with vesting conditions that are contingent upon the closing of an IPO will immediately vest and a portion of such award will vest over the associated vesting period; and (iii) a stock option award for which the grant is contingent upon an IPO will be effective and will vest over the associated vesting period. The accompanying unaudited pro forma consolidated balance sheet and consolidated statement of redeemable convertible preferred stock and stockholders’ (deficit) equity as of September 30, 2018 have been prepared as if our proposed IPO had occurred on September 30, 2018 to give effect to: (i) the automatic conversion of all outstanding shares of convertible preferred stock into 514,048,684 shares of common stock; (ii) the vesting of 843,750 performance-based restricted stock units with vesting conditions contingent upon the closing of the proposed IPO, resulting in the recognition of additional stock-based compensation expense; and (iii) the grant of an option award for the purchase of up to 10,000,000 shares of common stock that will vest over the associated vesting period, resulting in the recognition of additional stock-based compensation expense. The conversion of our convertible preferred stock is based on the respective conversion ratios. For the purposes of determining the unaudited pro forma information, we utilize the fair value per share of our common stock as determined in a contemporaneous valuation as of the date the transaction is assumed to have occurred. The shares of common stock expected to be issued and the proceeds expected to be received in our proposed IPO are excluded from such pro forma financial information.
The unaudited pro forma basic and diluted net loss per share attributable to common stockholders in the accompanying consolidated statements of operations for the year ended December 31, 2017 and the nine months ended September 30, 2018 were computed using the weighted average number of shares of common stock outstanding, including the pro forma effect of the following as if the IPO had occurred on the later of January 1, 2017 or the date the equity instruments were issued or vested: (i) the automatic conversion of all outstanding shares of convertible preferred stock into shares of common stock and (ii) the vesting of the performance-based restricted stock unit award with vesting conditions contingent upon the closing of the proposed IPO. The conversion of our convertible redeemable preferred stock is based on the respective conversion ratios. For the purposes of determining the pro forma information, we utilize the fair value per share of our common stock as determined in a contemporaneous valuation as of the date the transaction is assumed to have occurred. The unaudited pro forma net loss attributable to common stockholders used in the calculation of unaudited pro forma basic and diluted net loss per share attributable to common stockholders for the year ended December 31, 2017 and the nine months ended September 30, 2018 reflects the impact of the assumed closing of the IPO on the later of January 1, 2017 or the date the equity instruments were issued or vested as follows: (i) includes additional stock-based compensation expense related to the vesting of our performance-based restricted stock unit award with vesting conditions contingent upon the closing of the proposed IPO; (ii) includes additional stock-based compensation expense related to a stock option award that will be granted effective upon the closing of the proposed IPO; and (iii) excludes the impact of cumulative dividends reflected within the net loss attributable to common stockholders. The unaudited pro forma basic and diluted net loss per share attributable to common stockholders does not include the shares expected to be sold or related proceeds to be received in the proposed IPO (Note 13).

**Deferred Issuance Costs**

We capitalize certain legal, professional accounting and other third-party fees that are directly associated with in-process equity financings, including the proposed IPO, as deferred issuance costs until such financings are consummated. After consummation of our equity financing, these costs are recorded as a reduction of the proceeds generated as a result of the offering. Should the planned equity financing be abandoned, the deferred issuance costs will be expensed immediately as a charge to operating expenses in the consolidated statements of operations.

**Comprehensive Loss**

Comprehensive loss includes net loss and other comprehensive income (loss) for the period. Other comprehensive income (loss) consists of unrealized gains and losses on our investments. Total comprehensive loss for all periods presented has been disclosed in the consolidated statements of comprehensive loss.

The components of accumulated other comprehensive loss for the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2018 are as follows (in thousands):

<table>
<thead>
<tr>
<th>Description</th>
<th>Unrealized Gain (Loss) on Available-for-Sale Debt Securities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accumulated other comprehensive loss, balance at December 31, 2015</td>
<td>$ (566)</td>
</tr>
<tr>
<td>Other comprehensive income</td>
<td>163</td>
</tr>
<tr>
<td>Accumulated other comprehensive loss, balance at December 31, 2016</td>
<td>(405)</td>
</tr>
<tr>
<td>Other comprehensive loss</td>
<td>(754)</td>
</tr>
<tr>
<td>Accumulated other comprehensive loss, balance at December 31, 2017</td>
<td>(1,157)</td>
</tr>
<tr>
<td>Other comprehensive income (unaudited)</td>
<td>235</td>
</tr>
<tr>
<td>Accumulated other comprehensive loss, balance at September 30, 2018 (unaudited)</td>
<td>$ (922)</td>
</tr>
</tbody>
</table>
Subsequent Events

We consider events or transactions that occur after the balance sheet date as of December 31, 2017, and the balance sheet as of September 30, 2018 (unaudited), but prior to the issuance of the consolidated financial statements for potential recognition or disclosure in the consolidated financial statements. Subsequent events have been evaluated through August 30, 2018, the date the annual consolidated financial statements were issued, and October 31, 2018, the date the interim consolidated financial statements were issued, for potential recognition or disclosure in the consolidated financial statements (Note 15).

Emerging Growth Company Status

We are an “emerging growth company,” (EGC) as defined in the Jumpstart Our Business Startups Act, (JOBS Act), and may take advantage of certain exemptions from various reporting requirements that are applicable to other public companies that are not EGCs. We may take advantage of these exemptions until we are no longer an EGC under Section 107 of the JOBS Act, which provides that an EGC can take advantage of the extended transition period afforded by the JOBS Act for the implementation of new or revised accounting standards. We have elected to use the extended transition period for complying with new or revised accounting standards, and as a result of this election, our consolidated financial statements may not be comparable to companies that comply with public company FASB standards’ effective dates. We may take advantage of these exemptions up until the last day of the fiscal year following the fifth anniversary of an offering or such earlier time that we are no longer an EGC.

Recently Adopted Accounting Standards

In March 2016, the FASB issued ASU No. 2016-09, Improvements to Employee Share Based Payment Accounting. The new standard simplified several aspects of the accounting for share-based payments, including allowing an entity-wide accounting policy election to either estimate the number of awards that are expected to vest or account for forfeitures as they occur. We adopted this standard as of January 1, 2017 and elected to account for forfeitures as they occur. We recorded the cumulative impact of applying this standard, and recognized a cumulative increase to additional paid-in capital and an increase to accumulated deficit of $0.3 million included in stock-based compensation in the consolidated statements of redeemable convertible preferred stock and stockholders’ (deficit) equity.

Recently Issued Accounting Standards

From time to time, new accounting pronouncements are issued by the FASB or other standard setting bodies and adopted by us as of the specified effective date. Unless otherwise discussed, we believe that the impact of recently issued standards that are not yet effective will not have a material impact on our consolidated financial statements and disclosures.

In May 2014, the FASB issued ASU No. 2014-09, Revenue from Contracts with Customers, (Topic 606), which supersedes all existing revenue recognition requirements, including most industry specific guidance. The FASB has issued several updates to the standard which: i) clarify the application of the principal versus agent guidance; ii) clarify the guidance relating to performance obligations and licensing; iii) clarify assessment of the collectability criterion, presentation of sales taxes, measurement date for non-cash consideration and completed contracts at transaction; and iv) clarify narrow aspects of Topic 606 or corrects unintended application of the guidance (collectively, the Revenue ASUs). The Revenue ASUs provide an accounting standard for a single comprehensive model for use in accounting for revenue arising from contracts with customers and supersede
most of the current revenue recognition guidance. Under Topic 606, an entity recognizes revenue when its customer obtains control of promised goods or services, in an amount that reflects the consideration which the entity expects to receive in exchange for those goods or services. To determine revenue recognition for arrangements that an entity determines are within the scope of Topic 606, the entity performs the following five steps: (i) identify the contract(s) with a customer; (ii) identify the performance obligations in the contract; (iii) determine the transaction price; (iv) allocate the transaction price to the performance obligations in the contract; and (v) recognize revenue when (or as) the entity satisfies a performance obligation. Topic 606 also impacts certain other areas, such as the accounting for costs to obtain or fulfill a contract. The standard also requires disclosure of the nature, amount, timing, and uncertainty of revenue and cash flows arising from contracts with customers. The Revenue ASUs will be effective for us on January 1, 2019.

The Revenue ASUs allow for adoption using a full retrospective method or a modified retrospective method. We are in process of determining which adoption method we will utilize. We are also in process of assessing the effect of this accounting standard with regards to our revenue generating arrangements. Our performance obligations under our ongoing revenue recognition arrangements are not expected to be completed prior to the adoption of these standards. We are anticipating changes in our revenue recognition policies as a result of these new standards, the most significant of which is expected to be the method of revenue recognition for certain elements over time. Under the previous accounting standards, revenue was recognized ratably over the estimated period of performance while revenue will be recognized based on a proportional performance model under the Revenue ASUs. In addition, we expect that the changes in accounting for contingent milestone payments will have a significant effect on the future accounting treatment for the arrangement. The previous accounting guidance contained specific guidance related to the accounting for milestone payments including, if certain criteria were met, the ability to recognize all consideration related to the milestone once that milestone was achieved. The Revenue ASUs do not contain guidance specific to milestone payments, thereby requiring potential milestone payments to be considered in accordance with the overall revenue recognition model. As a result, revenue from contingent milestone payments may be recognized earlier under the Revenue ASUs than under the existing guidance, based on an assessment of the probability of achievement of the milestones and the likelihood of a significant reversal of such revenue at each reporting date. We will also be required to reassess the presentation of amounts as either gross revenue or net within operating expenses under the Revenue ASUs.

In February 2016, the FASB issued ASU No. 2016-02, Leases (Topic 842), which supersedes all existing lease guidance. This guidance offers specific accounting guidance for a lessee, a lessor and sale and leaseback transactions. The new standard requires lessees to recognize an operating lease with a term greater than one year on their balance sheets as a right-of-use asset and corresponding lease liability, measured at the present value of the lease payments. Lessees are required to classify leases as either finance or operating leases. If the lease is effectively a financed-purchase by the lessee, it is classified as a financing lease, otherwise it is classified as an operating lease. This classification will determine whether lease expense is recognized based on an effective interest method or on a straight-line basis over the term of the lease. ASC 842 provides accounting guidance for transactions that meet specific criteria for a leaseback transaction. If the criteria are not met, the transaction is considered a “failed sale” and the transaction must be accounted for as a financing arrangement. The new standard will be effective for us on January 1, 2020. Upon adoption, lessees must apply a modified retrospective transition approach for leases existing at, or entered after, the beginning of the earliest comparative period presented in the financial statements. We are currently evaluating the potential impact ASU 2016-02 may have on our financial position and results of operations. Our assessment will include, but is not limited to, evaluating the impact that this standard has on the lease of our corporate headquarters at 200 Technology Square in Cambridge, MA, the lease of our office and laboratory space at 500 Technology Square, Cambridge, MA and our manufacturing facility in Norwood, MA, for which we are deemed the owner for accounting purposes under our current accounting policies, and the identification of any embedded leases.
In November 2016, the FASB issued ASU No. 2016-18, Statement of Cash Flows Topic 230: Restricted Cash, which requires the statement of cash flows to explain the change during the period in the total of cash, cash equivalents, and amounts generally described as restricted cash or restricted cash equivalents. When cash, cash equivalents, restricted cash and restricted cash equivalents are presented in more than one line item on the balance sheet, the new guidance requires a reconciliation of the totals in the statement of cash flows to the related captions in the balance sheet. This reconciliation can be presented either on the face of the statement of cash flows or in the notes to the financial statements. The new standard will be effective for us on January 1, 2019. The adoption of this standard is expected to change our statement of cash flow presentation and disclosure.

In June 2018, the FASB issued ASU 2018-07, Compensation—Stock Compensation (Topic 718), Improvements to Nonemployee Share-Based Payment Accounting, which is intended to simplify aspects of share-based compensation issued to non-employees by making the guidance generally consistent with the accounting for employee share-based compensation. The new standard will be effective for us on January 1, 2019. The adoption of this standard is not expected to have a material impact on our consolidated financial statements and disclosure.

3. Collaboration Agreements

AstraZeneca – Strategic Alliances in Cardiovascular and Oncology

2013 Option Agreement and Services and Collaboration Agreement

In March 2013, we entered into an Option Agreement, the AZ Option Agreement, and a related Services and Collaboration Agreement, the AZ Services Agreement, with AstraZeneca, which were amended and restated in June 2018 (Note 15). We refer to these agreements in the forms that existed prior to the 2018 amendment and restatement as the 2013 AZ Agreements. Under the 2013 AZ Agreements, we granted AstraZeneca certain exclusive rights and licenses, and options to obtain exclusive rights to develop and commercialize potential therapeutic mRNA medicines directed at certain targets for the treatment of cardiovascular and cardiometabolic diseases and cancer, and agreed to provide related services to AstraZeneca. Pursuant to the 2013 AZ Agreements, AstraZeneca was responsible for all research, development and commercialization activities, while we provided specified research and manufacturing services during a research and evaluation period, as described below, to further AstraZeneca’s activities pursuant to an agreed upon services plan. Under the 2013 AZ Agreements, AstraZeneca could have requested we provide additional services, at AstraZeneca’s expense. Subject to customary “back-up” supply rights granted to AstraZeneca, we exclusively manufactured (or had manufactured) mRNA for all research, development and commercialization purposes under the 2013 AZ Agreements until, on a product-by-product basis, the expiration of the time period for which we are entitled to receive earn-out payments with respect to such product pursuant to the 2013 AZ Agreements.

As of the effective date of the 2013 AZ Agreements, AstraZeneca acquired forty options that it may exercise to obtain exclusive rights to clinically develop and commercialize identified development candidates (and related back-up candidates) directed to specified targets that arise during the research and evaluation period. During the research and evaluation period for research candidates under the 2013 AZ Agreements, AstraZeneca could have elected to designate a limited number of research candidates as development candidates in order to continue preclinical development on such development candidates (and related back-up candidates). From such pool of development candidates designated by AstraZeneca, during a specified option exercise period, AstraZeneca could have then exercised one of its options to obtain exclusive rights to clinically develop and commercialize an identified development candidate (and related back-up candidates). If AstraZeneca did not exercise one of its options to acquire exclusive rights to clinically develop and commercialize a particular development candidate during the defined option exercise period for such development candidate, AstraZeneca’s rights to exercise an option and other rights granted under the 2013 AZ Agreements with respect to such development candidate (and
related back-up candidates) would terminate, all rights to exploit such development candidate (and related back-up candidates) would be returned to us and all data and results generated by AstraZeneca with respect to such development candidate (and related back-up candidates) would be either assigned or licensed to us. Upon the earlier of termination of the 2013 AZ Agreements for any reason and a specified anniversary of the effective date of the 2013 AZ Agreements, all unexercised options, and the right to exercise any and all options if not previously exercised by AstraZeneca, would automatically terminate. On a target-by-target basis, we and AstraZeneca agreed to certain defined exclusivity obligations under the 2013 AZ Agreements with respect to the research, development and commercialization of mRNA medicines for such target.

As of the effective date of the 2013 AZ Agreements, AstraZeneca made upfront cash payments to us totaling $240.0 million. Under the 2013 AZ Agreements, we were entitled to receive payments that are not related to any specific program of up to $180.0 million in the aggregate for the achievement of three technical milestones relating to toxicity, delivery, and competition criteria. We achieved the toxicity and competition milestones in the year ended December 31, 2015. The delivery milestone has expired. Under the 2013 AZ Agreements, AstraZeneca was obligated to pay us a $10.0 million option exercise fee with respect to each development candidate (and related back-up candidates) for which it exercised an option. In addition, upon AstraZeneca’s exercise of each option, we were eligible to receive certain payments contingent upon the achievement of specified clinical, regulatory, and commercial events. For any product candidate optioned by AstraZeneca, we were eligible to receive, per product candidate, up to $100.0 million in payments for achievement of development milestones, up to $100.0 million payments for achievement of regulatory milestones, and up to $200.0 million payments for achievement of commercial milestones. Additionally, under the 2013 AZ Agreements, we were entitled to receive, on a product-by-product basis, earn-out payments on worldwide net sales of products ranging from a high-single digit percentage to 12%, subject to certain reductions, with an aggregate minimum floor.

We received from AstraZeneca under the 2013 AZ Agreements an option exercise payment of $10.0 million in the year ended December 31, 2016, and a clinical milestone payment of $30.0 million with respect to AstraZeneca’s VEGF-A product (AZD8601) subsequent to December 31, 2017, that is currently being developed in a Phase 2 clinical trial in certain fields.

Unless earlier terminated, the 2013 AZ Agreements would have continued until the expiration of AstraZeneca’s earn-out and contingent option exercise payment obligations for optioned product candidates. Either party had the right to terminate the 2013 AZ Agreements upon the other party’s material breach, either in its entirety or in certain circumstances, with respect to relevant candidates, subject to a defined materiality threshold and specified notice and cure provisions. If AstraZeneca had the right to terminate the 2013 AZ Agreements for our material breach, then AstraZeneca could have elected, in lieu of terminating the 2013 AZ Agreements, to have the 2013 AZ Agreements remain in effect, subject to reductions in certain payments we were eligible to receive and certain adjustments to AstraZeneca’s obligations under the 2013 AZ Agreements. AstraZeneca had the right to terminate the 2013 AZ Agreements in full, without cause, upon 90-days’ prior notice to us.

2016 Strategic Alliance with AstraZeneca – IL12

In January 2016, we entered into a new Strategic Drug Development Collaboration and License Agreement, which we refer to as the 2016 AZ Agreement, with AstraZeneca to discover, develop and commercialize potential mRNA medicines for the treatment of a range of cancers.

Under the terms of the 2016 AZ Agreement, we and AstraZeneca have agreed to work together on an immuno-oncology program focused on the intratumoral delivery of a potential mRNA medicine to make the IL12 protein.
The 2016 AZ Agreement initially included research activities with respect to a second discovery program. During a limited period of time, each party may propose additional discovery programs and the parties may agree to add such additional discovery programs to the 2016 AZ Agreement. We are responsible for conducting and funding all discovery and preclinical development activities under the 2016 AZ Agreement in accordance with agreed upon discovery program plan for the IL12 program and any other discovery program the parties agree to conduct under the 2016 AZ Agreement. For the IL12 program and any other discovery program the parties agree to conduct under the 2016 AZ Agreement, during a defined election period that commenced as of the effective date of the 2016 AZ Agreement (for the IL12 program) and otherwise will commence on the date of the next such discovery program. AstraZeneca may elect to participate in the clinical development of a development candidate arising under the 2016 AZ Agreement from such program. If AstraZeneca so elects (as it has for the IL12 program), AstraZeneca will lead clinical development activities worldwide and we will be responsible for certain activities, including being solely responsible for manufacturing activities, all in accordance with an agreed upon development plan. AstraZeneca will be responsible for funding all Phase 1 clinical development activities (including costs associated with our manufacture of clinical materials in accordance with the development plan), and Phase 2 clinical development activities (including costs associated with our manufacture of clinical materials in accordance with the development plan) up to a defined dollar threshold. We and AstraZeneca will equally share the costs of Phase 2 clinical development activities in excess of such dollar threshold, all Phase 3 clinical development activities and certain other costs of late-stage clinical development activities, unless we elect not to participate in further development and commercialization activities and instead receive tiered royalties, as described below.

We and AstraZeneca will co-commercialize products in the U.S. in accordance with an agreed upon commercialization plan and budget, and on a product-by-product basis will equally share the U.S. profits or losses arising from such commercialization. Notwithstanding, on a product-by-product basis, prior to a specified stage of development of a given product, we have the right to elect not to participate in the further development and commercialization activities for such product. If we make such election, instead of participating in the U.S. profits and losses share with respect to such product, we are obligated to discuss future financial terms with AstraZeneca. If we are unable to agree on future financial terms within a defined period of time, we are entitled to receive tiered royalties at default rates set forth in the 2016 AZ Agreement, ranging from percentages in the mid-single digits to 20% on worldwide net sales of products, subject to certain reductions with an aggregate minimum floor. AstraZeneca has sole and exclusive responsibility for all ex-U.S. commercialization efforts. Unless we have elected to not to participate in further development (in which case royalties on ex-U.S. net sales be at the default rates as described above, unless otherwise agreed by the parties), we are entitled to tiered royalties at rates ranging from 10% to 30% on ex-U.S. net sales of the products, subject to certain reductions with an aggregate minimum floor. Subject to customary “back-up” supply rights granted to AstraZeneca, we exclusively manufacture (or have manufactured) products for all development and commercialization purposes. We and AstraZeneca have agreed to certain defined exclusivity obligations with each other under the 2016 AZ Agreement with respect to the development and commercialization of mRNA medicines for IL12. Any exclusivity obligations for any new discovery program the parties agree to conduct under the 2016 AZ Agreement will be agreed to at the time such new discovery program is added.

Unless earlier terminated, our strategic alliance under the 2016 AZ Agreement will continue on a product-by-product basis (i) until both parties cease developing and commercializing such product without the intention to resume, if we have not elected our right not to participate in further development and commercialization of such product or (ii) on a country-by-country basis, until the end of the applicable royalty term for such product in such country, if we have elected our right not to participate in further development and commercialization of such product.
Either party may terminate the 2016 AZ Agreement upon the other party’s material breach, subject to specified notice and cure provisions. Each party may also terminate the 2016 AZ Agreement in the event the other party challenges such party’s patent rights, subject to certain defined exceptions. AstraZeneca has the right to terminate the 2016 AZ Agreement in full or with respect to any program for scientific, technical, regulatory or commercial reasons at any time upon 90 days’ prior written notice to us. On a product-by-product basis, we have the right to terminate the 2016 AZ Agreement in certain cases if AstraZeneca has suspended or is no longer proceeding with the development or commercialization of such product for a period of twelve consecutive months, subject to specified exceptions, including tolling for events outside of AstraZeneca’s control. On a product-by-product basis, if the 2016 AZ Agreement is terminated with respect to a given product, AstraZeneca’s rights in such product will terminate and, to the extent we terminated for AstraZeneca’s breach, patent challenge or cessation of development or AstraZeneca terminated in its discretion, AstraZeneca will grant us reversion licenses and take certain other actions so as to enable us to continue developing and commercializing such product in the oncology field.

If we continue developing and commercializing a given product following termination of the 2016 AZ Agreement by AstraZeneca in its discretion with respect to such product, AstraZeneca is entitled to receive a mid-single digit royalty on our worldwide net sales of such product and a high-single digit percentage of the amounts received by us from a third party in consideration of a license to such third party to exploit such product, in each case, until AstraZeneca recovers an amount equal to specified development costs incurred by AstraZeneca under the 2016 AZ Agreement with respect to such product prior to such termination. Such percentages increase by a low to mid-single digit amount to the extent such termination occurs after such product achieves a specified stage of development.

### 2017 Strategic Alliance with AstraZeneca – Relaxin

In October 2017, we entered a new Collaboration and License Agreement, which we refer to as the 2017 AZ Agreement, under which AstraZeneca may clinically develop and commercialize a development candidate, now known as AZD7970, which is comprised of an mRNA construct for the relaxin protein designed by us and encapsulated in one of our proprietary LNPs. We discovered and performed preclinical development activities for AZD7970 prior to the initiation of the strategic alliance with AstraZeneca under the 2017 AZ Agreement.

Under the terms of the 2017 AZ Agreement, we will fund and be responsible for conducting preclinical development activities for AZD7970 through completion of IND-enabling GLP toxicology studies and AstraZeneca will lead pharmacological studies, each in accordance with an agreed upon discovery program plan. During a defined election period that commences as of the effective date of the 2017 AZ Agreement, AstraZeneca may elect to participate in further development and commercialization of AZD7970. Upon such election, AstraZeneca will lead clinical development activities for AZD7970 worldwide and we will be responsible for manufacturing AZD7970, certain regulatory matters and any other development activities that we agree to perform and that are set forth in an agreed upon development plan. AstraZeneca will be responsible for funding Phase 1 clinical development activities (including costs associated with our manufacture of clinical materials in accordance with the development plan), up to a cap above which such costs are shared, and Phase 2 clinical development activities (including costs associated with our manufacture of clinical materials in accordance with the development plan, up to a cap above which such costs are shared) up to a defined dollar threshold. Thereafter, we and AstraZeneca will equally share the costs of Phase 2 clinical development activities, and Phase 3 clinical development activities and certain other costs of late-stage clinical development activities, unless we elect not to participate in further development and co-commercialization activities and instead receive tiered royalties as described below. If the development candidate is determined to be IND-ready, and AstraZeneca does not timely elect to participate in the clinical development of AZD7970, AstraZeneca is obligated to reimburse us for certain costs we incurred in the manufacture and development of AZD7970, since execution of the 2017 AZ Agreement.

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We and AstraZeneca will co-commercialize AZD7970 in the United States in accordance with an agreed upon commercialization plan and budget, and will equally share U.S. profits or losses arising from such commercialization. Notwithstanding, prior to a specified stage of development of AZD7970, we have the right to elect not to participate in the further development and commercialization activities for AZD7970. If we make such election, instead of participating in the U.S. profits and losses share with respect to AZD7970, we are obligated to discuss future financial terms with AstraZeneca. If we are unable to agree on future financial terms within a short, defined period of time, we are entitled to receive tiered royalties at default rates set forth in the 2017 AZ Agreement, ranging from percentages in the mid-single digits to the low 20s on worldwide net sales by AstraZeneca of AZD7970, subject to certain reductions, with an aggregate minimum floor. AstraZeneca has sole and exclusive responsibility for all ex-U.S. commercialization efforts. Unless we have elected not to participate in further development (in which case royalties on ex-U.S. net sales will be at the default rates as described above, unless otherwise agreed by the parties), we are entitled to receive tiered royalties at rates ranging from 10% to 30% on annual ex-U.S. net sales of AZD7970, subject to certain reductions with an aggregate minimum floor. Subject to customary “back-up” supply rights granted to AstraZeneca, we exclusively manufacture (or have manufactured) products for all development and commercialization purposes. Additionally, we and AstraZeneca have agreed to certain defined exclusivity obligations under the 2017 AZ Agreement with respect to the development and commercialization of mRNA medicines for Relaxin.

Unless earlier terminated, our strategic alliance under the 2017 AZ Agreement will continue (i) until the expiration of AstraZeneca’s election period, if it does not elect to participate in the clinical development of AZD7970, (ii) until both parties cease developing and commercializing AZD7970 without the intention to resume, if we have not elected our right not to participate in further development and commercialization of AZD7970, (iii) on a country-by-country basis, until the end of the applicable royalty term for AZD7970 in such country, if we have elected our right not to participate in further development and commercialization of AZD7970 or (iv) following completion of IND-enabling studies with respect to AZD7970, if we provide AstraZeneca with written notice that we do not reasonably believe that the product is IND-ready.

Either party may terminate the 2017 AZ Agreement upon the other party’s material breach, subject to specified notice and cure provisions. Each party may also terminate the 2017 AZ Agreement in the event the other party challenges the validity or enforceability of such party’s patent rights, subject to certain defined exceptions. AstraZeneca has the right to terminate the 2017 AZ Agreement in full for scientific, technical, regulatory or commercial reasons at any time upon 90 days’ prior written notice to us. We have the right to terminate the 2017 AZ Agreement in certain cases if AstraZeneca has suspended or is no longer proceeding with the development or commercialization of AZD7970 for a period of twelve consecutive months, subject to specified exceptions, including tolling for events outside of AstraZeneca’s control. If AstraZeneca does not timely elect to participate in clinical development of AZD7970, or the Agreement is terminated, AstraZeneca’s rights in AZD7970 will terminate and, to the extent we terminated for AstraZeneca’s breach, patent challenge or cessation of development or AstraZeneca terminated in its discretion, AstraZeneca will grant us reversion licenses and take certain other actions so as to enable us to continue developing and commercializing AZD7970 in the cardiovascular and cardiometabolic fields.

If we continue developing and commercializing AZD7970 following a termination of the 2017 AZ Agreement by AstraZeneca in its discretion, AstraZeneca is entitled to receive a mid-single digit royalty on our worldwide net sales of AZD7970 and a high-single digit percentage of the amounts received by us from a third party in consideration for a license to such third party to exploit AZD7970, in each case until AstraZeneca recovers an amount equal to specified development costs incurred by AstraZeneca under the 2017 AZ Agreement with respect to AZD7970 prior to such termination. Such percentages increase by a low to mid-single digit amount to the extent such termination occurs after such product achieves a specified stage of development.
2013 Agreements with AstraZeneca, amended and restated in 2018 (unaudited)

In June 2018, we entered into an Amended and Restated Option Agreement and a related Amended and Restated Services and Collaboration Agreement with AstraZeneca, or the 2018 A&R Agreements, which amended and restated the 2013 AZ Agreements. Under the 2018 A&R Agreements, we granted AstraZeneca certain exclusive rights and licenses to research, develop and commercialize potential therapeutic mRNA medicines directed at certain targets for the treatment of cardiovascular and cardiometabolic diseases and cancer, and agreed to provide related services to AstraZeneca. The activities to be performed by the parties under the 2018 A&R Agreements are limited to defined biological targets in the cardiovascular and cardiometabolic fields and one defined target in the cancer field.

Pursuant to the 2018 A&R Agreements, AstraZeneca is responsible for all research, development and commercialization activities and associated costs, while we provide specified research and manufacturing services during a research and evaluation period, as described below, to further AstraZeneca’s activities conducted pursuant to an agreed upon services plan. During this research and evaluation period, these research services, and manufacturing services in excess of a specified threshold, are provided at AstraZeneca’s expense, and manufacturing services below the specified threshold are provided at no additional expense to AstraZeneca. AstraZeneca may request we provide additional research and manufacturing services, at AstraZeneca’s expense, following the end of the research and evaluation period. Subject to customary “back-up” supply rights granted to AstraZeneca, we exclusively manufacture (or have manufactured) mRNA for all research, development and commercialization purposes under the 2018 A&R Agreements until, on a product-by-product basis, the expiration of the time period for which we are entitled to receive earn-out payments with respect to such product pursuant to the 2018 A&R Agreements.

As of the effective date of the 2013 AZ Agreements, and as further reflected in the 2018 A&R Agreements, AstraZeneca acquired forty options that it may exercise to obtain exclusive rights to clinically develop and commercialize identified development candidates (and related back-up candidates) directed to specified targets that arise during the research and evaluation period. During the research and evaluation period for research candidates, AstraZeneca may elect to designate a limited number of research candidates as development candidates (and related back-up candidates). From such pool of development candidates designated by AstraZeneca, during a specified option exercise period, AstraZeneca may then exercise one of its options to obtain exclusive rights to clinically develop and commercialize an identified development candidate (and related back-up candidates) in certain fields. If AstraZeneca does not exercise one of its options to acquire exclusive rights to clinically develop and commercialize a particular development candidate during the defined option exercise period for such development candidate, AstraZeneca’s rights to exercise an option and other rights granted under the 2018 A&R Agreements with respect to such development candidate (and related back-up candidates) will terminate. All rights to exploit such development candidate (and related back-up candidates) will be returned to us and all data and results generated by AstraZeneca with respect to such development candidate (and related back-up candidates) will be either assigned or licensed to us. Upon the earlier of termination of the 2018 A&R Agreements for any reason and a specified anniversary of the effective date of the 2013 AZ Agreements, all unexercised options, and the right to exercise any and all options if not previously exercised by AstraZeneca, will automatically terminate.

On a target-by-target basis, we and AstraZeneca have agreed to certain defined exclusivity obligations under the 2018 A&R Agreements with respect to the research, development and commercialization of mRNA medicines for such target in certain fields. In addition, we and AstraZeneca have agreed to certain defined exclusivity obligations with respect to the research, development and commercialization of mRNA medicines coding for the same polypeptide as any development candidate being developed under the 2018 A&R Agreements.
Unless earlier terminated, the 2018 A&R Agreements will continue until the expiration of AstraZeneca’s earn-out and contingent option exercise payment obligations for optioned product candidates. Either party may terminate the 2018 A&R Agreements upon the other party’s material breach, either in its entirety or in certain circumstances, with respect to relevant candidates, subject to a defined materiality threshold and specified notice and cure provisions. If AstraZeneca has the right to terminate the 2018 A&R Agreements for our material breach, then AstraZeneca may elect, in lieu of terminating the 2018 A&R Agreements, in their entirety or with respect to such candidates, to have the 2018 A&R Agreements remain in effect, subject to reductions in certain payments we are eligible to receive and certain adjustments to AstraZeneca’s obligations under the 2018 A&R Agreements. AstraZeneca may terminate the 2018 A&R Agreements in full, without cause, upon 90 days’ prior notice to us.

**Accounting Treatment**

*2013 Option Agreement and Services and Collaboration Agreement*

We determined that the AZ 2013 Agreements should be evaluated as a single contract for accounting purposes as the AZ Services Agreement and the AZ Option Agreement were negotiated in contemplation of one another and executed contemporaneously. We concluded the 2013 AZ Agreements are under the scope of ASC 808 as AstraZeneca and Moderna are both active participants and are exposed to significant risks and rewards that are dependent on commercial success of the activities of the arrangement. Additionally, we evaluated the 2013 AZ Agreements for recognition and measurement in accordance with ASC 605-25 and ASC 605-28. Prior to the 2016 AZ Agreement, we determined there were multiple deliverables in the 2013 AZ Agreements, including the licenses to exploit mRNA constructs coding for specific targets, research services, development pool services, supply of mRNA for research activities, and supply of mRNA for development pool activities.

We concluded that the licenses to exploit mRNA constructs coding for specific targets does not qualify for separation from any of other deliverables as AstraZeneca cannot fully exploit the value of the licenses without receipt of such services and supply. Our services and supply involve specialized expertise, particularly as it relates to mRNA technology that is not available in the marketplace. Accordingly, AstraZeneca has to obtain the research services, development pool services, supply of mRNA for research activities, and supply of mRNA for development pool activities from us, which significantly limits the ability for AstraZeneca to fully exploit the licenses for their intended purpose on a standalone basis. Accordingly, we concluded the delivered licenses do not have standalone value from the undelivered elements and we accounted for all of the deliverables as one unit of accounting.

We concluded that the options to obtain exclusive rights to clinically develop and commercialize up to forty development candidates (and related backup candidates) for identified cardiovascular/cardiometabolic or oncology targets were substantive and therefore not considered a deliverable at the inception of the 2013 AZ Agreements, as AstraZeneca is not contractually obligated to exercise the options, and we are at risk with regard to whether AstraZeneca will exercise the options as a result of the uncertain outcome of the research and development activities. Additionally, research and development services and certain mRNA supply outside of the specified deliverables, including clinical development supply, were determined to be substantive and therefore not considered a deliverable at the inception of the 2013 AZ Agreements. Further, we concluded that the options and the additional mRNA supply were not priced at a significant or incremental discount. Accordingly, AstraZeneca’s options and additional mRNA supply were not considered deliverables and the associated fees were not included in the allocable arrangement consideration.

The total arrangement consideration allocated to the single unit of accounting was the $240.0 million upfront pursuant to the 2013 AZ Agreements. We determined the period of performance for the research services,
development pool services, supply of mRNA for research activities, and supply of mRNA for development pool activities is ten years. As such, the $240.0 million arrangement consideration is being recognized ratably over the such ten years is no other discernible pattern of recognition.

We evaluated the contingent payments that we were eligible to receive under the 2013 AZ Agreements upon the achievement of certain technical, development, regulatory, and commercial milestone events. More specifically, we could have received additional payments of up to $180.0 million contingent on the achievement of three technical milestones for certain toxicity, delivery, and competition criteria that were not related to a specific product candidate. Such payments were payable only once, regardless of the number of options exercised. In addition, upon AstraZeneca’s exercise of each option, we were eligible to receive certain payments contingent upon the achievement of specified clinical, regulatory, and commercial events.

We concluded at the outset of the arrangement that two of the three technical milestones that are not related to a specific product candidate, specifically, the toxicity milestone and the delivery milestone, were substantive as the efforts to achieve the milestone are our responsibility and therefore achieved based on our past performances. Further, we concluded that these milestones were substantive on the basis of the contingent nature of the milestone, in consideration of factors such as the scientific, clinical, regulatory and other risks that must be overcome to achieve the milestone as well as the level of effort and investment required. Accordingly, payments upon the achievement of each of these substantive milestone events will be recognized as revenue in full in the period in which the associated milestone is achieved. We determined that the competition milestone did not qualify as substantive, as it was based, in part, on the performance of our competitors and therefore not achieved solely based on our past performances. Accordingly, upon achievement of a non-substantive milestone, the contingent payment earned will be recognized as additional arrangement consideration over the remaining estimated period of performance, if any, with a cumulative catch up for the elapsed portion of the performance period being recognized when the payment is earned. The contingent payments upon the achievement of all commercial milestones will be accounted for in the same manner as royalties, and recorded as revenue upon achievement of the milestone, assuming all other revenue recognition criteria are met. We will recognize royalty revenue in the period of sale of the related product(s), based on the underlying agreement terms, provided that the reported sales are reliably measurable, assuming all other revenue recognition criteria are met.

During the year ended December 31, 2015, we achieved two contingent technical milestones that were not related to a specific product candidate, the toxicity milestone and the competition milestone, pursuant to the 2013 AZ Agreements. As the toxicity milestone was determined to be substantive, the payment of $60.0 million was recognized as revenue in 2015. As the competition milestone was determined to be non-substantive, the payment of $60.0 million is being recognized as additional arrangement consideration over the remaining estimated period of performance, with a cumulative catch up for the elapsed portion of the performance period being recognized when the payment was earned. For the year ended December 31, 2015, we recognized $16.2 million in revenue for the achievement of the competition milestone event, including a cumulative catch up of $15.7 million from the effective date of the agreement to the achievement date of the respective milestone.

We recognized $0.6 million for each of the years ended December 31, 2016 and 2017, related to the performance of certain manufacturing services which we concluded were considered substantive options in the arrangement. These services are recognized as services are performed.
2016 Strategic Alliance with AstraZeneca – IL12

Given that the IL12 target was removed from the 2013 AZ Agreements for the purposes of the 2016 AZ Agreement, we determined the 2016 AZ Agreement is considered a material modification to the 2013 AZ Agreements and therefore should be evaluated with the 2013 AZ Agreements as a single contract. For the purposes of this accounting treatment discussion, we refer to the 2013 AZ Agreements and the 2016 AZ Agreement collectively as the 2013/2016 AZ Agreements.

We evaluated the 2013/2016 AZ Agreements in accordance with ASC 605-25. We determined there were multiple deliverables in the 2013/2016 AZ Agreements including: (i) licenses to exploit mRNA constructs coding for specific targets from the 2013 Agreements, (ii) research services from the 2013 Agreements, (iii) development pool services from the 2013 Agreements, (iv) supply of mRNA for research activities from the 2013 Agreements, (v) preclinical development obligations for the IL12 program under the 2016 AZ Agreement, (vi) preclinical development obligations for the other program under the 2016 AZ Agreement, (vii) development and commercialization rights for IL12 under the 2016 AZ Agreement, (viii) development and commercialization rights for the other program under the 2016 AZ Agreement, (ix) manufacturing and supply services for IL12 under the 2016 AZ Agreement, and (x) manufacturing and supply services for the other program under the 2016 AZ Agreement. We concluded AstraZeneca’s options to obtain development and commercialization rights for IL12 and the other program under the 2016 AZ Agreement during the election period were non-substantive. While AstraZeneca was not obligated to exercise its options to obtain the respective development and commercialization rights, they could exercise the option for no additional consideration. As such, we concluded there was no significant risk as to whether AstraZeneca would exercise its options. Therefore, the development and commercialization rights were included as deliverables at the inception of the 2016 AZ Agreement. Additionally, as it relates to the option to obtain exclusive rights to clinically develop and commercialize development candidates for identified cardiovascular, cardiometabolic or oncology targets pursuant to the 2013 AZ Agreements and the right to receive additional manufacturing and research services, consistent with the initial assessment of the 2013 AZ Agreements, we concluded that such options are substantive as there was still significant uncertainty as to whether AstraZeneca would exercise the options and therefore such options were not considered a deliverable at the date of the modification.

Consistent with the initial assessment of the 2013 AZ Agreements, we concluded as of the modification date that the licenses to exploit mRNA constructs coding for specific targets does not qualify for separation from the research services, development pool services, and supply of mRNA for research activities and development pool activities as AstraZeneca cannot fully exploit the value of the licenses without receipt of such services and supply. Accordingly, the licenses do not have standalone value from the research services, development pool services, and supply of mRNA for research activities and development pool activities and we accounted for these deliverables as one unit of accounting. As it relates to the additional deliverables pursuant to the 2016 AZ Agreement, we concluded the preclinical development obligations for each research program qualify for separation from each other and from the other deliverables as AstraZeneca will benefit from the results of the respective toxicology studies and product development to determine whether to nominate the respective product candidate for further development. Therefore, we concluded the preclinical development obligations for each research program have standalone value from the undelivered elements and represent a separate unit of accounting for each program. Additionally, we concluded that each of the development and commercialization rights do not qualify for separation from the related manufacturing and supply services for the respective program. This is primarily because AstraZeneca has to rely on us to provide the related manufacturing and supply services to fully exploit the value of the respective development and commercialize rights. Accordingly, we accounted for the development and commercialization rights and the related manufacturing and supply
services as a combined unit of accounting for each program. As a result, we determined there were five units of accounting under the 2016 AZ Agreement: (i) combined unit of accounting from the 2013 AZ Agreements, (ii) preclinical development obligations for IL12, (iii) preclinical development obligations for the other immuno-oncology program, (iv) combined development and commercialization rights and manufacturing and supply services for IL12, and (v) combined development and commercialization rights and manufacturing and supply services for the other immuno-oncology program.

We determined that neither VSOE nor TPE of selling price is available for any of the units of accounting identified at inception of the 2016 AZ Agreement. Accordingly, the selling price of each unit of accounting was determined based on our BESP. We developed the BESP for all units of accounting with the objective of determining the price at which it would sell such item if it were to be sold regularly on a standalone basis. We determined the BESP for each unit of accounting based the individual components comprising the unit of accounting, as applicable. For units of accounting that included or were solely comprised of a service component, we considered the nature of the services to be performed and estimates of the associated effort and cost of the services, adjusted for a reasonable profit margin that would be expected to be realized under other similar arrangements. For units of accounting that included a manufacturing and supply component, we considered the nature and duration of our obligation and estimates of the associated effort and cost of the manufacturing, adjusted for a reasonable profit margin that would be expected to be realized under similar arrangements. For units of accounting that included a license component, we considered the probability weighted present value of expected future cash flows associated with each license related to the specific or general research area, as applicable. In developing such estimate, we also considered applicable market conditions and relevant entity-specific factors, including those factors contemplated in negotiating the agreement, probability of success and the time needed to commercialize a product candidate pursuant to the associated license.

Total estimated arrangement consideration under the 2016 AZ Agreement was determined to be $240.4 million comprised of: (i) $218.2 million remaining deferred revenue under the 2013 AZ Agreements as of the 2016 AZ Agreement effective date and (ii) $22.2 million of estimated consideration for the anticipated manufacturing and supply services related to IL12 and the other immuno-oncology program. The aggregate allocable arrangement consideration of $240.4 million was allocated amongst the separate units of accounting using the relative selling price method as follows: (i) combined unit of accounting from the 2013 Agreements: $209.6 million, (ii) preclinical development obligations for IL12: $4.1 million (iii) preclinical development obligations for the other immuno-oncology program: $4.7 million, (iv) combined development and commercialization rights and manufacturing and supply services for IL12: $10.4 million, and (v) combined development and commercialization rights and manufacturing and supply services for the other immuno-oncology program: $11.6 million. We recognize revenue related to amounts allocated to the combined accounting unit pertaining to the 2013 Agreements ratably over the remaining period of performance of the research services, development pool services, mRNA supply for research services and development pool services as there is no other discernible pattern of recognition. We recognize revenue related to amounts allocated to the preclinical development obligations for IL12 unit of accounting and the preclinical development obligations for the other immuno-oncology program unit of accounting as the respective services are performed. We recognize revenue related to amounts allocated to the combined development and commercialization rights and manufacturing and supply services for IL12 unit of accounting and the combined development and commercialization rights and manufacturing and supply services for the other immuno-oncology program as the respective supply is delivered, assuming AstraZeneca exercises its option to obtain the respective development and commercialization rights, or upon expiration of such option. The contingent option exercise payments upon the achievement of certain milestones events and option exercise earn-out payments will continue to be recognized consistent with the initial assessment.
In August 2016, AstraZeneca exercised its option to obtain development and commercialization rights for an identified development candidate (AZD8601) (and related back-up candidates) under the 2013 AZ Agreements. We concluded such option was substantive and was not considered a deliverable in the 2013 AZ Agreements, under the 2013/2016 AZ Agreements or under the 2018 A&R Agreements. In conjunction with the option exercise, we received $10.0 million upon the option exercise and are entitled to reimbursement of the manufacturing cost of the clinical supply. In May 2018, we received a $30.0 million (unaudited) payment upon the achievement of a clinical event related to AZD8601. We determined the deliverables pertaining to option exercise are: (i) the right to develop and commercialize the product candidate (and related back-up candidates) and (ii) the related clinical supply of mRNA. We concluded that the right to develop and commercialize the identified development candidate (and related back-up candidates) does not qualify for separation from the related clinical supply of mRNA. This is primarily due to the fact that AstraZeneca must rely upon us to provide the related clinical supply of mRNA to fully exploit the value of the respective development and commercialize rights. Accordingly, we concluded the delivered item does not have standalone value from the undelivered element and we accounted for the deliverables as a combined unit of accounting. Arrangement consideration consists of: (i) the product option fee of $10.0 million; (ii) the $30.0 million (unaudited) clinical event payment; and (iii) the estimated reimbursement for the clinical supply of mRNA. However, we could not reasonably estimate the consideration pertaining to the clinical supply of mRNA as the supply requirements are uncertain until the Phase 3 study design is complete. Therefore, total arrangement consideration could not be reasonably estimated as of December 31, 2016 and 2017 or September 30, 2018. As a result, the $10.0 million product option fee and the $30.0 million (unaudited) clinical event payment have been deferred and will continue to be, along with future consideration received, until the consideration pertaining to the clinical supply of mRNA can be reasonably estimated. Once the total arrangement consideration can be estimated, the arrangement consideration will be recognized as the clinical supply is provided to AstraZeneca for use in the clinical trial.

2017 Strategic Alliance with AstraZeneca – Relaxin
We determined the 2017 AZ Agreement should be accounted for separately from the 2013/2016 AZ Agreements, as the Relaxin program was not subject to the 2013/2016 AZ Agreements at the time when we entered into the 2017 AZ Agreement and the agreements are not otherwise interrelated or interdependent on each other.

We concluded the 2017 AZ Agreement is under the scope of ASC 808 as AstraZeneca and Moderna are both active participants in the development, manufacturing and commercialization activities and are exposed to significant risks and rewards that are dependent on commercial success of the activities of the arrangement. Additionally, we determined the development, manufacturing and commercialization activities are not deliverables under ASC 605-25. As a result, the activities conducted pursuant to the development, manufacturing and commercialization activities will be accounted for as a component of the related expense in the period incurred. We considered ASC 605-45 in determining the appropriate treatment for the transactions between AstraZeneca and Moderna and concluded that reimbursement for transactions in which we are considered to be the principal, which includes being the primary obligor and having the risks and rewards of ownership, are accounted for as gross revenue. No revenue was recognized from the 2017 AZ Agreement in 2017.

2013 Agreements with AstraZeneca, amended and restated in 2018 (unaudited)
As the 2018 A&R Agreements amended and restated the 2013 AZ Agreements, we determined the 2018 A&R Agreements are considered a material modification to the 2013/2016 AZ Agreements. For purpose of this accounting treatment discussion, we refer to the 2013/2016 AZ Agreements and the 2018 A&R Agreements collectively as the Combined 2018 AZ Agreements.
We evaluated the Combined 2018 AZ Agreements in accordance with ASC 605-25. We determined there were multiple deliverables in the Combined 2018 AZ Agreements including: (i) licenses to exploit mRNA constructs coding for specific targets from the 2018 A&R Agreements, (ii) supply of mRNA for research activities and for development pool activities from the 2018 A&R Agreements, (iii) preclinical development obligations for the IL12 program under the 2016 AZ Agreement, (iv) preclinical development obligations for the other program under the 2016 AZ Agreement, (v) development and commercialization rights for IL12 under the 2016 AZ Agreement, (vi) development and commercialization rights for the other program under the 2016 AZ Agreement, (vii) manufacturing and supply services for IL12 under the 2016 AZ Agreement, and (viii) manufacturing and supply services for the other program under the 2016 AZ Agreement. We concluded AstraZeneca’s options to obtain development and commercialization rights for IL12 and the other program under the 2016 AZ Agreement during the election period were non-substantive. While AstraZeneca was not obligated to exercise its options to obtain the respective development and commercialization rights, they could exercise the option for no additional consideration. As such, we concluded there was no significant risk as to whether AstraZeneca would exercise its options. Therefore, the development and commercialization rights were included as deliverables under the Combined 2018 AZ Agreements. Additionally, pursuant to the 2018 A&R AZ Agreements, as it relates to the option to obtain (i) exclusive rights to clinically develop and commercialize development candidates for the identified cardiovascular and cardiometabolic targets and the oncology target (ii) research and development pool services and (iii) certain additional manufacturing services, we concluded that such options are substantive as there was still significant uncertainty as to whether AstraZeneca would exercise the options and therefore such options were not considered a deliverable at the date of the modification.

Consistent with the assessment of the 2013/2016 AZ Agreements, we concluded the licenses to exploit mRNA constructs coding for specific targets does not qualify for separation from the supply of mRNA for research activities and development pool activities as AstraZeneca cannot fully exploit the value of the licenses without receipt of such supply. Accordingly, the licenses do not have standalone value from the supply of mRNA for research activities and development pool activities and we accounted for these deliverables as one unit of accounting (the combined unit of accounting from the 2018 A&R Agreements). Further, we concluded the preclinical development obligations for each research program qualify for separation from each other and from the other deliverables as AstraZeneca will benefit from the results of the respective toxicology studies and product development to determine whether to nominate the respective product candidate for further development. Therefore, we concluded the preclinical development obligations for each research program have standalone value from the undelivered elements and represent a separate unit of accounting for each program. Additionally, we concluded that each of the development and commercialization rights do not qualify for separation from the related manufacturing and supply services for the respective program. This is primarily because AstraZeneca has to rely on us to provide the related manufacturing and supply services to fully exploit the value of the respective development and commercialize rights. Accordingly, we accounted for the development and commercialization rights and the related manufacturing and supply services as a combined unit of accounting for each program.

As a result, we determined there were five units of accounting under the Combined 2018 AZ Agreements: (i) combined unit of accounting from the 2018 A&R AZ Agreements, (ii) preclinical development obligations for IL12 (iii) preclinical development obligations for the other immuno-oncology program, (iv) combined development and commercialization rights and manufacturing and supply services for IL12, and (v) combined development and commercialization rights and manufacturing and supply services for the other immuno-oncology program.

We determined that neither VSOE nor TPE of selling price is available for any of the units of accounting identified at the modification date. Accordingly, the selling price of each unit of accounting was determined based on our BESP. We developed the BESP for each unit of accounting with the objective of determining the price at which it would sell such item if it were to be sold regularly on a standalone basis. We determined the
BESP for each unit of accounting based on the individual components comprising the unit of accounting, as applicable. For units of accounting that included or were solely comprised of a service component, we considered the nature of the services to be performed and estimates of the associated effort and cost of the services. For units of accounting that included a manufacturing and supply component, we considered the nature and duration of our obligation and estimates of the associated effort and cost of the manufacturing under similar arrangements. For units of accounting that included a license component, we considered the probability weighted present value of expected future cash flows associated with each license related to the specific or general research area, as applicable. In developing such estimate, we also considered applicable market conditions and relevant entity-specific factors, including those factors contemplated in negotiating the agreement, probability of success and the time needed to commercialize a product candidate pursuant to the associated license.

Total estimated arrangement consideration under the Combined 2018 AZ Agreements was determined to be $217.1 million (unaudited) comprised of: (i) $145.9 million (unaudited) remaining deferred revenue under the 2013/2016 AZ Agreements as of the modification date and (ii) $71.2 million (unaudited) of estimated consideration for the anticipated manufacturing and supply services related to IL12 and the other immuno-oncology program. The aggregate allocable arrangement consideration of $217.1 million (unaudited) was allocated amongst the separate units of accounting using the relative selling price method as follows: (i) combined unit of accounting from the 2018 A&R AZ Agreements of $144.3 million (unaudited); (ii) preclinical development obligations for IL12 of $0.5 million (unaudited); (iii) preclinical development obligations for the other immuno-oncology program of $5.4 million (unaudited); (iv) combined development and commercialization rights and manufacturing and supply services for IL12 of $33.1 million (unaudited); and (v) combined development and commercialization rights and manufacturing and supply services for the other immuno-oncology program of $33.8 million (unaudited). We recognize revenue related to amounts allocated to the accounting units pertaining to the 2018 A&R AZ Agreements as the mRNA supply for research services and development pool services are delivered. We recognize revenue related to amounts allocated to the preclinical development obligations for IL12 unit of accounting and the preclinical development obligations for the other immuno-oncology program unit of accounting as the respective services are performed. We recognize revenue related to amounts allocated to the combined development and commercialization rights and manufacturing and supply services for IL12 unit of accounting and the combined development and commercialization rights and manufacturing and supply services for the other immuno-oncology program as the respective supply is delivered, assuming AstraZeneca exercises its option to obtain the respective development and commercialization rights, or upon expiration of such option. The contingent option exercise payments upon the achievement of certain milestones events and option exercise earn-out payments will continue to be recognized consistent with the initial assessment.

For the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018, we recognized collaboration revenue of $32.4 million, $30.0 million, $22.2 million (unaudited) and $33.2 million (unaudited), respectively, from AstraZeneca. We had deferred revenue of $197.2 million, $169.6 million and $169.1 million (unaudited), as of December 31, 2016 and 2017 and September 30, 2018, respectively, from AstraZeneca.

**Merck – Strategic Alliances in Infectious Diseases and Cancer Vaccines**

**2015 Strategic Alliance with Merck – Infectious Disease**

In January 2015, we entered into a Master Collaboration and License Agreement with Merck, which we refer to as the 2015 Merck Agreement, to research, develop, and commercialize potential mRNA medicines for the prevention and treatment of infections by RSV and three additional undisclosed viruses. Pursuant to the 2015
Merck Agreement. Merck is primarily responsible for research, development and commercialization activities and associated costs. We are responsible for designing and manufacturing all mRNA constructs for preclinical and Phase 1 and Phase 2 clinical development purposes. In addition, we are responsible for performing collaboration and design activities set forth in a platform work plan, a proof of biology work plan and Moderna development program work plans. Responsibility for manufacturing mRNA constructs for late stage clinical development and commercialization purposes is to be determined. A Joint Steering Committee comprised of representatives of each party oversees the performance of collaboration activities.

The focus of the initial four-year period of the 2015 Merck Agreement, ending in January 2019, is the discovery and development of mRNA vaccines and antibodies directed to the four viruses that are the subject of the 2015 Merck Agreement. The 2015 Merck Agreement also includes an additional three-year period during which Merck may continue to preclinically and clinically develop product candidates that arise from the initial four-year research period. Merck may, prior to the end of the seventh year of the 2015 Merck Agreement, elect to exclusively develop and commercialize up to five product candidates.

During the four-year discovery and development phase of the alliance, we and Merck will work exclusively with each other to develop potential mRNA medicines for the prevention and treatment of infections by the four viruses that are the subject of the 2015 Merck Agreement. Additionally, we and Merck have agreed to certain defined exclusivity obligations following the four-year discovery and development phase of the alliance. Under the 2015 Merck Agreement, we grant certain licenses to Merck to enable Merck to perform its collaboration activities.

Under the terms of the 2015 Merck Agreement, we received a $50.0 million upfront payment. We are eligible to receive, on a product-by-product basis, up to $65.0 million in payments for achievement of development milestones, up to $60.0 million in payments for achievement of regulatory milestones and up to $175.0 million in payments for achievement of commercial milestones. As of December 31, 2017, we have received from Merck a clinical milestone payment of $5.0 million with respect to the initiation of a Phase 1 clinical trial for a Merck RSV vaccine product candidate. On a product-by-product basis, we are also entitled to receive royalties on Merck’s net sales of products at rates ranging from the mid-single digits to low teens, subject to certain reductions, with an aggregate minimum floor. Additionally, concurrent with entering into the 2015 Merck Agreement, Merck made a $50.0 million equity investment in Moderna.

Unless earlier terminated, the 2015 Merck Agreement will continue on a product-by-product and country-by-country basis for so long as royalties are payable by Merck on a given product in a given country. Either party may terminate the 2015 Merck Agreement upon the other party’s material breach, either in its entirety or with respect to a particular program, product candidate, product or country, subject to specified notice and cure provisions. Merck may terminate the 2015 Merck Agreement, in full or with respect to a particular product candidate or product upon certain advance notice to us for any reason, or earlier if Merck determines the alliance or product is no longer commercially practicable. If Merck has the right to terminate the 2015 Merck Agreement, in its entirety or with respect to a program, product candidate or product, for our material breach, then Merck may elect, in lieu of terminating the 2015 Merck Agreement to have the 2015 Merck Agreement remain in effect, subject to reductions in certain payments we are eligible to receive with respect to the terminable rights. Upon a termination of the 2015 Merck Agreement with respect to a program, all licenses and other rights granted to Merck with respect to such program will terminate and the continued development and commercialization of product candidates and products will revert to us. If the 2015 Merck Agreement is terminated with respect to a given product candidate or product, all licenses and other rights granted to Merck with respect to such product candidate or product will terminate and, to the extent we terminated for Merck’s breach, Merck will grant us licenses under select Merck technology for our continued development and commercialization of such product candidate or product.
2016 Expansion of the Infectious Disease Strategic Alliance

In January 2016, we expanded our infectious disease strategic alliance with Merck. Specifically, we and Merck agreed to amend the original 2015 Merck Agreement to include the research, development, and commercialization of mRNA medicines for the prevention and treatment of infection by the varicella zoster virus in place of one of the viruses initially included under the 2015 Merck Agreement. Under the terms of the amended 2015 Merck Agreement, we received an upfront payment of $10.0 million from Merck for the inclusion of the new program and we agreed with Merck to increase the royalty rates ranging from the mid-single digits to low-teens for net sales of products directed to this virus.

Accounting Treatment

We concluded the 2015 Merck Agreement should be accounted for separately from Merck’s investment in our Series E redeemable convertible preferred stock, as the agreements are not interrelated or interdependent on each other. Further, the investment in the Series E redeemable convertible preferred stock was negotiated with terms representative of fair value at the same purchase price paid by other investors. As such, the proceeds related to the equity investment were excluded from the consideration related to the 2015 Merck Agreement.

We concluded the 2015 Merck Agreement is under the scope of ASC 808 as Merck and Moderna are both active participants and are exposed to significant risks and rewards that are dependent on commercial success of the activities of the arrangement. Additionally, we evaluated the 2015 Merck Agreement for recognition and measurement in accordance with ASC 605-25 and ASC 605-28. The agreement contains multiple deliverables, including the licenses for collaboration activities, our performance of certain collaboration activities, mRNA design activities, our performance of platform work plan activities, our performance of proof of biology program activities, our performance of activities for the Moderna development programs, manufacturing of non-cGMP mRNA, exclusivity and participation in joint steering committee services. In addition, clinical mRNA supply for Phase 1 and Phase 2 was concluded to be substantive and therefore not considered a deliverable at the inception of the 2015 Merck Agreement. Further, we concluded that the clinical mRNA supply was not priced at a significant or incremental discount. Accordingly, the clinical mRNA supply was not considered a deliverable and the associated fees were not included in the allocable arrangement consideration.

We concluded the licenses for performing collaboration activities do not qualify for separation from any of the other deliverables in the agreement as Merck cannot fully exploit the value of such licenses without receipt of mRNA design services and non-cGMP mRNA supply from us. The products and services to be provided by us, which involve specialized expertise, particularly as it relates to mRNA technology, are not available in the marketplace. Accordingly, Merck has to obtain such services and supply pursuant to the collaboration activities, design activities, platform work plan, proof of biology program, development programs, manufacturing of non-cGMP mRNA, exclusivity and joint steering committee services from us which significantly limits the ability for Merck to utilize such licenses for its intended purpose on a standalone basis. Accordingly, the delivered licenses do not have standalone value from the undelivered elements and we accounted for all of the deliverables as one unit of accounting.

The total arrangement consideration to be allocated to the single unit of accounting at inception of the arrangement consists of the $50.0 million upfront payment and estimated amounts related to research and development services and manufacturing that are included in the unit of accounting. We determined the period of performance of the undelivered elements is commensurate with the four-year discovery and development phase of the collaboration. As such, the $50.0 million arrangement consideration will be recognized ratably over the four-year period, as there is no other discernible pattern of recognition.
We have evaluated all the milestones that may be received under the arrangement. We concluded at the outset of the arrangement that none of the future development and regulatory milestones qualified as substantive milestones, as the efforts to achieve the milestones are Merck’s responsibility and therefore the milestone is not achieved based on our past performance. Accordingly, upon achievement of a development or regulatory milestone event, the corresponding amount earned will be recognized as additional arrangement consideration over the remaining estimated period of performance, if any, with a cumulative catch up for the elapsed portion of the performance period being recognized when the payment is earned. All commercial milestones will be accounted for in the same manner as royalties, and recorded as revenue upon achievement of the milestone, assuming all other revenue recognition criteria are met. We will recognize royalty revenue in the period of sale of the related product(s), based on the underlying agreement terms, assuming all other revenue recognition criteria are met.

We recognized $2.1 million and $1.0 million for the years ended December 31, 2016 and 2017, respectively, related to the performance of certain manufacturing services which were considered substantive options in the arrangement. These services are recognized as they are performed.

We determined the 2016 amendment of the 2015 Merck Agreement, to replace one of Merck’s exclusive viruses, should be combined with the original 2015 Merck Agreement and the comparable deliverables associated with the new virus should be combined with the deliverables from the original 2015 Merck Agreements into a single unit of accounting. As such, the $10.0 million of consideration pertaining to the amendment was added to the remaining deferred revenue at the time of modification and is being recognized ratably over the remaining period of performance which is commensurate with the remaining discovery and development phase.

For the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018, we recognized collaboration revenue of $27.5 million, $22.9 million, $17.1 million (unaudited) and $16.6 million (unaudited), respectively, from the Merck 2015 Agreement and the 2016 Amendment. We had deferred revenue of $32.1 million, $16.3 million and $4.4 million (unaudited), as of December 31, 2016 and 2017 and September 30, 2018, respectively, from the Merck 2015 Agreement and the 2016 Amendment.

2016 Cancer Vaccine Strategic Alliance—Personalized mRNA Cancer Vaccines

In June 2016, we entered into a personalized mRNA cancer vaccines (PCV) Collaboration and License Agreement with Merck Sharp & Dohme Corp., or Merck, which we refer to as the PCV Agreement, to develop and commercialize PCVs for individual patients using our mRNA vaccine and formulation technology. Under the strategic alliance, we identify genetic mutations present in a particular patient’s tumor cells, synthesize mRNA for these mutations, encapsulate the mRNA in one of our proprietary LNPs and administer to each patient a unique mRNA cancer vaccine designed to specifically activate the patient’s immune system against her or his own cancer cells.

Pursuant to the PCV Agreement, we are responsible for designing and researching PCVs, providing manufacturing capacity and manufacturing PCVs, and conducting Phase 1 and Phase 2 clinical trials for PCVs, alone and in combination with KEYTRUDA (pembrolizumab), Merck’s anti-PD-1 therapy, all in accordance with an agreed upon development plan and budget and under the oversight of a committee comprised of equal representatives of each party. The parties have entered into a clinical quality agreement with respect to Moderna’s manufacture and supply activities. We received an upfront payment of $200.0 million from Merck. In November 2017, we and Merck announced the achievement of a key milestone for the first-in-human dosing of a PCV (mRNA-4157) as a part of the alliance. The Phase 1 open-label, dose escalation, multicenter clinical trial in the United States (KEYNOTE-603) is designed to assess the safety, tolerability and immunogenicity of mRNA-
4157 alone in subjects with resected solid tumors and in combination with KEYTRUDA, in subjects with unresectable solid tumors.

Until the expiration of a defined period of time following our completion of Phase 1 and Phase 2 clinical trials for PCVs under the PCV Agreement and delivery of an associated data package to Merck, Merck has the right to elect to participate in future development and commercialization of PCVs by making a $250.0 million participation payment to us. If Merck exercises its election and pays the participation payment, then the parties will equally co-fund subsequent clinical development of PCVs, with Merck primarily responsible for conducting clinical development activities under a jointly agreed development plan and budget. Each party may also conduct additional clinical trials for PCVs that are not included in the jointly agreed development plan and budget, in which case the non-conducting party will reimburse the conducting party for half of the total costs for such trials, plus interest, from its share of future profits resulting from sales of such PCVs, if any. Merck will lead worldwide commercialization of PCVs, subject to Moderna’s option to co-promote PCVs in the United States, and the parties will equally share the profits or losses arising from worldwide commercialization. Until a PCV becomes profitable, we may elect to defer payment of our share of the commercialization and related manufacturing costs and instead reimburse Merck for such costs, plus interest, from our share of future profits resulting from sales of such PCV, if any. Subject to customary “back-up” supply rights granted to Merck, we will manufacture (or have manufactured) PCVs for preclinical and clinical purposes. Manufacture of PCVs for commercial purposes will be determined by the parties in accordance with the terms of the PCV Agreement. Under the PCV Agreement, we grant certain licenses to Merck to perform its collaboration activities.

If Merck does not exercise its right to participate in future development and commercialization of PCVs, then Moderna will retain the exclusive right to develop and commercialize PCVs developed during the strategic alliance, subject to Merck’s rights to receive a percentage in the high teens to the low 20s, subject to reductions of our net profits on sales of such PCVs. During a limited period following such non-exercise, Merck will lead worldwide commercialization of PCVs, subject to certain defined, limited exclusivity obligations with respect to the development and commercialization of PCVs.

2018 Expansion of the Cancer Vaccine Strategic Alliance—Shared Neoepitope Cancer Vaccines (unaudited)

In April 2018, we and Merck agreed to expand our cancer vaccine strategic alliance to include the development and commercialization of our KRAS vaccine development candidate, mRNA-5671, and potentially other shared neoantigen mRNA cancer vaccines (SAVs). We preclinically developed mRNA-5671 prior to its inclusion in the cancer vaccine strategic alliance and it is comprised of novel mRNA constructs designed by us and encapsulated in one of our proprietary LNPs. The PCV Agreement was amended and restated to include the new SAV strategic alliance (PCV/SAV Agreement).

We have granted Merck certain licenses and we and Merck have agreed to certain exclusivity obligations with respect to SAVs and particular SAV programs, which obligations are subject to termination or expiration upon certain triggering events.
Under the PCV/SAV Agreement, Merck will be responsible for conducting Phase 1 and Phase 2 clinical trials for mRNA-5671 and for all costs associated with such activities, in accordance with a jointly agreed development plan and budget, and we will be responsible for manufacturing and supplying all mRNA-5671 required to conduct such trials and for all costs and expenses associated with such manufacture and supply. Under the PCV/SAV Agreement, our budgeted commitment for PCVs increased to $243.0 million. Until the expiration of a defined period of time following the completion of Phase 1 and Phase 2 clinical trials for mRNA-5671 under the PCV/SAV Agreement and our delivery of an associated data package to Merck, Merck has the right to elect to participate in future development and commercialization of mRNA-5671 by making a participation payment to us. If Merck exercises its participation rights, then the parties will equally co-fund subsequent clinical development of mRNA-5671, with Merck primarily responsible for conducting clinical development activities under a jointly agreed development plan and budget. If Merck declines to participate in future development and commercialization activities following the initial Phase 1 and Phase 2 clinical trials for mRNA-5671, then we will retain the rights to develop and commercialize mRNA-5671. If Merck elects to participate in future development and commercialization of mRNA-5671, Merck may also conduct additional clinical trials for mRNA-5671 that are not included in the jointly agreed development plan and budget, in which case we will reimburse Merck for half of the total development costs for such clinical trials, plus interest, from our share of future profits resulting from sales of mRNA-5671, if any. If Merck does conduct additional clinical trials for mRNA-5671, we will be responsible for manufacturing and supplying all mRNA-5671 required to conduct such trials. Merck will lead worldwide commercialization of mRNA-5671, subject to our option to co-promote mRNA-5671 in the United States, and the parties will equally share the operating profits or losses arising from worldwide commercialization. Until mRNA-5671 becomes profitable, we may elect to defer payment of our share of the commercialization and related manufacturing costs and instead reimburse Merck for such costs, plus interest, from our share of future profits resulting from sales of mRNA-5671, if any. Subject to “back-up” supply rights granted to Merck, we will manufacture (or have manufactured) mRNA-5671 and other SAVs for preclinical and clinical purposes. After Merck exercises its right to participate in future development and commercialization of mRNA-5671 and other SAVs, we will grant the applicable development and commercialization licenses and the parties are obligated to discuss responsibility for future manufacturing, giving consideration to applicable criteria.

Pursuant to the PCV/SAV Agreement, for a defined period of time, either party may propose that the parties conduct additional programs for the research and development of SAVs directed to different shared neoantigens. If the parties agree to conduct any such programs, then we will be responsible for conducting and funding preclinical discovery and research activities for such SAVs, and otherwise the programs would be conducted on substantially the same terms as mRNA-5671 program. If we or Merck propose a new SAV program and the other party does not agree to conduct such program, then the PCV/SAV Agreement includes provisions allowing the proposing party to proceed with such development, at the proposing party’s expense. If Merck is the proposing party, we will be responsible for manufacturing and supplying material for such program at Merck’s expense. In such case, the non-proposing party will have the right to opt-in to such SAV program any time before the proposing party commits to performing Good Laboratory Practice (GLP)-toxicity studies. Until the expiration of a defined period of time following our completion of Phase 1 and Phase 2 clinical trials for any SAV program mutually agreed by the parties under the PCV/SAV Agreement and our delivery of an associated data package to Merck, Merck has the right to elect to participate in future development and commercialization of such SAV by making a participation payment to us.

Unless earlier terminated, the PCV/SAV Agreement will continue on a program-by-program basis until Merck terminates its participation in such program. Following any such termination, we will retain the exclusive right to develop and commercialize PCVs or SAVs developed as a part of such program, subject to restrictions and certain limited rights retained by Merck.

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In connection with the amendment of the PCV Agreement to include the development and commercialization of mRNA-5671 and potentially other SAVs, Merck made a contemporaneous equity investment in our Series H redeemable convertible preferred stock resulting in gross proceeds of $125.0 million, of which $13.0 million is determined to be a premium and recorded to deferred revenue.

**Accounting Treatment**

**2016 Cancer Vaccine Strategic Alliance—Personalized mRNA Cancer Vaccines**

We determined that the PCV Agreement should be accounted for separately from a prior collaboration agreement with Merck, as the agreements were not negotiated in contemplation of one another and the elements within each of the agreements are not closely interrelated or interdependent on each other. We concluded the PCV Agreement is under the scope of ASC 808 as Merck and Moderna are both active participants and are exposed to significant risks and rewards that are dependent on commercial success of the activities of the arrangement. Additionally, we evaluated the PCV Agreement for recognition and measurement in accordance with the provisions of ASC 605-25 and ASC 605-28. The arrangement contains multiple deliverables, including licenses to perform collaboration activities under the proof of concept (POC) plan, collaboration research and development activities, potentially an additional POC term study, POC committee services, exclusivity, regulatory matters, manufacturing and supply of PCVs during the POC period, manufacturing capabilities and a clinical quality agreement.

We concluded that Merck’s right to elect to participate in future development and commercialization of PCVs is substantive and therefore is not considered a deliverable at the inception of the PCV Agreement. Merck is not contractually obligated to exercise the right. Additionally, because of the uncertain outcome of the research and development activities, we are at risk as to whether Merck will exercise its right to elect to participate in future development and commercialization of PCVs. Further, we determined that Merck’s right was not priced at a significant or incremental discount. Accordingly, Merck’s right was not considered a deliverable and the associated participation payment was not included in the allocable arrangement consideration.

We concluded that the licenses to perform the collaboration activities do not qualify for separation from any of the other deliverables in the arrangement as Merck cannot fully exploit the value of such licenses without receipt of such services and supply. Our products and services involve specialized expertise, particularly as they relate to mRNA technology that is not available in the marketplace. Accordingly, Merck must obtain the services and supply under the collaboration research and development activities, additional POC term study, POC committee services, exclusivity, regulatory matters, manufacturing and supply of PCVs during the POC period, manufacturing capabilities and clinical quality agreement from us, which significantly limits the ability for Merck to utilize such licenses for its intended purpose on a standalone basis. As the delivered licenses do not have standalone value from the undelivered elements, we accounted for all of the deliverables as one unit of accounting.

The total arrangement consideration to be allocated to the single unit of accounting consists of the $200.0 million upfront payment. We determined the period of performance of the undelivered elements is through the expected date of delivery of the data and information generated and collected under the plan, which is commensurate with the initial five-year arrangement term. As such, the $200.0 million arrangement consideration is being recognized ratably over the initial five-year period, as there is no other discernible pattern of recognition.

**2018 Expansion of the Cancer Vaccine Strategic Alliance—Shared Neoepitope Cancer Vaccines (unaudited)**

Consistent with the PCV Agreement, the PCV/SAV Agreement was accounted for separately from the 2015 Merck Agreement, as amended, as the agreements were not negotiated in contemplation of one another and the
elements within each of the agreements are not closely interrelated or interdependent on each other. Conversely, the PCV/SAV Agreement was accounted for as a modification to the PCV Agreement because the amendment expanded the existing scope of the arrangement. Accordingly, the newly negotiated obligations under the PCV/SAV Agreement are accounted for together with the remaining unfulfilled obligations under the PCV Agreement. Similarly, the equity investment in our Series H redeemable convertible preferred stock was considered together with the PCV/SAV Agreement as the transactions were executed contemporaneously in contemplation of one another. Further, the purchase price paid by Merck with respect to the investment in the Series H redeemable convertible preferred stock was not representative of fair value on the date of such purchase. As such, the incremental proceeds received in excess of the fair value of the underlying stock related to the equity investment were included in the consideration related to the PCV/SAV Agreement.

We evaluated the PCV/SAV Agreement for recognition and measurement in accordance with the provisions of ASC 605-25. The arrangement contains multiple deliverables. As it relates to the PCV program, there were no substantive changes to the deliverables pursuant to the PCV/SAV Agreement other than an expansion of certain collaboration research and development activities and related manufacturing and supply obligations effected through the revisions made to the POC plan that resulted in an increase to the associated budget. Accordingly, the deliverables for the PCV program include licenses to perform collaboration activities under the POC plan, collaboration research and development activities, potentially an additional POC term study, POC committee services, exclusivity, regulatory matters, manufacturing and supply of PCVs during the POC period, manufacturing capabilities and a clinical quality agreement. As it relates to the KRAS program, the deliverables include licenses to perform collaboration activities under a POC plan and manufacturing and supply of mRNA-5671 during the POC period.

As of the date of inception of the PCV/SAV Agreement, we concluded that Merck’s rights to elect to participate in future development and commercialization of PCVs and mRNA-5671 are substantive and therefore are not considered deliverables at the inception of the PCV/SAV Agreement. Merck is not contractually obligated to exercise either of the rights. Additionally, because of the uncertain outcome of the research and development activities, we are at risk as to whether Merck will exercise its rights to elect to participate in future development and commercialization of PCVs and/or mRNA-5671. Further, we determined that Merck’s rights were not priced at a significant or incremental discount. Accordingly, neither of Merck’s such rights were considered deliverables and the associated payment were not included in the allocable arrangement consideration. Similarly, we concluded that Merck’s rights to obtain additional license(s) covering the PCV program and/or other SAV programs, research and development services associated with certain programs and manufacturing and supply in support of certain programs, are substantive and therefore are not considered deliverables at the inception of the PCV/SAV Agreement. Merck is not contractually obligated to exercise any of the rights. Additionally, because of the uncertain outcome of the research and development activities, we are at risk as to whether Merck will exercise its rights to obtain any of such goods and/or services. Further, we determined that Merck’s rights were not priced at a significant or incremental discount. Accordingly, none of Merck’s such rights were considered deliverables and the associated payments were not included in the allocable arrangement consideration.

Consistent with the assessment under the PCV Agreement, we concluded that the licenses to perform the collaboration activities for the PCV program do not qualify for separation from any of the other deliverables in the arrangement under the terms of the PCV/SAV Agreement as Merck cannot fully exploit the value of such licenses without receipt of such services and supply. Our products and services involve specialized expertise, particularly as they relate to mRNA technology that is not available in the marketplace. Accordingly, Merck must obtain the services and supply under the collaboration research and development activities, additional POC term study, POC committee services, exclusivity, regulatory matters, manufacturing and supply of PCVs during the
POC period, manufacturing capabilities and clinical quality agreement from us, which significantly limits the ability for Merck to utilize such licenses for their intended purpose on a standalone basis. As the delivered licenses do not have standalone value from the undelivered elements, we accounted for all of the deliverables associated with the PCV program as one unit of accounting (the PCV Unit of Accounting). Similarly, we concluded that the licenses to perform the collaboration activities for the KRAS program do not qualify for separation from the associated manufacturing and supply of mRNA-5671 as Merck cannot fully exploit the value of such licenses without receipt of such supply. This is due to the contractual limitations inherent in the licenses conveyed wherein Merck does not have the contractual right to manufacture during the POC period. Accordingly, Merck must obtain the manufacturing and supply of mRNA-5671 during the POC period from us, which significantly limits the ability for Merck to utilize such licenses for their intended purpose on a standalone basis. As the delivered licenses do not have standalone value from the undelivered elements, we accounted for all of the deliverables associated with the KRAS program as one unit of accounting (the KRAS Unit of Accounting). Conversely, we concluded that the PCV Unit of Accounting and the KRAS Unit of Accounting qualify for separation from each other because Merck can fully exploit the value of each program for its intended purpose without the deliverables associated with the other program. Additionally, the arrangement does not include a general right of return.

We determined that neither VSOE nor TPE of selling price is available for either of the units of accounting identified at inception of the modified arrangement with Merck. Accordingly, the selling price of each unit of accounting was determined based on our BESP as of the date of the modification. We developed the BESP for each of the units of accounting included in the PCV/SAV Agreement with the objective of determining the price at which we would sell such an item if it were to be sold regularly on a standalone basis. We developed the BESP for the licenses included in each of the PCV Unit of Accounting and the KRAS Unit of Accounting primarily based on the probability-weighted present value of expected future cash flows associated with each license related to each specific program. In developing such estimate, we also considered applicable market conditions and relevant entity-specific factors, including those factors contemplated in negotiating the agreement, probability of success and the time needed to commercialize a product candidate pursuant to the associated license. We developed the BESP for the services and manufacturing and supply included in each of the PCV Unit of Accounting and the KRAS Unit of Accounting primarily based on the nature of the services to be performed and goods to be produced and estimates of the associated effort and cost associated with the services to be performed and products to be manufactured, that would be expected to be realized under similar contracts.

Allocable arrangement consideration at inception of the modified arrangement is comprised of: (i) the remaining unrecognized portion of the $200.0 million (unaudited) upfront payment of $125.7 million (unaudited) and (ii) the premium associated with the contemporaneous sale of Series H redeemable convertible preferred stock of $13.0 million (unaudited). The aggregate allocable arrangement consideration of $138.7 million (unaudited) was allocated among the separate units of accounting using the relative selling price method as follows: (i) PCV Unit of Accounting: $132.9 million (unaudited) and (ii) KRAS Unit of Accounting: $5.8 million (unaudited). The shares of Series H redeemable convertible preferred stock purchased by Merck were recorded at their respective fair value on the date of issuance.

As of the date of the PCV/SAV Agreement, we determined the period of performance for the PCV Unit of Accounting remains through the expected date of delivery of the data and information generated and collected under the associated plan, which continues to be commensurate with the initial five-year arrangement term. Accordingly, as of the date of the modification, the amount allocated to the PCV Unit of Accounting is being recognized ratably on a prospective basis over the remaining period of performance, which is estimated to be 3.1 years (unaudited), as there is no other discernible pattern of recognition. We determined the period of performance for the KRAS Unit of Accounting is based on the period over which the underlying manufacturing
and supply will be provided pursuant to the associated plan. As such, the amount allocated to the KRAS Unit of Accounting is being recognized over
such period based on a proportionate amount of arrangement consideration as the related products are delivered.

We recognized collaboration revenue for the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018 of
$20.2 million, $40.0 million, $30.0 million (unaudited) and $30.9 million (unaudited), respectively, from the Merck PCV Agreement and the Merck
PCV/SAV Agreement. We had deferred revenue as of December 31, 2016 and 2017 and September 30, 2018 of $179.8 million, $139.8 million and
$121.9 million (unaudited), respectively, from the Merck PCV Agreement and the Merck PCV/SAV Agreement.

**Vertex – 2016 Strategic Alliance in Cystic Fibrosis**

In July 2016, we entered into a Strategic Collaboration and License Agreement, with Vertex Pharmaceuticals Incorporated, and Vertex Pharmaceuticals
(Europe) Limited, together, Vertex, which we refer to as the Vertex Agreement. The Vertex Agreement is aimed at the discovery and development of
potential mRNA medicines for the treatment of cystic fibrosis (CF) by enabling cells in the lungs of people with CF to produce functional CFTR
proteins.

Pursuant to the Vertex Agreement, we lead discovery efforts during a three-year research period, leveraging our Platform technology and mRNA
delivery expertise along with Vertex’s scientific experience in CF biology and the functional understanding of CFTR. Vertex is responsible for
conducting development and commercialization activities for candidates and products that arise from the strategic alliance, including the costs
associated with such activities. Subject to customary “back-up” supply rights granted to Vertex, we exclusively manufacture (or have manufactured)
mRNA for preclinical, clinical and commercialization purposes. The parties established a joint steering committee to oversee and coordinate activities
under the Vertex Agreement. We and Vertex have granted each other certain licenses under the Vertex Agreement.

Under the terms of the Vertex Agreement, we received a $20.0 million upfront payment from Vertex. Vertex has the right to extend the initial three-year
research period by one additional year by making an additional payment to us. We are eligible to receive up to $55.0 million in payments for
achievement of development milestones, up to $220.0 million in payments for achievement of regulatory milestones and potentially could receive an
additional $3.0 million milestone payment for achievement of a regulatory milestone for second and each subsequent product under the Vertex
Agreement. Vertex will also pay us tiered royalties at rates ranging from the low- to high-teens on worldwide net sales of products arising from the
strategic alliance, subject to certain reductions, with an aggregate minimum floor. In connection with the strategic alliance, Vertex also made a $20.0
million equity investment in us.

During the term of the Vertex Agreement, we and Vertex have agreed to certain defined exclusivity obligations under the Vertex Agreement with
respect to the development and commercialization of certain mRNA medicines.

Unless earlier terminated, the Vertex Agreement will continue until the expiration of all royalty terms. Vertex may terminate the Vertex Agreement for
convenience upon 90 days’ prior written notice, except if termination relates to a product in a country where Vertex has received marketing approval,
which, in such case, Vertex must provide 180 days’ prior written notice. Either party may terminate the Vertex Agreement upon the other party’s
material breach, subject to specified notice and cure provisions. Each party may also terminate the Vertex Agreement in the event that the other party
challenges the validity or enforceability of such party’s patent rights, subject to certain exceptions, or if the other party becomes insolvent.
Accounting Treatment

We concluded the Vertex Agreement should be accounted for separately from the Vertex investment in our Series F redeemable convertible preferred stock, as the transactions are not interrelated or interdependent on each other. Further, the investment in the Series F redeemable convertible preferred stock was negotiated with terms representative of fair value at the same purchase price paid by other investors. As such, the proceeds related to the equity investment were excluded from the consideration related to the Vertex Agreement.

We concluded the Vertex Agreement is under the scope of ASC 808 as Vertex and Moderna are both active participants and are exposed to significant risks and rewards that are dependent on commercial success of the activities of the arrangement. Additionally, we evaluated the Vertex Agreement for recognition and measurement in accordance with ASC 605-25 and ASC 605-28. The agreement contains multiple deliverables, including a research, development and commercialization license, a manufacturing license, a formulation and delivery technology license, collaboration activities, regulatory matters, manufacturing and supply of non-cGMP mRNA, exclusivity and joint steering committee services. Additionally, we concluded that Vertex’s right to extend the research period for an additional year is substantive as Vertex is not contractually obligated to exercise the right. Therefore, the right is not considered a deliverable at the inception of the Vertex Agreement. Because of the uncertain outcome of the research activities, we are at risk as to whether Vertex will exercise the extension right. In addition, clinical mRNA supply was concluded to be substantive and therefore not considered a deliverable at the inception of the Vertex Agreement. Further, we concluded that the extension right and the clinical mRNA supply were not priced at a significant or incremental discount. Accordingly, the extension right and clinical mRNA supply were not considered deliverables and the associated fees were not included in the allocable arrangement consideration.

We concluded that the licenses do not qualify for separation from any of the other deliverables in the agreement as Vertex cannot fully exploit the value of the licenses without receipt of such services and supply until a product candidate has been identified. Our services and supply involve specialized expertise, particularly as it relates to mRNA technology that is not available in the marketplace. Accordingly, Vertex has to obtain the collaboration activities, regulatory matters, manufacturing and supply, exclusivity and joint steering committee services from us which significantly limits Vertex’s ability to utilize the licenses for their intended purpose on a standalone basis. Therefore, the delivered items do not have standalone value from the undelivered elements and we accounted for all the deliverables as one unit of accounting.

The total arrangement consideration to be allocated to the single unit of accounting at inception of the arrangement consists of the $20.0 million upfront payment and estimated amounts related to research and development services and manufacturing that are included in the unit of accounting. We determined the period of performance of the undelivered elements is commensurate with the initial three-year research period. As such, the $20.0 million arrangement consideration is recognized ratably over the initial three-year period, as there is no other discernible pattern of recognition.

We evaluated all the milestones that may be received under the arrangement. We concluded at the outset of the arrangement that none of the future development and regulatory milestones qualified as substantive milestones as the efforts to achieve the milestones are Vertex’s responsibility and therefore the milestones are not achieved based on our past performances. Accordingly, upon achievement of a development or regulatory milestone event, the corresponding amount earned will be recognized as additional arrangement consideration over the remaining estimated period of performance, if any, with a cumulative catch up for the elapsed portion of the performance period being recognized when the payment is earned. All commercial milestones will be accounted for in the same manner as royalties, and recorded as revenue upon achievement of the milestone, assuming all other
revenue recognition criteria are met. We will recognize royalty revenue in the period of sale of the related product(s), based on the underlying agreement terms, assuming all other revenue recognition criteria are met.

For the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2018, we recognized collaboration revenue of $3.5 million, $9.1 million, $6.8 million (unaudited) and $9.0 million (unaudited), respectively, from Vertex. We had deferred revenue of $16.7 million, $10.0 million and $5.0 million (unaudited), as of December 31, 2016 and 2017 and September 30, 2018, respectively, from Vertex.

**Alexion – 2014 Strategic Alliance in Rare Diseases**

In January 2014, we entered into an Option Agreement and a related Services and Collaboration Agreement, which we refer to as the 2014 Alexion Agreements, with Alexion Pharma Holding Unlimited Company (Alexion) to research, develop and commercialize potential therapeutic mRNA medicines for the treatment of certain rare diseases. Pursuant to the 2014 Alexion Agreements, we granted certain licenses to Alexion and we provided specified research and manufacturing services pursuant to an agreed upon services plan. Under the 2014 Alexion Agreements, Alexion could have requested we provide additional services, at Alexion’s expense, following the end of the research and evaluation period. Under the terms of the 2014 Alexion Agreements, we received an upfront payment of $100.0 million from Alexion. On July 27, 2017, Alexion exercised its right to terminate the 2014 Alexion Agreements without cause effective as of October 25, 2017. At the time of termination, Alexion had not exercised any options to acquire rights to develop and commercialize any products. Upon the termination of the 2014 Alexion Agreements, all rights to mRNA researched, developed or supplied as a part of the programs under the 2014 Alexion Agreements reverted back to us. During the term of the 2014 Alexion Agreements, the parties were subject to certain exclusivity obligations. In connection with entering into the 2014 Alexion Agreements, Alexion also made a $25.0 million equity investment in us.

**Accounting Treatment**

We determined that the 2014 Alexion Agreements should be evaluated as a single contract for accounting purposes as the Option Agreement and the Services and Collaboration Agreement were negotiated in contemplation of one another. Additionally, we concluded the 2014 Alexion Agreements should be accounted for separately from Alexion’s $25.0 million investment in our Series D redeemable convertible preferred stock, as the agreements are not interrelated or interdependent on each other. Further, the investment in the Series D redeemable convertible preferred stock was negotiated with terms representative of fair value at the same purchase price paid by other investors. As such, the proceeds related to the equity investment were excluded from the consideration related to the 2014 Alexion Agreements.

We concluded the 2014 Alexion Agreements are under the scope of ASC 808 as Alexion and Moderna are both active participants and are exposed to significant risks and rewards that are dependent on commercial success of the activities of the arrangements. Additionally, we evaluated the 2014 Alexion Agreements for recognition and measurement in accordance with ASC 605-25 and ASC 605-28. The deliverables in the arrangement contain multiple deliverables, including evaluation licenses for certain mRNA constructs coding for specific targets, research services, development pool services, mRNA coding for research polypeptides, research phase API, and exclusivity. In addition, we concluded that Alexion’s options to acquire rights to develop and commercialize up to ten development candidates were substantive options and therefore not considered a deliverable at the inception of the 2014 Alexion Agreements. Alexion was not contractually obligated to exercise such options. As a result of the uncertain outcome of the research and development activities, we were at risk as to whether Alexion would exercise the options. Additionally, clinical mRNA supply was determined to be substantive and therefore not considered a deliverable at the inception of the 2014 Alexion Agreements. Further, we concluded
that Alexion’s options and the clinical mRNA supply were not priced at a significant or incremental discount. Accordingly, Alexion’s options and the clinical mRNA supply were not considered a deliverable and the associated fees were not included in the allocable arrangement consideration.

We concluded that the evaluation licenses for certain mRNA constructs coding for specific targets did not qualify for separation from any of the other deliverables in the arrangement as Alexion could not fully exploit the value of these licenses without receipt of such services and supply. Our services and supply involve specialized expertise, particularly as it relates to mRNA technology that is not available in the marketplace. Accordingly, Alexion had to obtain the research services, development pool services, mRNA coding for research polypeptides, research phase API, and exclusivity from us, which significantly limited Alexion’s ability to utilize the licenses for their intended purposes on a standalone basis. Accordingly, the delivered licenses did not have standalone value from the undelivered elements and we accounted for all of the deliverables as one unit of accounting.

The total arrangement consideration allocated to the single unit of accounting at inception consisted of the $100.0 million upfront payment and estimated amounts related to research and development services and manufacturing that are included in the unit of accounting. We determined the period of performance of the undelivered elements was commensurate with the ten-year services term. As such, the $100.0 million arrangement consideration was being recognized ratably over the ten-year period, as there was no other discernible pattern of recognition.

Upon exercise of each option, we were eligible to receive, per product candidate, certain payments contingent upon achievement of development, regulatory, and commercial milestones. At the time of termination, no milestones had been achieved. We evaluated all of the milestones that may have been received under the arrangement. We concluded at the outset of the arrangement that none of the future development and regulatory milestones qualified as substantive milestones, as the efforts to achieve the milestones were Alexion’s responsibility and therefore the milestone would not be achieved based on our past performance. Accordingly, upon achievement of a development or regulatory milestone event, the corresponding amount earned would have been recognized as additional arrangement consideration over the remaining estimated performance period, if any, with a cumulative catch-up for the elapsed portion of the performance period being recognized in full when the payment was earned. All commercial milestones would have been accounted for in the same manner as royalties, and recorded as revenue upon achievement of the milestone, assuming all other revenue recognition criteria were met. No options were exercised and therefore no milestones or royalties were earned under the 2014 Alexion Agreements prior to termination.

In conjunction with the termination of the 2014 Alexion Agreements in 2017, we determined there were no remaining deliverables pursuant to the 2014 Alexion Agreements as the agreements and all unexercised options were terminated. Therefore, $70.3 million of deferred revenue was recognized in full upon the termination in 2017. There were no other amounts for which we were entitled pursuant to the termination.

For the years ended December 31, 2016 and 2017, and the nine months ended September 30, 2017, we recognized collaboration revenue of $17.2 million, $74.4 million, and $12.2 million (unaudited), respectively, from Alexion. We had no collaboration revenue for the nine months ended September 30, 2018, from Alexion. We had deferred revenue of $70.3 million as of December 31, 2016. We had no deferred revenue as of December 31, 2017 and September 30, 2018, respectively, from Alexion.
Biomedical Advanced Research and Development Authority (BARDA)

In September 2016, we received an award of up to $125.8 million under Agreement No. HHSO100201600029C from BARDA, a component of the Office of the Assistant Secretary for Preparedness and Response, or ASPR within the U.S. Department of Health and Human Services, or HHS, to help fund our Zika vaccine program. Under the terms of the agreement with BARDA, an initial base award of $8.2 million supported toxicology studies, a Phase 1 clinical trial, and associated manufacturing activities. Contract options were available, for $117.6 million to support an additional Phase 1 study of an improved Zika vaccine candidate, Phase 2 and Phase 3 clinical studies, as well as large-scale manufacturing for the Zika vaccine.

As of December 31, 2017 and September 30, 2018 (unaudited), three of the four contract options had been exercised resulting in $117.3 million of available funding with an additional $8.5 million available if the final contract option is exercised. For the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018, we recognized revenue of $0.9 million, $20.1 million, $17.3 million (unaudited) and $4.6 million (unaudited), respectively, relating to the BARDA Agreement.

The Bill & Melinda Gates Foundation

In January 2016, we entered a global health project framework agreement with the Gates Foundation to advance mRNA-based development projects for various infectious diseases. The Gates Foundation has committed up to $20.0 million in grant funding to support our initial project related to the evaluation of antibody combinations in a preclinical setting as well as the conduct of a first-in-human Phase 1 clinical trial of a potential mRNA medicine to help prevent human immunodeficiency virus, or HIV, infections. Follow-on projects which could bring total potential funding under the framework agreement up to $100.0 million (including the HIV antibody project) to support the development of additional mRNA-based projects for various infectious diseases can be proposed and approved until the sixth anniversary of the framework agreement, subject to the terms of the framework agreement, including our obligation to grant to the Gates Foundation certain non-exclusive licenses.

As of December 31, 2017, up to $20.0 million has been committed for funding with up to an additional $80.0 million available if additional follow-on projects are approved. For the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018, we recognized $1.6 million, $1.1 million, $0.7 million (unaudited) and $1.0 million (unaudited), respectively, related to the Gates Foundation agreement. Deferred revenue of $3.3 million, $2.2 million and $1.3 million (unaudited) was recorded as of December 31, 2016 and 2017 and September 30, 2018, respectively, related to the Gates Foundation agreement.

Defense Advanced Research Projects Agency (DARPA)

In October 2013, DARPA awarded us up to $24.6 million under Agreement No. W911NF-13-1-0417, which was subsequently adjusted to $20.5 million in 2016, to research and develop potential mRNA medicines as a part of DARPA’s Autonomous Diagnostics to Enable Prevention and Therapeutics, or ADEPT, program, which is focused on assisting with the development of technologies to rapidly identify and respond to threats posed by natural and engineered diseases and toxins. The DARPA awards have been deployed primarily in support of our vaccine and antibody programs to protect against chikungunya infection.

As of December 31, 2017 and September 30, 2018 (unaudited), $17.3 million has been committed, and an additional $3.2 million is available at the election of DARPA. We recognized $3.8 million, $7.7 million, $7.3 million (unaudited) and $4.0 million (unaudited), for the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018, respectively, related to the DARPA agreement.
5. Financial Instruments

Cash and Cash Equivalents and Investments

The following tables summarize our cash and available-for-sale securities by significant investment category at December 31, 2016 and 2017 and September 30, 2018 (in thousands):

### December 31, 2016

<table>
<thead>
<tr>
<th></th>
<th>Amortized Cost</th>
<th>Unrealized Gains</th>
<th>Unrealized Losses</th>
<th>Fair Value</th>
<th>Cash and Cash Equivalents</th>
<th>Current Marketable Securities</th>
<th>Non-Current Marketable Securities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash and cash equivalents</td>
<td>$ 50,080</td>
<td>—</td>
<td>—</td>
<td>$ 50,080</td>
<td>$ 50,080</td>
<td>—</td>
<td>$ —</td>
</tr>
<tr>
<td>Available-for-sale:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 2:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certificates of deposit</td>
<td>330,516</td>
<td>254</td>
<td>(5)</td>
<td>330,765</td>
<td>—</td>
<td>321,768</td>
<td>8,997</td>
</tr>
<tr>
<td>U.S. treasury securities</td>
<td>206,147</td>
<td>2</td>
<td>(383)</td>
<td>205,766</td>
<td>—</td>
<td>105,517</td>
<td>100,249</td>
</tr>
<tr>
<td>Debt securities of U.S. government agencies and corporate entities</td>
<td>708,367</td>
<td>273</td>
<td>(544)</td>
<td>708,096</td>
<td>—</td>
<td>580,773</td>
<td>127,323</td>
</tr>
<tr>
<td></td>
<td>$1,295,110</td>
<td>$ 529</td>
<td>$(932)</td>
<td>$1,294,707</td>
<td>$ 50,080</td>
<td>$1,008,058</td>
<td>$ 236,569</td>
</tr>
</tbody>
</table>

### December 31, 2017

<table>
<thead>
<tr>
<th></th>
<th>Amortized Cost</th>
<th>Unrealized Gains</th>
<th>Unrealized Losses</th>
<th>Fair Value</th>
<th>Cash and Cash Equivalents</th>
<th>Current Marketable Securities</th>
<th>Non-Current Marketable Securities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash and cash equivalents</td>
<td>$ 134,859</td>
<td>—</td>
<td>—</td>
<td>$ 134,859</td>
<td>$ 134,859</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Available-for-sale:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 2:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certificates of deposit</td>
<td>245,884</td>
<td>35</td>
<td>(218)</td>
<td>245,701</td>
<td>—</td>
<td>198,398</td>
<td>47,303</td>
</tr>
<tr>
<td>U.S. treasury securities</td>
<td>118,278</td>
<td>—</td>
<td>(354)</td>
<td>117,924</td>
<td>—</td>
<td>117,924</td>
<td>—</td>
</tr>
<tr>
<td>Debt securities of U.S. government agencies and corporate entities</td>
<td>404,016</td>
<td>61</td>
<td>(681)</td>
<td>403,396</td>
<td>—</td>
<td>304,848</td>
<td>98,548</td>
</tr>
<tr>
<td></td>
<td>$ 903,037</td>
<td>$ 96</td>
<td>$(1,253)</td>
<td>$ 901,880</td>
<td>$ 134,859</td>
<td>$621,170</td>
<td>$ 145,851</td>
</tr>
</tbody>
</table>
Table of Contents
MODERN, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
(including data related to unaudited periods) (continued)
September 30, 2018
(unaudited)

<table>
<thead>
<tr>
<th></th>
<th>Amortized Cost</th>
<th>Unrealized Gains</th>
<th>Unrealized Losses</th>
<th>Fair Value</th>
<th>Cash and Cash Equivalents</th>
<th>Current Marketable Securities</th>
<th>Non-Current Marketable Securities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash and cash equivalents</td>
<td>$ 167,060</td>
<td>$ —</td>
<td>$ —</td>
<td>$ 167,060</td>
<td>$ 167,060</td>
<td>$ —</td>
<td>$ —</td>
</tr>
</tbody>
</table>

Available-for-sale:

Level 2:

Certificates of deposit

|                      | 254,278      | 90              | (80)              | 254,288    | —                         | 108,961                      | 15,188                          |

U.S. treasury securities

|                      | 109,090      | (129)           | 108,961           | —          | 108,961                   |                              |                                 |

Debt securities of U.S. government agencies and corporate entities

|                      | 693,049      | 127             | (927)             | 692,249    | —                         | —                            | 557,082                         |

Total

|                      | $1,223,477   | 217             | (1,136)           | $1,222,558 | $167,060                  | 905,143                      | 150,355                         |

The amortized cost and estimated fair value of marketable securities, by contractual maturity at December 31, 2017 and September 30, 2018 are as follows (in thousands):

<table>
<thead>
<tr>
<th></th>
<th>December 31, 2017</th>
<th>Estimated Fair Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Due in one year or less</td>
<td>$ 622,020</td>
<td>$ 621,170</td>
</tr>
<tr>
<td>Due after one year through five years</td>
<td>146,158</td>
<td>145,851</td>
</tr>
<tr>
<td>Total</td>
<td>$ 768,178</td>
<td>$ 767,021</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>September 30, 2018</th>
<th>Estimated Fair Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Due in one year or less</td>
<td>$ 906,002</td>
<td>$ 905,143</td>
</tr>
<tr>
<td>Due after one year through five years</td>
<td>150,415</td>
<td>150,355</td>
</tr>
<tr>
<td>Total</td>
<td>$1,056,417</td>
<td>$1,055,498</td>
</tr>
</tbody>
</table>

At December 31, 2017, we held 173 available-for-sale securities, or an estimated fair value of $602.0 million, out of our total investment portfolio that were in a continuous unrealized loss position for more than 12 months with a gross unrealized loss of $0.3 million. At September 30, 2018, we held 23 (unaudited) available-for-sale securities, or an estimated fair value of $66.5 million (unaudited), out of our total investment portfolio that were in a continuous unrealized loss position for more than 12 months with a gross unrealized loss of $0.2 million (unaudited). We concluded that the net declines in market value of our available-for-sale securities investment portfolio were temporary in nature and did not consider any of our investments to be other-than-temporarily impaired. In accordance with our investment policy, we place investments in investment grade securities with high credit quality issuers, and generally limit the amount of credit exposure to any one issuer. We evaluate securities for other-than-temporary impairment at the end of each reporting period. Impairment is evaluated considering numerous factors, and their relative significance varies depending on the situation. Factors considered include the length of time and extent to which fair value has been less than the cost basis, the financial condition and near-term prospects of the issuer, and our intent and ability to hold the investment to allow for an anticipated recovery in fair value. Furthermore, the aggregate of individual unrealized losses that
had been outstanding for 12 months or less was not significant as of December 31, 2016 and December 31, 2017 and September 30, 2018. We neither intend to sell these investments nor conclude that we are more-likely-than-not that we will have to sell them before recovery of their carrying values. We also believe that we will be able to collect both principal and interest amounts due to us at maturity.

6. Balance Sheet Components

Prepaid Expenses and Other Current Assets

Prepaid expenses and other current assets, as of December 31, 2016 and 2017 and September 30, 2018 consists of the following (in thousands):

<table>
<thead>
<tr>
<th></th>
<th>December 31, 2016</th>
<th>December 31, 2017</th>
<th>September 30, 2018 (unaudited)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepaid expenses</td>
<td>$11,063</td>
<td>$9,587</td>
<td>$27,317</td>
</tr>
<tr>
<td>Interest receivable on marketable securities</td>
<td>4,428</td>
<td>3,239</td>
<td>6,039</td>
</tr>
<tr>
<td><strong>Prepaid expenses and other current assets</strong></td>
<td><strong>$15,491</strong></td>
<td><strong>$12,826</strong></td>
<td><strong>$33,356</strong></td>
</tr>
</tbody>
</table>

Property and Equipment, Net

Property and equipment, net as of December 31, 2016 and 2017 and September 30, 2018 consists of the following (in thousands):

<table>
<thead>
<tr>
<th></th>
<th>December 31, 2016</th>
<th>December 31, 2017</th>
<th>September 30, 2018 (unaudited)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building</td>
<td>$—</td>
<td>$—</td>
<td>$130,695</td>
</tr>
<tr>
<td>Laboratory equipment</td>
<td>62,847</td>
<td>77,351</td>
<td>86,764</td>
</tr>
<tr>
<td>Internally developed software</td>
<td>7,020</td>
<td>7,020</td>
<td>7,020</td>
</tr>
<tr>
<td>Leasehold improvements</td>
<td>11,909</td>
<td>12,222</td>
<td>16,024</td>
</tr>
<tr>
<td>Computer equipment and software</td>
<td>5,092</td>
<td>9,420</td>
<td>13,848</td>
</tr>
<tr>
<td>Construction in progress</td>
<td>21,873</td>
<td>80,759</td>
<td>15,652</td>
</tr>
<tr>
<td>Other</td>
<td>275</td>
<td>290</td>
<td>290</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td><strong>109,016</strong></td>
<td><strong>187,062</strong></td>
<td><strong>270,293</strong></td>
</tr>
<tr>
<td>Less: Accumulated depreciation</td>
<td>(27,809)</td>
<td>(48,031)</td>
<td>(63,836)</td>
</tr>
<tr>
<td><strong>Property and equipment, net</strong></td>
<td><strong>$81,207</strong></td>
<td><strong>$139,031</strong></td>
<td><strong>$206,457</strong></td>
</tr>
</tbody>
</table>

Depreciation expense for the years ended December 31, 2016 and 2017 and nine months ended September 30, 2017 and 2018 was $15.1 million, $20.5 million, $14.6 million (unaudited) and $17.5 million (unaudited), respectively.

F-52
Accrued Liabilities

Accrued liabilities, as of December 31, 2016 and 2017 and September 30, 2018 consists of the following (in thousands):

<table>
<thead>
<tr>
<th></th>
<th>December 31, 2016</th>
<th>December 31, 2017</th>
<th>September 30, 2018 (unaudited)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-licenses</td>
<td>$ —</td>
<td>$25,000</td>
<td>$ —</td>
</tr>
<tr>
<td>Property and equipment</td>
<td>7,478</td>
<td>14,624</td>
<td>4,520</td>
</tr>
<tr>
<td>Compensation-related</td>
<td>11,689</td>
<td>18,221</td>
<td>17,445</td>
</tr>
<tr>
<td>External goods and services</td>
<td>5,885</td>
<td>14,870</td>
<td>23,461</td>
</tr>
<tr>
<td>Accrued liabilities</td>
<td>$25,052</td>
<td>$72,715</td>
<td>$45,426</td>
</tr>
</tbody>
</table>

7. Commitments and Contingencies

Lease Obligations

We have entered into various long-term non-cancelable operating lease arrangements for our facilities and equipment expiring at various times through 2032. Certain of these arrangements have free rent periods or escalating rent payment provisions, which we recognize rent expense under such arrangements on a straight-line basis. We have two campuses in Massachusetts. We occupy a multi-building campus in Technology Square in Cambridge, MA with a mix of offices and research laboratory space totaling 190,712 square feet. Our Cambridge facility leases have expiry ranges from 2020 to 2027. We have approximately 200,000 square feet of a manufacturing facility in Norwood, MA. This facility is leased through 2032.

Cambridge Leases

In May 2016, we entered into a lease agreement for 124,760 square feet of office and laboratory space at 200 Technology Square in Cambridge, Massachusetts. The lease commenced on September 1, 2016, with the base rent subject to increases over an 11-year term. We will occupy the premises in six phases which started in September 2016, with the last phase estimated to begin in December 2020. We have the option to extend the lease term for two extension periods of five years each, at market-based rates. In addition to rent payments, the lease also provides that we pay our proportionate share of operating expenses and taxes during the term of the lease. As the amount of square footage to be leased increases over the term of the lease, we will recognize each phase’s total rent payments on a straight-line basis over the respective lease term. The lease provides us with an initial tenant allowance of $10.00 per square foot against which costs incurred will be capitalized as leasehold improvements. We have provided a security deposit of $1.3 million, that is classified as non-current restricted cash on the consolidated balance sheet. As we occupy additional space through the six phases of occupancy, the security deposit will increase up to $2.2 million.

In August 2015, we entered into a facility lease agreement for 61,618 square feet of office and laboratory space at 500 Technology Square in Cambridge, MA. The lease commenced in April 2016, with rental fees beginning at a rate of $3.9 million per annum and escalating over the six-year term of the lease. The lease provides a $3.1 million tenant improvement allowance against which costs incurred will be capitalized as leasehold improvements. The lease also provides that we pay our proportionate share of operating expenses and taxes during the term of the lease. We will record rent expense on a straight-line basis through the end of the lease term, inclusive of the period in which there are no scheduled rent payments, and will record deferred rent on the consolidated balance sheet, accordingly. We have provided a security deposit of $1.0 million, that is classified as non-current restricted cash on the consolidated balance sheet.

F-53
Norwood Leases

In August 2016, we entered into a lease agreement for approximately 200,000 square feet of office, laboratory, and light manufacturing space in Norwood, MA. The lease commencement date for accounting purposes was October 1, 2016. In connection with this lease, the landlord provided a tenant improvement allowance of approximately $24.2 million for costs associated with the design, engineering, and construction of tenant improvements for the building. For accounting purposes, we were deemed to be the owner of the building during the construction period as we were involved in the construction project, including having responsibilities for cost overruns for planned tenant improvements that did not qualify as normal tenant improvements under the lease accounting guidance. During the construction period, we capitalized the fair value of the building as of lease commencement along with a corresponding construction financing obligation. We also capitalized project construction costs incurred by us as an asset. Property and equipment, net included $18.2 million and $75.0 million as of December 31, 2016 and 2017, respectively, related to construction in process costs for the building. We completed the construction of the building and started our Norwood operation in July 2018. During the three months ended September 30, 2018, we transferred $139.8 million of construction in process to property and equipment, including the building of $130.7 million. Certain manufacturing equipment and processes are still in progress which are expected to be completed in 2019. The carrying value of the construction financing obligation related to the building, was $12.5 million, $15.7 million and $26.9 million (unaudited), as of December 31, 2016 and 2017 and September 30, 2018, respectively. We recorded $14.5 million and $4.3 million (unaudited) in accrued liabilities on the consolidated balance sheets as of December 31, 2017 and September 30, 2018, respectively.

During the construction period, we bifurcated our future lease payments pursuant to the lease into: (i) a portion that is allocated to the building; and (ii) a portion that is allocated to the land on which the building is located, which is recorded as rental expense. The fair value of the building and the land were estimated by us with the assistance of a third-party valuation expert and giving consideration to comparable properties. Although we did not begin making lease payments pursuant to the lease until October 2017, the portion of the lease obligation allocated to the land is treated for accounting purposes as an operating lease commencing on October 1, 2016. Rent expense, comprised solely of land rent, of approximately $0.2 million and $1.3 million was incurred during the years ended December 31, 2016 and 2017, respectively, related to this lease. There was no depreciation expense recorded for the years ended December 31, 2016 or 2017 relating to capitalized construction costs as the building had not been placed in service.

Upon completion of the construction of the building, we evaluated the lease and determined that it did not meet the criteria for “sale-leaseback” treatment. Accordingly, we depreciate the building and incur interest expense related to the construction financing obligation recorded on our balance sheet. We bifurcate our lease payments pursuant to the lease into: (i) a portion that is allocated to the building; and (ii) a portion that is allocated to the land on which the building was constructed. The portion of the lease obligation allocated to land is treated as an operating lease.

The lease will terminate in September 2032. We have the option to extend the term for two extension periods of ten years each at market-based rents. The base rent is subject to increases over the term of the lease. We have provided a security deposit of $8.9 million that is classified as non-current restricted cash on the consolidated balance sheets as of December 31, 2016 and 2017 and September 30, 2018 (unaudited).

In April 2017, we entered into a lease agreement for land adjacent to Norwood. We determined, for accounting purposes, this land lease should be accounted for separately from the lease entered in August 2016. The lease commenced in April 2017, with rental fees beginning at a rate of $0.3 million per annum and escalating over the
In connection with Norwood leases, we incurred $1.5 million in interest expense, $1.2 million in depreciation expense and $1.3 million in rent expense for the nine months ended September 30, 2018.

Total rent expense, for the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018 was $13.7 million, $18.6 million, $13.6 million (unaudited) and $14.7 million (unaudited), respectively. Future minimum lease payments under non-cancelable operating lease agreements as of December 31, 2017, are as follows (in thousands):

<table>
<thead>
<tr>
<th>Years ending December 31</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>Thereafter</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$231,979</td>
<td></td>
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</table>

(1) The amounts in the table above do not include the optional extensions in the Norwood lease terms.

**Strategic Collaborations**

Under our strategic collaboration agreements, we are committed to perform certain research, development, and manufacturing activities. As part of our PCV Agreement and PCV/SAV Agreement with Merck, we are committed to perform certain research, development and manufacturing activities related to PCV products through an initial Phase 2 clinical trial up to a budgeted amount of $200.0 million and $243.0 million (unaudited) as of December 31, 2017 and September 30, 2018, respectively (Note 3).

**Legal Proceedings**

We are not currently a party to any material legal proceedings.

**Indemnifications**

As permitted under Delaware law, we indemnify our officers, directors, and employees for certain events, occurrences while the officer, or director is, or was, serving at our request in such capacity. The term of the indemnification is for the officer’s or director’s lifetime.

We have standard indemnification arrangements in its leases for laboratory and office space that require it to indemnify the landlord against any liability for injury, loss, accident, or damage from any claims, actions, proceedings, or costs resulting from certain acts, breaches, violations, or non-performance under our leases.

Through December 31, 2017, we had not experienced any losses related to these indemnification obligations, and no material claims were outstanding. We do not expect significant claims related to these indemnification obligations and, consequently, concluded that the fair value of these obligations is negligible, and no related reserves were established.
Purchase Commitments and Purchase Orders
As of December 31, 2017, we had $20.3 million non-cancelable purchase commitments under certain manufacturing service agreements, which were expected to be paid in 2018.

In addition to manufacturing commitments, we have agreements with third parties for various services, including services related to clinical operations and support, for which we are not contractually able to terminate for convenience and avoid any and all future obligations to the vendors. Certain agreements provide for termination rights subject to termination fees or wind down costs. Under such agreements, we are contractually obligated to make certain payments to vendors, mainly, to reimburse them for their unrecoverable outlays incurred prior to cancellation. At December 31, 2017, we had cancelable open purchase orders of $44.4 million in total under such agreements for our significant clinical operations and support. These amounts represent only our estimate of those items for which we had a contractual commitment to pay at December 31, 2017, assuming we would not cancel these agreements. The actual amounts we pay in the future to the vendors under such agreements may differ from the purchase order amounts.

Licenses to Patented Technology
In December 2010, we entered into an exclusive license agreement to sublicense rights to certain technology to aid in drug development efforts. According to the terms of the license, we issued 472,966 shares of common stock prior to December 31, 2012. We recorded the fair value of common stock issued as research and development expense. Pursuant to the agreement, we are required to make certain other payments, such as an annual license fee and costs of patent prosecution. Additionally, the license provides for milestone payments and royalties, that are contingent on entering clinical trials and on future net sales in each case, with respect to licensed products. We did not incur material expenses associated with the license agreements for the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2018.

On June 26, 2017, we entered into sublicense agreements with Cellscript, LLC and its affiliate, mRNA RiboTherapeutics, Inc. to sublicense certain patent rights. Pursuant to each agreement, we are required to pay certain license fees, annual maintenance fees, minimum royalties on future net sales and milestone payments contingent on achievement of certain development, regulatory and commercial milestones for specified products, on a product-by-product basis. We concluded the assets acquired in connection with the sublicense agreements should be accounted for as an asset acquisition of in-process research and development. Accordingly, all payments to be made that meet the characteristics of research and development expenses with no alternative future use will be expensed in the period in which they are incurred. As such, the initial sublicense payments totaling $28.0 million were expensed at inception and future sublicense payments will be recorded when it becomes certain we will be obliged to make the future payments. Additionally, the development and regulatory milestone payments, up to $1.5 million for therapeutic and prophylactic products and up to $0.5 million for diagnostic products, will be recognized as a cost of the asset acquired upon resolution of the associated contingency and will be capitalized or expensed depending on the nature of the associated asset as of the date of recognition. Conversely, commercial milestone payments, up to $24.0 million for therapeutic and prophylactic products and $0.5 million for diagnostic products, will be accounted for as additional expense of the related product sales in the period in which the corresponding sales occur. In conjunction with the agreements entered in 2017, we recognized expense of $53.3 million, and paid consideration of $28.3 million in 2017. We recorded $25.0 million of accrued liabilities in the consolidated balance sheet as of December 31, 2017. In the nine months ended September 30, 2018, we paid Cellscript, LLC $22.0 million (unaudited) and its affiliate, mRNA RiboTherapeutics, Inc. $3.0 million (unaudited). At September 30, 2018, we had no accrued liabilities for Cellscript, LLC and its affiliate, mRNA RiboTherapeutics, Inc.
8. Redeemable Convertible Preferred Units and Common Units

2016 Reorganization

On August 10, 2016, we completed a series of reorganizational transactions, which included the Stock Split. Moderna Therapeutics, Inc. continued to exist as the parent corporation with Moderna LLC surviving as the wholly owned subsidiary of Moderna Therapeutics, Inc. As part of the transactions: (i) each issued and outstanding redeemable convertible preferred unit and common unit of Moderna LLC outstanding as of the 2016 Reorganization was exchanged for shares of redeemable convertible preferred stock and common stock, respectively, of Moderna Therapeutics, Inc.; (ii) previously outstanding incentive units of Moderna LLC were exchanged for shares of restricted common stock of Moderna Therapeutics, Inc.; (iii) previously outstanding options to purchase common units of Moderna LLC were exchanged for options to purchase common stock of Moderna Therapeutics, Inc.; and (iv) for the effect of the Stock Split. If such outstanding units or options were subject to vesting at the time of the 2016 Reorganization, then such shares or options issued by Moderna Therapeutics, Inc. were subject to continued vesting pursuant to the same terms.

The following is a summary of the impact of the 2016 Reorganization.

- Each outstanding redeemable convertible preferred unit of Series A, B, C, D and E of Moderna LLC was exchanged for shares of Series A, B, C, D and E redeemable convertible preferred stock, respectively, of Moderna.
- Each outstanding common unit of Moderna LLC was exchanged for shares of common stock of Moderna, and if such outstanding unit was subject to vesting at the time of such exchange, then such common stock was issued by Moderna subject to continued vesting to the same extent as such outstanding common unit.
- Each outstanding incentive unit issued pursuant to Moderna LLC’s 2013 Equity Incentive Plan was exchanged for shares of restricted common stock of Moderna Therapeutics, Inc. under Moderna Therapeutics, Inc.’s 2016 Stock Option and Grant Plan. Additionally, incentive unit holders were granted options to purchase common stock of Moderna Therapeutics, Inc. if such outstanding incentive unit was subject to vesting at the time of such exchange, then such restricted common stock and stock options were issued by Moderna Therapeutics, Inc. subject to continued vesting to the same extent as such outstanding incentive unit.
- Each outstanding option to purchase common units issued pursuant to Moderna LLC’s 2013 Unit Option and Grant Plan was exchanged for an option to purchase common stock of Moderna Therapeutics, Inc. under Moderna Therapeutics, Inc. 2016 Stock Option and Grant Plan, and if such outstanding unit option was subject to vesting at the time of such exchange, then such stock option was issued by Moderna Therapeutics, Inc. subject to continued vesting to the same extent as such outstanding unit option.

As a result of the 2016 Reorganization, the consolidated financial statements, as of December 31, 2016 reflect the exchange of common units to common stock, redeemable convertible preferred units to redeemable convertible preferred stock and the incremental compensation expense associated with the modification of certain of Moderna’s equity awards. (Note 10).

Redeemable Convertible Preferred Units

Prior to the 2016 Reorganization on August 10, 2016, we had two classes of units: (i) capital units, comprising preferred units and common units; and (ii) incentive units, comprising non-voting and voting incentive units.
of January 1, 2016, we had 128,885,510 common units, 394,685,560 preferred units outstanding (Series A, B, C, D and E), and 2,791,240 incentive units outstanding.

As of December 31, 2016 and 2017 and September 30, 2018, we had no outstanding, redeemable convertible preferred units, common units or incentive units as a result of the 2016 Reorganization.

The following table summarizes our redeemable convertible preferred unit activity (in thousands, except unit data):

<table>
<thead>
<tr>
<th></th>
<th>Series A Preferred Units</th>
<th>Series B Preferred Units</th>
<th>Series C Preferred Units</th>
<th>Series D Preferred Units</th>
<th>Series E Preferred Units</th>
<th>Total Preferred Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Units</td>
<td>Amount</td>
<td>Units</td>
<td>Amount</td>
<td>Units</td>
<td>Amount</td>
</tr>
<tr>
<td>Balance at December 31, 2015</td>
<td>42,000,000</td>
<td>191</td>
<td>115,296,280</td>
<td>675</td>
<td>85,669,780</td>
<td>35,125</td>
</tr>
<tr>
<td>Distribution of Tax, Capital and Dividends to Unit holders</td>
<td>—</td>
<td>(118)</td>
<td>—</td>
<td>(343)</td>
<td>—</td>
<td>(240)</td>
</tr>
<tr>
<td>Accrued dividends and accretion of redeemable convertible preferred units issuance costs</td>
<td>—</td>
<td>109</td>
<td>—</td>
<td>458</td>
<td>—</td>
<td>1,353</td>
</tr>
<tr>
<td>Balance at December 31, 2016</td>
<td>—</td>
<td>—</td>
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</table>

9. Redeemable Convertible Preferred Stock and Common Stock

We determined the exchange of common units, Series A, B, C, D and E redeemable convertible preferred units, incentive units, restricted stock units, and unit options upon the 2016 Reorganization was a modification of such units. Accordingly, the Series A, B, C, D and E redeemable convertible preferred stock were recorded at their historical carrying values, including previously accrued cumulative dividends, on the effective date of the 2016 Reorganization.

On February 28, 2018 and May 7, 2018, the Board of Directors approved an amendment to our Certificate of Incorporation resulting in a total of 775,000,000 shares of common stock and a total of 509,352,795 shares of redeemable convertible preferred stock being authorized.

Redeemable Convertible Preferred Stock

Contemporaneous with the 2016 Reorganization, we entered into a preferred stock purchase agreement which authorized the sale and issuance of up to 68,337,129 shares of our Series F redeemable convertible preferred
stock at a purchase price of $8.78 per share. We completed a financing in August 2016 which resulted in the issuance of an aggregate of 54,001,241 shares of Series F redeemable convertible preferred stock at an issuance price of $8.78 per share for gross proceeds of $474.1 million, less issuance costs of approximately $0.6 million.

In February 2018 and May 2018, we completed additional preferred stock financings which resulted in the issuance of 55,666,004 shares of Series G redeemable convertible preferred stock (unaudited) and 5,000,000 shares of Series H redeemable convertible preferred stock (unaudited), respectively. Series G redeemable convertible preferred stock was issued at a purchase price of $10.06 per share (unaudited) for gross proceeds of $560.0 million (unaudited), less issuance costs of $10.5 million (unaudited). Series H redeemable convertible preferred stock was issued at a purchase price of $25.00 per share (unaudited) for gross proceeds of $112.0 million (unaudited), less issuance costs of $0.4 million (unaudited). The Series H preferred stock is not convertible at the option of the holder until after February 7, 2020, after which, it will be convertible into common stock on a one-for-2.485 basis because the applicable original issuance price for such series is $25.00 and the initial applicable conversion price is $10.06. The initial carrying amount of the Series H redeemable convertible preferred stock was recorded at its fair value of $22.39 per share (unaudited), which we determined based in part on an independent third-party valuation contemporaneously performed. The difference between the purchase price and the fair value of Series H redeemable convertible preferred stock was determined to be the premium associated with the Merck PCV/SAV Agreement entered in conjunction with the Series H issuance and recorded to deferred revenue of $13.0 million (unaudited) (Note 3).

In September 2018, we repurchased 269,180 shares of our Series D redeemable convertible preferred stock and 544,100 shares of our Series E redeemable convertible preferred stock for an aggregate purchase price of $8.2 million. The repurchase was recorded as a decrease of carrying value of preferred stock and the excess of the purchase price paid to an existing shareholder over the carrying amount of redeemable convertible preferred stock surrendered was recorded to additional paid-in capital.
The following table summarizes the activity for each series of our outstanding redeemable convertible preferred stock for the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2018 (in thousands, except share data):

<table>
<thead>
<tr>
<th>Series</th>
<th>Redeemable Convertible Preferred Stock</th>
<th>Series</th>
<th>Redeemable Convertible Preferred Stock</th>
<th>Series</th>
<th>Redeemable Convertible Preferred Stock</th>
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<th>Redeemable Convertible Preferred Stock</th>
<th>Series</th>
<th>Redeemable Convertible Preferred Stock</th>
<th>Series</th>
<th>Redeemable Convertible Preferred Stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Shares</td>
<td>Amount</td>
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<td>Total</td>
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</tr>
</tbody>
</table>

Balance at December 31, 2015: 42,000,000 $182 122,296,280 $770 85,669,774 36,238 63,291,156 81,428,340 394,685,550 703,129

Exchange of units for stock on 2016 Reorganization (split adjusted): 42,000,000 182,296,280 770 85,669,774 36,238 63,291,156 81,428,340 394,685,550 703,129

Issuance of Series F redeemable convertible preferred stock, net of issuance costs of $599: 54,001,241 473,532

Balance at December 31, 2016: 42,000,000 182,296,280 770 85,669,774 36,238 63,291,156 81,428,340 549,413 848,686,791 1,176,661

Balance at December 31, 2017: 42,000,000 182,296,280 770 85,669,774 36,238 63,291,156 81,428,340 549,413 848,686,791 1,176,661

Issuance of Series G redeemable convertible preferred stock, net of issuance costs of $10,517 (unaudited): 55,666,004 549,413

Issuance of Series H redeemable convertible preferred stock, net of issuance costs of $474 (unaudited): 5,000,000 111,546

Repurchase of Series D redeemable convertible preferred stock: (269,180) (704)

Repurchase of Series E redeemable convertible preferred stock: (544,100) (3,355)

Balance at September 30, 2018 (unaudited): 42,000,000 182,296,280 770 85,669,774 36,238 63,291,156 81,428,340 549,413 508,539,515 1,833,561

F-60
Our redeemable convertible preferred stock as of December 31, 2016 and 2017 and September 30, 2018 consisted of the following (in thousands, except share amounts):

<table>
<thead>
<tr>
<th>Series</th>
<th>Redeemable Convertible Preferred Shares Authorized</th>
<th>Redeemable Convertible Preferred Shares Issued and Outstanding</th>
<th>Carrying Value</th>
<th>Liquidation Preference As of December 31,</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series A redeemable convertible preferred stock</td>
<td>42,000,000</td>
<td>42,000,000</td>
<td>$182</td>
<td>$2,533</td>
</tr>
<tr>
<td>Series B redeemable convertible preferred stock</td>
<td>122,296,280</td>
<td>122,296,280</td>
<td>770</td>
<td>11,067</td>
</tr>
<tr>
<td>Series C redeemable convertible preferred stock</td>
<td>85,669,774</td>
<td>85,669,774</td>
<td>36,238</td>
<td>37,476</td>
</tr>
<tr>
<td>Series D redeemable convertible preferred stock</td>
<td>63,291,156</td>
<td>63,291,156</td>
<td>164,059</td>
<td>168,662</td>
</tr>
<tr>
<td>Series E redeemable convertible preferred stock</td>
<td>81,428,340</td>
<td>81,428,340</td>
<td>501,880</td>
<td>502,169</td>
</tr>
<tr>
<td>Series F redeemable convertible preferred stock</td>
<td>54,001,241</td>
<td>54,001,241</td>
<td>473,532</td>
<td>474,131</td>
</tr>
<tr>
<td>Balance at December 31, 2016</td>
<td>448,686,791</td>
<td>448,686,791</td>
<td>$1,176,661</td>
<td>$1,196,038</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Series</th>
<th>Redeemable Convertible Preferred Shares Authorized</th>
<th>Redeemable Convertible Preferred Shares Issued and Outstanding</th>
<th>Carrying Value</th>
<th>Liquidation Preference September 30, 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series A redeemable convertible preferred stock (unaudited)</td>
<td>42,000,000</td>
<td>42,000,000</td>
<td>$182</td>
<td>$2,827</td>
</tr>
<tr>
<td>Series B redeemable convertible preferred stock (unaudited)</td>
<td>122,296,280</td>
<td>122,296,280</td>
<td>770</td>
<td>12,351</td>
</tr>
<tr>
<td>Series C redeemable convertible preferred stock (unaudited)</td>
<td>85,669,774</td>
<td>85,669,774</td>
<td>36,238</td>
<td>41,326</td>
</tr>
<tr>
<td>Series D redeemable convertible preferred stock (unaudited)</td>
<td>63,291,156</td>
<td>63,021,976</td>
<td>163,355</td>
<td>186,765</td>
</tr>
<tr>
<td>Series E redeemable convertible preferred stock (unaudited)</td>
<td>81,428,340</td>
<td>80,884,240</td>
<td>498,525</td>
<td>498,814</td>
</tr>
<tr>
<td>Series F redeemable convertible preferred stock (unaudited)</td>
<td>54,001,241</td>
<td>54,001,241</td>
<td>473,532</td>
<td>474,131</td>
</tr>
<tr>
<td>Series G redeemable convertible preferred stock (unaudited)</td>
<td>55,666,004</td>
<td>55,666,004</td>
<td>549,413</td>
<td>560,000</td>
</tr>
<tr>
<td>Series H redeemable convertible preferred stock (unaudited)</td>
<td>5,000,000</td>
<td>5,000,000</td>
<td>111,546</td>
<td>125,000</td>
</tr>
<tr>
<td>Balance at September 30, 2018 (unaudited)</td>
<td>509,352,795</td>
<td>508,539,515</td>
<td>$1,833,561</td>
<td>$1,901,214</td>
</tr>
</tbody>
</table>

The holders of the redeemable convertible preferred stock have the following rights:

**Voting Rights**

The holders of redeemable convertible preferred stock are entitled to vote on all matters and have the number of votes equal to the number of shares of common stock into which the shares of redeemable convertible preferred stock are convertible. Certain directors comprising the Board of Directors shall be elected by majority vote of holders of redeemable convertible preferred stock. A majority vote of the holders of redeemable convertible preferred stock is required to liquidate or dissolve the Company, amend the Certificate of Incorporation or Bylaws, reclassify common stock or establish another class of capital stock, create shares that would rank senior to or authorize additional shares of redeemable convertible preferred stock, declare a dividend or make a distribution, change the authorized number of directors constituting the Board of Directors, or establish a new employee stock option plan.
Dividends

Dividends are cumulative and accrue annually, whether or not declared, and whether or not there are net profits available to pay dividends. The holders of Series A redeemable convertible preferred stock, Series B redeemable convertible preferred stock, Series C redeemable convertible preferred stock, and Series D redeemable convertible preferred stock are entitled to dividends, at a rate per share, per annum, of $0.004, $0.006, $0.02568, and $0.171, respectively. The holders of the Series E redeemable convertible preferred stock, Series F redeemable convertible preferred stock, Series G redeemable convertible preferred stock and Series H redeemable convertible preferred stock are not entitled to dividends with respect to such shares. The amount of accrued cumulative dividends at December 31, 2016 and 2017 and September 30, 2018 was $46.0 million, $59.9 million and $63.3 million (unaudited), respectively.

Liquidation Preference

The holders of the redeemable convertible preferred stock have preferences in the event of any voluntary or involuntary liquidation, dissolution or winding-up of the Company, as defined in the Third Amended and Restated Certificate of Incorporation. The preferences are set forth below:

i. first, to the holders of Series H redeemable convertible preferred stock and Series G redeemable convertible preferred stock, on a pari passu basis, an amount equal to the greater of (a) each respective original issue price plus dividends declared but unpaid or (b) such amount that would be payable had all respective shares been converted to common stock;

ii. next, to the holders of the Series F redeemable convertible preferred stock an amount equal to the greater of (a) the original issue price plus dividends declared but unpaid or (b) such amount that would be payable had all respective shares been converted to common stock;

iii. next, to the holders of the Series E redeemable convertible preferred stock an amount equal to the greater of (a) the original issue price plus dividends declared but unpaid or (b) such amount that would be payable had all respective shares been converted to common stock;

iv. next, to the holders of the Series D redeemable convertible preferred stock an amount equal to the original issue price plus any dividends declared but unpaid;

v. next, pari passu, in relation to the holders of the Series A redeemable convertible preferred stock an amount equal to the greater of (a) the original issue price plus the Series A redeemable convertible preferred stock dividends accrued but unpaid or (b) such amount that would be payable had all respective shares been converted to common stock and in relation to the holders of the Series B redeemable convertible preferred stock an amount equal to the greater of (a) the original issue price plus the Series B redeemable convertible preferred stock dividends accrued but unpaid or (b) such amount that would be payable had all respective shares been converted to common stock;

vi. next, to the holders of the Series D redeemable convertible preferred stock an amount equal to the Series D redeemable convertible preferred stock dividends accrued but unpaid; and

vii. finally, to all holders of common stock, pro rata based on the number of shares held by each such holder.
Redemption

Pursuant to the Third Amended and Restated Certificate of Incorporation as of May 7, 2018 the redeemable convertible preferred stock does not have any redemption rights that are at the election of the holder. However, the redeemable convertible preferred stock is entitled to payment upon the occurrence of certain contingent events.

As it relates to the payment upon the occurrence of a contingent event, we evaluated the redeemable convertible preferred stock in accordance with the guidance in FASB ASC Topic 480, Distinguishing Liabilities from Equity (ASC 480), and determined that the payment of liquidation amounts due upon the occurrence of a contingent event is not solely within our control and accordingly the redeemable convertible preferred stock is classified in temporary equity in the consolidated balance sheet. As it relates to the accretion to redemption value, the redeemable convertible preferred stock is not currently redeemable, nor is it probable that the instrument will become redeemable, as it is only redeemable upon the occurrence of a contingent event. Accordingly, no accretion has been recognized for the redeemable convertible preferred stock and it will not be accreted until it is probable that the shares will become redeemable. At December 31, 2016 and 2017 and September 30, 2018, the occurrence of the contingent events is not considered probable.

Conversion

Each share of Series A redeemable convertible preferred stock, Series B redeemable convertible preferred stock, Series C redeemable convertible preferred stock, Series D redeemable convertible preferred stock, Series E redeemable convertible preferred stock, Series F redeemable convertible preferred stock, and Series G redeemable convertible preferred stock is convertible at the option of the holder, at any time, into the number of shares of fully paid and non-assessable shares of common stock determined by dividing the applicable original issue price for such series of redeemable convertible preferred stock by the applicable conversion price then in effect for such series. The applicable conversion price shall initially be $0.05, $0.075, $0.321, $2.133, $6.167, $8.78, and $10.06 per share, for the Series A redeemable convertible preferred stock, Series B redeemable convertible preferred stock, Series C redeemable convertible preferred stock, Series D redeemable convertible preferred stock, Series E redeemable convertible preferred stock, Series F redeemable convertible preferred stock, and Series G redeemable convertible preferred stock, respectively. In the case of Series H redeemable convertible preferred stock, shares are not convertible at the option of the holder until the date that is twenty-one months following the date of filing of the Third Amended and Restated Certificate of Incorporation, February 7, 2020, after which, shares are convertible at the option of the holder with an applicable conversion price of $10.06 per share, consistent with the mechanics of conversion for the other series of redeemable convertible preferred stock. Each applicable conversion ratio will be adjusted, if applicable, at the time of conversion of a share of redeemable convertible preferred stock into common stock. The adjustment will contemplate cash distributions made to holders of the redeemable convertible preferred stock through the date of conversion by decreasing the number of shares of common stock into which the redeemable convertible preferred stock will convert by an amount equal to the distributions divided by the fair value of the common stock at the time of conversion. All outstanding shares of redeemable convertible preferred stock will be automatically converted into fully paid and non-assessable shares of common stock at the applicable conversion ratio then in effect upon: (i) the date and time, or the occurrence of an event, specified by vote or written consent of the requisite vote; (ii) the closing of a public offering pursuant to an effective registration statement under the Securities Act of 1933, as amended, as approved by the Board of Directors; or (iii) the date and time, or occurrence of an event, specified by vote or written consent of the holders of a majority or two-thirds (as applicable) of the then outstanding shares of the associated series of redeemable convertible preferred stock (applicable on a series-by-series basis).
In the case of Series H redeemable convertible preferred stock, in the event of an automatic conversion prior to the twenty-one-month anniversary, shares will convert at (a) in the case of an IPO, a conversion ratio equal to the quotient obtained by dividing the original issue price by the greater of (i) the product of 0.9 multiplied by the public offering price per share of common stock set forth on the cover page of the final prospectus for such offering and (ii) $10.06 or (b) in the case of a liquidation, dissolution, winding up or deemed liquidation event, a conversion ratio equal to the quotient obtained by dividing the original issue price by an amount equal to the greater of (i) the product of 0.9 multiplied by the consideration per share payable to the holders of common stock, in their capacity as such, in connection with such transaction and (ii) $10.06.

We evaluated each series of our redeemable convertible preferred stock and determined that each individual series is considered an equity host under FASB ASC Topic No. 815, Derivatives and Hedging (ASC 815). In making this determination, we followed the whole instrument approach, which compares an individual feature against the entire preferred stock instrument which includes that feature. Our analysis was based on a consideration of the economic characteristics and risks of each series of redeemable convertible preferred stock. More specifically, we evaluated all of the stated and implied substantive terms and features, including (i) whether the redeemable convertible preferred stock included redemption features, (ii) how and when any redemption features could be exercised, (iii) whether the holders of redeemable convertible preferred stock were entitled to dividends, (iv) the voting rights of the redeemable convertible preferred stock, (v) any protective provisions of the redeemable convertible preferred stock and (vi) the existence and nature of any conversion rights. As a result of our conclusion that the redeemable convertible preferred stock represents an equity host, the conversion feature of all series of redeemable convertible preferred stock is considered to be clearly and closely related to the associated preferred stock host instrument. Accordingly, the conversion feature of all series of redeemable convertible preferred stock is not considered an embedded derivative that requires bifurcation.

We assess for potentially beneficial conversion features under FASB ASC Topic No. 470-20, Debt with Conversion and Other Options (ASC 470-20). At the time of each of the issuances of redeemable convertible preferred stock, our common stock into which each series of redeemable convertible preferred stock is convertible had an estimated fair value less than the effective conversion prices of the redeemable convertible preferred stock. Therefore, there were no beneficial conversion features on any of the respective commitment dates. Further, any variability in the number of shares of common stock into which each series of redeemable convertible preferred stock will convert resulting from adjustments to the applicable conversion ratio for either: (i) cash distributions or (ii) fluctuations in common stock pricing with respect to the Series H redeemable convertible preferred stock, would result in an increase to the effective conversion prices of the associated redeemable convertible preferred stock. Therefore, upon a change in the number of shares of common stock into which each series of redeemable convertible preferred stock will convert, the effective conversion price will remain in excess of the estimated fair value of the common stock at the commitment date so there is no contingent beneficial conversion feature for any series of redeemable convertible preferred stock.

**Common Stock**

The voting, dividend and liquidation rights of the holders of common stock are subject to and qualified by the rights, powers and preferences of the holders of redeemable convertible preferred stock as summarized above.

**10. Stock-Based Compensation**

**Equity Plans**

In October 2013, we adopted the 2013 Equity Incentive Plan (the 2013 Incentive Plan) and the 2013 Unit Option and Grant Plan (the 2013 Option Plan), which provided for the grant of incentive units, non-qualified unit options, and restricted and unrestricted unit awards to our employees, officers, directors, advisors, and outside...
consultants. Historically, we also granted restricted stock to founders, officers, directors, and advisors outside any of the Plans.

In August 2016, we adopted the 2016 Stock Option and Grant Plan (the 2016 Equity Plan), which replaced the 2013 Option Plan and the 2013 Incentive Plan. The 2016 Equity Plan and provides for the grant of incentive stock options, non-qualified stock options, restricted stock, and restricted stock units to our employees, officers, directors, consultants, and other key persons.

The terms and conditions of stock-based awards are defined at the sole discretion of our Board of Directors. We issue service-based awards, vesting over a defined period of service, and performance-based awards, vesting upon achievement of defined conditions. Service based awards generally vest over a four-year period, with the first 25% of such awards vesting following twelve months of continued employment or service. The remaining awards vests in twelve quarterly installments over the following twelve quarters. Stock options granted under the 2016 Equity Plan expire ten years from the date of grant and the exercise price must be at least equal to the fair market value of common stock on the grant date.

The number of shares initially reserved for issuance under the 2016 Equity Plan was 81,271,240. On March 3, 2017, our Board of Directors approved 24,000,000 additional shares of common stock be authorized for issuance under the 2016 Equity Plan, resulting in an aggregate of 105,271,240 shares authorized for issuance under the 2016 Equity Plan. Upon adoption of the 2016 Equity Plan and consummation of the 2016 Reorganization, there were no shares outstanding or available for future grant under any of the preceding equity plans. At December 31, 2016 and 2017, there were 3,898,041 and 11,125,718, respectively, available for future issuance under the 2016 Equity Plan.

On February 28, 2018, our Board of Directors approved 25,000,000 additional shares of common stock to be authorized for issuance under the 2016 Equity Plan. At September 30, 2018, there were 11,591,369 shares (unaudited) available for future issuance under the 2016 Equity Plan.

2016 Reorganization

Pursuant to the Reorganization, we cancelled all outstanding incentive units of Moderna LLC and exchanged such incentive units into 15,785,549 shares of restricted stock of Moderna Therapeutics, Inc., based on an applicable conversion ratio, which are subject to the same vesting conditions as the originally issued incentive units. In addition, we issued to the incentive unit holders 11,966,693 options to purchase common stock of Moderna Therapeutics, Inc., based on the original number of incentive units granted, as split adjusted, less the number of shares of restricted stock issued in conjunction with the 2016 Reorganization. The weighted average grant date fair value of such restricted stock was $5.57 per share, based on the fair value of the common stock as of the 2016 Reorganization. The options to purchase common stock issued in relation to the incentive units were granted with a strike price of $8.78 and an expiration date of ten years from the 2016 Reorganization, but otherwise subject to the same vesting conditions as the original incentive units. The weighted average grant date fair value of such options issued was $1.53 per option, based on the Black-Scholes option pricing model.

We accounted for the exchange of incentive units in Moderna LLC for restricted stock and for the additional options granted to purchase common stock of Moderna Therapeutics, Inc., as a modification in accordance with the requirements of ASC 718. Accordingly, we determined there was excess fair value of the replacement awards over the fair value of the cancelled awards at the cancellation date, which resulted in incremental compensation expense of $30.9 million related to 234 employees and former employees, and $1.5 million related to 13 non-employees. The incremental fair value related to vested awards was recognized immediately as compensation expense in the year ended December 31, 2016. The incremental fair value of unvested awards and any remaining
unrecognized compensation of the original awards are recognized as compensation expense over the remaining vesting period. Additionally, the non-employee incentive units which were exchanged into restricted stock and the additional options to purchase common stock are re-measured based on the fair value of the respective modified award at each reporting date.

Modification of Stock Awards

During the year-ended December 31, 2017, certain restricted stock and option awards issued under the 2016 Equity Plan were modified. We accounted for these modifications in accordance with the requirements of ASC 718. Accordingly, we determined there was an excess fair value of the modified awards over the fair value of the original awards at the modification date. The incremental fair value related to vested awards was immediately recognized as compensation expense. The incremental fair value of unvested awards and any remaining unrecognized compensation of the original awards are recognized as compensation expense over the remaining vesting period. This incremental fair value along with an acceleration of expense for certain awards, resulted in additional compensation expense of $1.2 million in 2017.

Incentive Units

Prior to the 2016 Reorganization, we granted incentive units pursuant to the 2013 Incentive Plan. The following table summarizes our incentive unit activity:

<table>
<thead>
<tr>
<th>Units</th>
<th>Weighted Average Strike Price</th>
<th>Weighted Average Fair Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outstanding at January 1, 2016</td>
<td>27,503,040</td>
<td>$ 3.73</td>
</tr>
<tr>
<td>Granted</td>
<td>1,100,000</td>
<td>6.17</td>
</tr>
<tr>
<td>Exercised</td>
<td>—</td>
<td>4.25</td>
</tr>
<tr>
<td>Cancelled</td>
<td>(693,140)</td>
<td>4.25</td>
</tr>
<tr>
<td>Exchanged as part of the 2016 Reorganization</td>
<td>(27,911,900)</td>
<td>3.81</td>
</tr>
<tr>
<td>Outstanding at December 31, 2016</td>
<td>—</td>
<td>$ —</td>
</tr>
</tbody>
</table>

As of December 31, 2016 and 2017 and September 30, 2018 (unaudited), we had no outstanding incentive units as a result of the 2016 Reorganization.

The terms and conditions of the incentive unit awards are defined at the sole discretion of our Board of Directors. Our Board of Directors set a strike price with respect to each incentive unit issued. The strike price was to be at least equal to the amount a common unit would receive on the date of issuance of such incentive unit in a hypothetical liquidation on the date of issuance of such incentive unit in which we sold our assets for their fair market value, satisfied our liabilities, and distributed the net proceeds to the holders of units in liquidation.

Typically, incentive units vested over a four-year period, with the first 25% of such incentive units vesting following twelve months of continued employment or service, and the remaining incentive units vested in twelve equal quarterly installments over the following twelve quarters. Incentive units granted were non-voting incentive units, and did not carry the right to vote on any matter.

The incentive units granted in 2016 were exchanged as part of the 2016 Reorganization and the associated compensation costs recognized in 2016 were immaterial.
Options

We grant options under the 2016 Equity Plan. Prior to the 2016 Reorganization, we granted options pursuant to the 2013 Option Plan. Upon the 2016 Reorganization such options outstanding were exchanged for options under the 2016 Equity Plan, with the same terms. Additionally, in conjunction with the 2016 Reorganization, we granted stock options to individuals who previously held incentive units. The following table summarizes our option activity during the years ended December 31, 2016 and 2017 and September 30, 2018, as adjusted for the Stock Split (as applicable):

<table>
<thead>
<tr>
<th>Options</th>
<th>Number of Options</th>
<th>Weighted-Average Exercise Price per Share</th>
<th>Weighted-Average Grant Date Fair Value per Share</th>
<th>Weighted-Average Remaining Contractual Term</th>
<th>Aggregate Intrinsic Value (in thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outstanding at December 31, 2015</td>
<td>25,377,530</td>
<td>$ 0.38</td>
<td>$ 0.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Granted prior to the 2016 Reorganization</td>
<td>15,188,510</td>
<td>5.00</td>
<td>3.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercised prior to the 2016 Reorganization</td>
<td>(40,000)</td>
<td>0.16</td>
<td>0.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cancelled/forfeited prior to the 2016 Reorganization</td>
<td>(1,606,320)</td>
<td>1.06</td>
<td>0.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exchanged as part of the 2016 Reorganization</td>
<td>(38,919,720)</td>
<td>2.15</td>
<td>1.48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Issued in conjunction with the 2016 Reorganization</td>
<td>50,867,683</td>
<td>3.71</td>
<td>1.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Granted after the 2016 Reorganization</td>
<td>6,422,600</td>
<td>5.57</td>
<td>3.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercised after the 2016 Reorganization</td>
<td>(10,500)</td>
<td>0.45</td>
<td>0.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cancelled/forfeited after the 2016 Reorganization</td>
<td>(1,271,956)</td>
<td>4.98</td>
<td>2.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outstanding at December 31, 2016</td>
<td>56,007,827</td>
<td>3.90</td>
<td>1.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Granted</td>
<td>23,110,171</td>
<td>5.60</td>
<td>3.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercised</td>
<td>(44,783)</td>
<td>4.67</td>
<td>2.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cancelled/forfeited</td>
<td>(5,641,801)</td>
<td>6.05</td>
<td>2.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outstanding at December 31, 2017</td>
<td>73,431,414</td>
<td>4.27</td>
<td>2.25</td>
<td>7.8 years</td>
<td>130,587</td>
</tr>
<tr>
<td>Granted (unaudited)</td>
<td>26,576,868</td>
<td>6.59</td>
<td>3.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercised (unaudited)</td>
<td>(927,283)</td>
<td>1.60</td>
<td>0.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cancelled/forfeited (unaudited)</td>
<td>(2,994,951)</td>
<td>5.76</td>
<td>3.48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outstanding at September 30, 2018 (unaudited)</td>
<td>96,086,048</td>
<td>4.84</td>
<td>2.69</td>
<td>7.7 years</td>
<td>131,737</td>
</tr>
<tr>
<td>Exercisable at December 31, 2017</td>
<td>37,731,360</td>
<td>2.83</td>
<td>1.13</td>
<td>6.6 years</td>
<td>127,109</td>
</tr>
<tr>
<td>Vested and expected to vest at December 31, 2017</td>
<td>72,840,934</td>
<td>4.25</td>
<td>2.24</td>
<td>7.8 years</td>
<td>130,315</td>
</tr>
<tr>
<td>Exercisable at September 30, 2018 (unaudited)</td>
<td>44,986,987</td>
<td>3.44</td>
<td>1.50</td>
<td>6.3 years</td>
<td>123,926</td>
</tr>
<tr>
<td>Vested and expected to vest at September 30, 2018 (unaudited)</td>
<td>96,003,742</td>
<td>4.85</td>
<td>2.71</td>
<td>7.7 years</td>
<td>129,210</td>
</tr>
</tbody>
</table>

(1) Aggregate intrinsic value is calculated as the difference between the exercise price of the underlying options and the fair value of common stock for those options in the money as of December 31, 2017 and September 30, 2018 (unaudited).
The total intrinsic value of options exercised was $0.2 million and less than $0.1 million for the years ended December 31, 2016 and 2017, respectively.

Stock-based compensation for options granted is determined using the Black-Scholes option pricing model. The weighted-average assumptions used to estimate the fair value of the options granted for the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018 are as follows:

<table>
<thead>
<tr>
<th>Weighted Average</th>
<th>Year Ended December 31,</th>
<th>Nine Months Ended September 30,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td>Risk-free interest rate</td>
<td>1.65%</td>
<td>2.02%</td>
</tr>
<tr>
<td>Expected term</td>
<td>5.98 years</td>
<td>6.21 years</td>
</tr>
<tr>
<td>Expected volatility</td>
<td>68%</td>
<td>63%</td>
</tr>
<tr>
<td>Expected dividends</td>
<td>— %</td>
<td>— %</td>
</tr>
<tr>
<td>Weighted average fair value per share</td>
<td>$1.75</td>
<td>$3.65</td>
</tr>
</tbody>
</table>

The risk-free interest rate assumption for options is based on the U.S. Treasury yield curve rate at the date of grant with a maturity approximating the expected term of the grant. The expected term assumption for options granted to employees is determined using the simplified method that represents the average of the contractual term of the option and the weighted average vesting period of the option. We use the simplified method because we do not have sufficient historical option exercise data to provide a reasonable basis upon which to estimate expected term. For non-employee options, the contractual term of the option issued is used as the expected term. Assumption as to expected volatility for our common stock is based on an average of the historical volatility of a peer group of public companies that we believe are similar in nature to us. The historical volatility is generally calculated based on a period of time commensurate with the expected term assumption. The assumed dividend yield is based upon our expectation of not paying dividends in the foreseeable future. The fair values per share is determined by our board of directors as of the date of each grant based on the independent third-party valuations, taking into consideration various objective and subjective factors.
Restricted Common Stock

We grant restricted stock awards under the 2016 Equity Plan. We also granted restricted stock awards pursuant to the 2013 Option Plan which were subsequently exchanged for restricted stock awards under the 2016 Equity Plan, with the same terms. Additionally, in conjunction with the 2016 Reorganization, we granted restricted stock awards in exchange for the incentive units that were outstanding. The following table summarizes our restricted stock activity during the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2018, as adjusted for the Stock Split (as applicable):

<table>
<thead>
<tr>
<th>Number of Shares</th>
<th>Weighted Average Grant Date per Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outstanding, non-vested at January 1, 2016</td>
<td></td>
</tr>
<tr>
<td>Issued prior to the 2016 Reorganization</td>
<td>625,000</td>
</tr>
<tr>
<td>Vested prior to the 2016 Reorganization</td>
<td>—</td>
</tr>
<tr>
<td>Repurchased prior to the 2016 Reorganization</td>
<td>—</td>
</tr>
<tr>
<td>Exchanged as part of the 2016 Reorganization</td>
<td>—</td>
</tr>
<tr>
<td>Issued in conjunction with the 2016 Reorganization</td>
<td>(312,500)</td>
</tr>
<tr>
<td>Issued after the 2016 Reorganization</td>
<td>—</td>
</tr>
<tr>
<td>Vested as of and after the 2016 Reorganization</td>
<td>(9,146,841)</td>
</tr>
<tr>
<td>Repurchased after the 2016 Reorganization</td>
<td>(102,760)</td>
</tr>
<tr>
<td>Outstanding, non-vested at December 31, 2016</td>
<td>6,535,948</td>
</tr>
<tr>
<td>Issued</td>
<td>—</td>
</tr>
<tr>
<td>Vested</td>
<td>(3,482,872)</td>
</tr>
<tr>
<td>Cancelled/forfeited</td>
<td>—</td>
</tr>
<tr>
<td>Repurchased</td>
<td>(696,047)</td>
</tr>
<tr>
<td>Outstanding, non-vested at December 31, 2017</td>
<td>2,357,029</td>
</tr>
<tr>
<td>Issued (unaudited)</td>
<td>(1,643,999)</td>
</tr>
<tr>
<td>Vested (unaudited)</td>
<td>—</td>
</tr>
<tr>
<td>Cancelled/forfeited (unaudited)</td>
<td>—</td>
</tr>
<tr>
<td>Repurchased (unaudited)</td>
<td>45,336</td>
</tr>
<tr>
<td>Outstanding, non-vested at September 30, 2018 (unaudited)</td>
<td>667,694</td>
</tr>
</tbody>
</table>

The aggregate fair value of restricted stock awards vested during the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018, were $51.1 million, $21.1 million, $15.3 million (unaudited) and $10.3 million (unaudited), respectively.

F-69
Restricted Common Stock Units

The following table summarizes our restricted stock unit activity:

<table>
<thead>
<tr>
<th></th>
<th>Units</th>
<th>Weighted-Average Grant Date per Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outstanding, non-vested at January 1, 2017</td>
<td>—</td>
<td>$ —</td>
</tr>
<tr>
<td>Issued</td>
<td>1,500,000</td>
<td>5.47</td>
</tr>
<tr>
<td>Vested</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Cancelled/forfeited</td>
<td>(500,000)</td>
<td>5.47</td>
</tr>
<tr>
<td>Repurchased</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Outstanding, non-vested at December 31, 2017</td>
<td>1,000,000</td>
<td>$ 5.47</td>
</tr>
<tr>
<td>Outstanding, non-vested at September 30, 2018 (unaudited)</td>
<td>1,000,000</td>
<td>$ 5.47</td>
</tr>
</tbody>
</table>

The restricted stock units outstanding as of December 31, 2017 and September 30, 2018 (unaudited) are performance-based restricted stock units with vesting that is contingent on the closing of an IPO and completion of service period.

Stock-Based Compensation Expense

The following table presents the components and classification of stock-based compensation expense for the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018, as follows (in thousands):

|                                | Twelve Months Ended December 31 | Nine Months Ended September 30 (unaudited) |
|                                | 2016       | 2017       | 2017       | 2018       |
| Options                        | $23,607    | $31,724    | $22,624    | $37,228    |
| Restricted common stock and units | 11,370    | 8,331      | 6,403      | 3,696      |
| Common                         | 4,383      | —          | —          | —          |
| Total                          | $39,360    | $40,055    | $29,027    | $40,924    |
| Research and development       | $20,687    | $21,679    | $15,104    | $24,498    |
| General and administrative     | 18,673     | 18,376     | 13,923     | 16,426     |
| Total                          | $39,360    | $40,055    | $29,027    | $40,924    |

For the years ended December 31, 2016 and 2017, $1.2 million and $0.8 million, respectively, of stock-based compensation expense related to performance-based awards for which achievement of such performance-based condition was deemed probable. No stock-based compensation expense was recognized for the year ended December 31, 2017 for the performance-based restricted stock units granted in 2017. For the years ended December 31, 2016 and 2017, $2.4 million and $1.0 million, respectively, of stock-based compensation expense related to non-employee awards.

As of December 31, 2017 and September 30, 2018, there were $113.6 million and $170.4 million (unaudited), respectively, of total unrecognized compensation cost related to non-vested stock-based compensation with respect to options and restricted stock granted. That cost is expected to be recognized over a weighted-average period of 3.3 years and 3.6 years (unaudited) at December 31, 2017 and September 30, 2018, respectively.
11. Employee Benefit Plan

We provide a retirement savings option to our eligible U.S. employees through the Moderna, Inc. 401(k) Plan (the 401(k) Plan), subject to certain limitations. As allowed under Section 401(k) of the Internal Revenue Code, the 401(k) Plan allows tax deferred salary deductions for eligible employees. We match 50% up to the first 6% contributed by a participant. All matching contributions are immediately vested. Total matching contributions to the 401(k) Plan were $1.2 million, $2.1 million, $1.6 million (unaudited) and $1.5 million (unaudited) for the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018, respectively.

12. Income Taxes

Loss before provision for (benefit from) income taxes for the years ended December 31, 2016 and 2017 consist of the following (in thousands):

<table>
<thead>
<tr>
<th>Year Ended December 31,</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>$(211,786)</td>
<td>$(247,784)</td>
</tr>
<tr>
<td>Foreign</td>
<td>(3,382)</td>
<td>(8,212)</td>
</tr>
<tr>
<td>Loss before provision for (benefit from) income taxes</td>
<td>$(215,168)</td>
<td>$(255,996)</td>
</tr>
</tbody>
</table>

The provision for (benefit from) income taxes for the years ended December 31, 2016 and 2017 consist of the following components (in thousands):

<table>
<thead>
<tr>
<th>Year Ended December 31,</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal</td>
<td>$ 704</td>
<td>$(252)</td>
</tr>
<tr>
<td>State</td>
<td>51</td>
<td>172</td>
</tr>
<tr>
<td>Total current</td>
<td>755</td>
<td>(80)</td>
</tr>
<tr>
<td>Deferred:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal</td>
<td>288</td>
<td>—</td>
</tr>
<tr>
<td>Total deferred</td>
<td>288</td>
<td>—</td>
</tr>
<tr>
<td>Total income tax provision for (benefit from) income taxes</td>
<td>$1,043</td>
<td>$(80)</td>
</tr>
</tbody>
</table>
The reconciliation of the U.S. statutory income tax rate to our effective tax rate for the years ended December 31, 2016 and 2017 are as follows:

<table>
<thead>
<tr>
<th>Year Ended December 31,</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax effected at statutory rate</td>
<td>34.0%</td>
<td>34.0%</td>
</tr>
<tr>
<td>State taxes, net of federal benefit</td>
<td>5.1%</td>
<td>8.5%</td>
</tr>
<tr>
<td>Non-deductible items</td>
<td>(3.0%)</td>
<td>(1.3%)</td>
</tr>
<tr>
<td>Change in valuation allowance</td>
<td>(40.2%)</td>
<td>(20.4%)</td>
</tr>
<tr>
<td>Federal research and development credits</td>
<td>4.3%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Foreign tax rate differential</td>
<td>(0.5%)</td>
<td>(1.1%)</td>
</tr>
<tr>
<td>Impact of federal rate change on net deferred taxes</td>
<td>0.0%</td>
<td>(25.0%)</td>
</tr>
<tr>
<td>Other</td>
<td>(0.2%)</td>
<td>0.5%</td>
</tr>
<tr>
<td>Effective tax rate</td>
<td>(0.5%)</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

The significant components of our deferred tax assets and tax liabilities as of December 31, 2016 and 2017 are as follows (in thousands):

<table>
<thead>
<tr>
<th>As of December 31,</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deferred tax assets:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net operating loss carry-forwards</td>
<td>$142,577</td>
<td>$100,372</td>
</tr>
<tr>
<td>Stock-based compensation</td>
<td>11,397</td>
<td>15,637</td>
</tr>
<tr>
<td>Capitalized start-up costs</td>
<td>14,241</td>
<td>18,732</td>
</tr>
<tr>
<td>Tax credit carry-forwards</td>
<td>24,155</td>
<td>47,804</td>
</tr>
<tr>
<td>Accrued expenses</td>
<td>10,814</td>
<td>16,490</td>
</tr>
<tr>
<td>Deferred revenue</td>
<td>—</td>
<td>7,103</td>
</tr>
<tr>
<td>Other</td>
<td>1,646</td>
<td>1,997</td>
</tr>
<tr>
<td>Total gross deferred tax assets</td>
<td>$204,830</td>
<td>$208,135</td>
</tr>
<tr>
<td>Less: valuation allowance</td>
<td>(145,823)</td>
<td>(198,650)</td>
</tr>
<tr>
<td>Total deferred tax assets, net of valuation allowance</td>
<td>$59,007</td>
<td>$9,485</td>
</tr>
<tr>
<td>Deferred tax liabilities:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deferred revenue</td>
<td>(46,781)</td>
<td>—</td>
</tr>
<tr>
<td>Fixed assets</td>
<td>(12,226)</td>
<td>(9,485)</td>
</tr>
<tr>
<td>Total deferred tax liabilities</td>
<td>(59,007)</td>
<td>(9,485)</td>
</tr>
<tr>
<td>Net deferred tax assets</td>
<td>$ —</td>
<td>$ —</td>
</tr>
</tbody>
</table>

We have evaluated the positive and negative evidence bearing upon the realization of our deferred tax assets, including our history of losses and in accordance with the applicable accounting standards, has fully reserved the net deferred tax asset. We concluded that realization of our net deferred tax assets is more-likely-than-not to be realized. The valuation allowance increased by approximately $86.6 million in the year ended December 31, 2016, primarily due to the increase in net operating loss carry-forwards, stock-based compensation, and research and development tax credits. The valuation allowance increased by approximately $52.8 million in the year ended December 31, 2017, primarily due to an increase in the deferred tax assets related to deferred revenue, stock-based compensation, capitalized license and research and development tax credits.
As of December 31, 2016, we had gross federal and state net operating losses of approximately $1.4 million and $1.2 million, respectively, related to excess tax deductions that had been excluded from the above table. The benefit of these net operating losses would have been recognized as an increase in additional paid-in capital when it resulted in a reduction of taxes payable. In January 2017, we adopted ASU 2016-09, Improvements to Employee Share-Based Payment Accounting. As part of the adoption, we recorded $0.5 million additional deferred tax assets and charged to accumulated deficit, net of tax, related to previously unrecognized tax losses with an equal and offsetting adjustment to our valuation allowance. There was no impact of the adoption on our net deferred tax assets.

On December 22, 2017, the Tax Cuts and Jobs Act (the Act). The Act was enacted, among other things, contains significant changes to corporate taxation, including reduction of the corporate tax rate from a top marginal rate of 35% to a flat rate of 21%, limitation of the tax deduction for interest expense to 30% of adjusted earnings (except for certain small businesses), limitation of the deduction for net operating losses to 80% of current year taxable income and elimination of net operating loss carrybacks, one time taxation of offshore earnings at reduced rates regardless of whether they are repatriated, elimination of U.S. tax on foreign earnings (subject to certain important exceptions), immediate deductions for certain new investments instead of deductions for depreciation expense over time, and modifying or repealing many business deductions and credits.

Concurrent with the passing of the Act, the U.S. Securities and Exchange Commission (SEC) issued guidance under Staff Accounting Bulletin No. 118, Income Tax Accounting Implications of the Tax Cuts and Jobs Act directing taxpayers to consider the impact of the U.S. legislation as “provisional” when it does not have the necessary information available, prepared or analyzed (including computations) in reasonable detail to complete its accounting for the change in tax law.

We recognize changes in tax law, including the Act, in the period in which the law is enacted. Accordingly, the effects of the Act have been recognized in the financial statements for the year ended December 31, 2017. Items for which we were unable to determine a reasonable estimate, and thus are considered provisional, resulted in a $64.1 million reduction to deferred tax assets and a corresponding reduction in our valuation allowance. Our preliminary estimate of the effects of the Act, including the re-measurement of deferred tax assets and liabilities, is subject to the finalization of our analysis related to certain matters, such as developing interpretations of the provisions of the Act and the filing of our tax returns. U.S. Treasury regulations, administrative interpretations or court decisions interpreting the Act may require further adjustments and changes in estimates. The final determination of the effects of the Act will be completed as additional information becomes available, but no later than one year from the enactment of the Act. We will continue to refine our calculations as additional analysis is completed.

At December 31, 2017, we had approximately $380.4 million and $325.2 million of federal and state net operating loss carry-forwards, respectively, which begin to expire in 2030. At December 31, 2017 we also had federal and state research and development credit carry-forwards of approximately $31.3 million and $19.3 million, respectively, which begin to expire in 2028. At December 31, 2017, we also had state investment tax credit carry-forwards of approximately $2.1 million which begin to expire in 2018.

Utilization of the net operating loss (NOL) and tax credit carry-forwards may be subject to a substantial annual limitation due to ownership change limitations that have occurred previously, or that could occur in the future, as provided by Section 382 of the Internal Revenue Code of 1986, as amended, or Section 382, as well as similar state provisions and other provisions of the Internal Revenue Code. Ownership changes may limit the amount of NOLs and tax credit carry-forwards that can be utilized annually to offset future taxable income and tax, respectively. In general, an ownership change, as defined by Section 382, results from transactions that increase
the ownership of 5% shareholders in the stock of a corporation by more than 50% in the aggregate over a three-year period. We may experience ownership changes in the future as a result of subsequent shifts in our stock ownership, some of which may be outside our control.

We file income tax returns in the United States and the Commonwealth of Massachusetts. All tax years since the date of our incorporation remain open to examination by the major taxing jurisdictions (state and federal) to which we are subject, as carry-forward attributes generated in years past may still be adjusted upon examination by the Internal Revenue Service (IRS) or other authorities if they have or will be used in a future period. We are not currently under examination by the IRS, or any other jurisdictions, for any tax year.

We recognize, in our financial statements, the effect of a tax position when it is more likely than not, based on the technical merits, that the position will be sustained upon examination. We had unrecognized tax benefits of approximately $0.9 million as of December 31, 2017. A reconciliation of the beginning and ending amounts of unrecognized tax benefits during the two years ended December 31, 2016 and 2017 are as follows (in thousands):

<table>
<thead>
<tr>
<th></th>
<th>Balance as of December 31, 2015</th>
<th>$388</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decrease due to prior positions</td>
<td>518</td>
<td></td>
</tr>
<tr>
<td>Increase due to current year position</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>Balance as of December 31, 2016</td>
<td>906</td>
<td></td>
</tr>
<tr>
<td>Decrease due to prior positions</td>
<td>(15)</td>
<td></td>
</tr>
<tr>
<td>Increase due to current year tax position</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>Balance as of December 31, 2017</td>
<td>$940</td>
<td></td>
</tr>
</tbody>
</table>

Unrecognized tax benefits may change during the next twelve months for items that arise in the ordinary course of business. We do not anticipate a material change to our unrecognized tax benefits over the next twelve months that would have an adverse effect on our consolidated operating results. We recognize interest and penalties, if applicable, related to uncertain tax positions as a component of income tax expense; however, there have been none to date.

Prior to the 2016 Reorganization, Moderna LLC was taxed under the partnership provisions of the United States Internal Revenue Code of 1986, as amended (the Code). Accordingly, all income and deductions of Moderna LLC were reported on the members’ individual income tax returns, and no income taxes were recorded by Moderna LLC. Moderna LLC is a holding company, and does not have any business operations. All interests of members of Moderna LLC (the Members) were represented by their units of membership interests in Moderna LLC. Effective after the 2016 Reorganization, we are taxed as a C corporation.
13. Net Loss per Share and Unaudited Pro Forma Net Loss per Share

Net Loss per Share Attributable to Common Stockholders

Basic and diluted net loss per share attributable to common stockholders for the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018 are calculated as follows (in thousands, except share and per share data):

<table>
<thead>
<tr>
<th></th>
<th>Year Ended December 31,</th>
<th>Nine Months Ended September 30,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td>Numerator:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net loss</td>
<td>$ (216,211)</td>
<td>$ (255,916)</td>
</tr>
<tr>
<td>Accretion of redeemable convertible preferred units</td>
<td>(8,663)</td>
<td>—</td>
</tr>
<tr>
<td>Cumulative dividends on redeemable convertible preferred stock</td>
<td>(5,440)</td>
<td>(13,925)</td>
</tr>
<tr>
<td>Premium paid on repurchase of redeemable convertible preferred stock</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Net loss attributable to common stockholders</td>
<td>$ (230,314)</td>
<td>$ (269,841)</td>
</tr>
<tr>
<td>Denominator:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weighted average common shares used in net loss per share attributable to common stockholders, basic and diluted</td>
<td>132,429,389</td>
<td>140,604,647</td>
</tr>
<tr>
<td>Net loss per share attributable to common stockholders, basic and diluted</td>
<td>$ (1.74)</td>
<td>$ (1.92)</td>
</tr>
</tbody>
</table>

The following common stock equivalents, presented based on amounts outstanding as of December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018 were excluded from the calculation of diluted net loss per share attributable to common stockholders for the periods indicated because their inclusion would have been anti-dilutive:

<table>
<thead>
<tr>
<th></th>
<th>December 31,</th>
<th>September 30,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2017 (unaudited)</td>
</tr>
<tr>
<td>Redeemable convertible preferred stock</td>
<td>445,877,185</td>
<td>446,315,101</td>
</tr>
<tr>
<td>Stock options</td>
<td>56,007,827</td>
<td>73,431,414</td>
</tr>
<tr>
<td>Restricted common stock</td>
<td>6,535,948</td>
<td>2,357,029</td>
</tr>
<tr>
<td>Restricted common stock units</td>
<td>—</td>
<td>1,000,000</td>
</tr>
<tr>
<td></td>
<td>508,420,960</td>
<td>523,103,544</td>
</tr>
</tbody>
</table>

Unaudited Pro Forma Net Loss per Share Attributable to Common Stockholders

The unaudited pro forma basic and diluted net loss per share attributable to common stockholders in the consolidated statement of operations for the year ended December 31, 2017 and the nine months ended September 30, 2018 were computed to give effect of the following as if the IPO had occurred on the later of...
January 1, 2017 or the date the equity instruments were issued or vested: (i) the automatic conversion of all outstanding shares of redeemable convertible preferred stock into shares of common stock, considering the impact of shares that were repurchased; (ii) the vesting of a performance-based restricted stock unit award with vesting conditions contingent upon the closing of the proposed IPO and the recognition of additional stock-based compensation expense; (iii) additional stock-based compensation expense related to a stock option award that will be granted effective upon the closing of the proposed IPO; (iv) excludes the impact of cumulative dividends reflected within the net loss attributable to common stockholders; and (v) excludes the impact of the premium paid on the repurchase of redeemable convertible preferred stock reflected within the net loss attributable to common stockholders.

Unaudited pro forma basic and diluted net loss per share attributable to common stockholders for the year ended December 31, 2017 and the nine months ended September 30, 2018 are calculated as follows (in thousands, except share and per share data):

<table>
<thead>
<tr>
<th></th>
<th>Year Ended December 31, 2017</th>
<th>Nine Months Ended September 30, 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Numerator:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net loss attributable to common stockholders</td>
<td>$(269,841)</td>
<td>$(257,758)</td>
</tr>
<tr>
<td>Cumulative dividends on redeemable convertible preferred stock</td>
<td>$13,925</td>
<td>$10,323</td>
</tr>
<tr>
<td>Premium paid on repurchase of redeemable convertible preferred stock</td>
<td>—</td>
<td>$4,127</td>
</tr>
<tr>
<td>Stock-based compensation expense for stock-based award with vesting conditions contingent upon an initial public offering</td>
<td>$(4,725)</td>
<td>$(4,105)</td>
</tr>
<tr>
<td><strong>Pro forma net loss attributable to common stockholders</strong></td>
<td>$(260,641)</td>
<td>$(247,413)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Denominator:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Weighted average common shares used in net loss per share attributable to common stockholders, basic and diluted</td>
<td>140,604,647</td>
</tr>
<tr>
<td>Pro forma adjustment for the automatic conversion of all outstanding shares of redeemable convertible preferred stock into shares of common stock</td>
<td>445,877,185</td>
</tr>
<tr>
<td>Pro forma adjustment for the vesting of stock-based award with vesting conditions contingent upon an initial public offering</td>
<td>361,644</td>
</tr>
<tr>
<td><strong>Pro forma weighted average common shares used in pro forma net loss per share attributable to common stockholders, basic and diluted</strong></td>
<td>586,843,476</td>
</tr>
<tr>
<td><strong>Pro forma net loss per share attributable to common stockholders, basic and diluted</strong></td>
<td>$(0.44)</td>
</tr>
</tbody>
</table>

(1) The conversion ratio for our redeemable convertible preferred stock is based on its respective conversion ratio. For purposes of determining the unaudited pro forma information, we utilize the fair value per share of our common stock as determined in a contemporaneous valuation as of the date the transaction is assumed to have occurred.
14. Related Party Transactions

Series G Redeemable Convertible Preferred Stock Financing

On January 30, 2018 and on February 12, 2018, respectively, we entered into Series G Preferred Stock Purchase Agreements, pursuant to which we issued and sold an aggregate of 55,666,004 shares of our Series G redeemable convertible preferred stock at a price per share of $10.06, for an aggregate purchase price of $560.0 million. The following table sets forth the number of shares of our Series G redeemable convertible preferred stock that we issued to our related parties in this transaction (in thousands, except share data):

<table>
<thead>
<tr>
<th>Name</th>
<th>Shares of Series G Redeemable Convertible Preferred Stock</th>
<th>Total Purchase Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCHA LLC (1)</td>
<td>50,000</td>
<td>$ 503</td>
</tr>
</tbody>
</table>

(1) OCHA LLC is an entity controlled by an officer.

Series F Redeemable Convertible Preferred Stock Financing

On August 10, 2016, we entered into a Series F redeemable convertible preferred stock Purchase Agreement pursuant to which we issued and sold an aggregate of 54,001,241 shares of our Series F redeemable convertible preferred stock at a price per share of $8.78, for an aggregate purchase price of $474.0 million. The following table sets forth the number of shares of our Series F redeemable convertible preferred stock that we issued to our related parties in this transaction (in thousands, except share data):

<table>
<thead>
<tr>
<th>Name</th>
<th>Shares of Series F Redeemable Convertible Preferred Stock</th>
<th>Total Purchase Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>AstraZeneca and affiliated entities</td>
<td>15,945,330</td>
<td>$ 140,000</td>
</tr>
<tr>
<td>Boston Biotech Ventures LLC (1)</td>
<td>10,000</td>
<td>$ 88</td>
</tr>
</tbody>
</table>

(1) Boston Biotech Ventures LLC is an entity controlled by an officer.

Other Transactions

The following is a description of additional transactions we have engaged in for the year ended December 31, 2016 and 2017, with our related parties.

One of our board members currently serves as Senior Counsel at Covington & Burling LLP (Covington). We paid Covington approximately $0.2 million for legal services for both the year ended December 31, 2017 and the nine months ended September 30, 2018 (unaudited). We had no outstanding accounts payable balances to Covington at December 31, 2017 and 2016 and September 30, 2018.

AstraZeneca is considered to be a related party due to its equity ownership in us. We have also entered into strategic alliances with AstraZeneca. For the years ended December 31, 2016 and 2017 and the nine months ended September 30, 2017 and 2018, we received payments of $72.0 million, $1.1 million, $0.9 million (unaudited) and $32.4 million (unaudited), respectively. Refer to Note 3 for a discussion of the strategic alliances and related transactions.
15. Subsequent Events

We have completed an evaluation of all subsequent events after the audited balance sheet date of December 31, 2017 and the unaudited balance sheet date of September 30, 2018 through the filing date of this Registration Statement on Form S-1 with the SEC, to ensure that these consolidated financial statements include appropriate disclosure of events both recognized in the consolidated financial statements as of December 31, 2017 and September 30, 2018, and events which occurred subsequently but were not recognized in the consolidated financial statements. We have concluded that no subsequent events have occurred that require disclosure, except as disclosed within these consolidated financial statements and except as described below.

a. Series G Redeemable Convertible Preferred Stock

On January 30, 2018 and February 12, 2018, we issued Series G redeemable convertible preferred stock for total gross proceeds of $560.0 million (Note 9).

b. Series H Redeemable Convertible Preferred Stock

On May 7, 2018, we issued Series H redeemable convertible preferred stock for total gross proceeds of $125.0 million, of which $13.0 million is determined to be a premium, and recorded to deferred revenue as part of the Merck PCV/SAV Agreement executed contemporaneously (Note 9).

c. 2018 Expansion of the Cancer Vaccine Strategic Alliance—Shared Neoepitope Cancer Vaccines

In April 2018, we and Merck agreed to expand our cancer vaccine strategic alliance to include the development and commercialization of our KRAS vaccine development candidate, mRNA-5671, and potentially other shared neoantigen mRNA cancer vaccines (SAVs). We preclinically developed mRNA-5671 prior to its inclusion in the cancer vaccine strategic alliance and it is comprised of novel mRNA constructs designed by us and encapsulated in one of our proprietary LNPs. The PCV Agreement was amended and restated to include the new SAV strategic alliance (PCV/SAV Agreement).

We have granted Merck certain licenses and we and Merck have agreed to certain exclusivity obligations with respect to SAVs and particular SAV programs, which obligations are subject to termination or expiration upon certain triggering events.

Under the PCV/SAV Agreement, Merck will be responsible for conducting Phase 1 and Phase 2 clinical trials for mRNA-5671 and for all costs associated with such activities, in accordance with a jointly agreed development plan and budget, and we will be responsible for manufacturing and supplying all mRNA-5671 required to conduct such trials and for all costs and expenses associated with such manufacture and supply. Under the PCV/SAV Agreement, our budgeted commitment for PCVs increased to $243.0 million. Until the expiration of a defined period of time following our completion of Phase 1 and Phase 2 clinical trials for mRNA-5671 under the PCV/SAV Agreement and delivery of an associated data package to Merck, Merck has the right to elect to participate in future development and commercialization of mRNA-5671 by making a participation payment to us. If Merck exercises its participation rights, then the parties will equally co-fund subsequent clinical development of mRNA-5671, with Merck primarily responsible for conducting clinical development activities under a jointly agreed development plan and budget. If Merck declines to participate in future development and commercialization activities following the initial Phase 1 and Phase 2 clinical trials for mRNA-5671, then we will retain the rights to develop and commercialize mRNA-5671. If Merck elects to participate in future development and commercialization of mRNA-5671, Merck may also conduct additional clinical trials for
mRNA-5671 that are not included in the jointly agreed development plan and budget, in which case we will reimburse Merck for half of the total
development costs for such clinical trials, plus interest, from our share of future profits resulting from sales of mRNA-5671, if any. If Merck does
direct additional clinical trials for mRNA-5671, we will be responsible for manufacturing and supplying all mRNA-5671 required to conduct such
trials. Merck will lead worldwide commercialization of mRNA-5671, subject to our option to co-promote mRNA-5671 in the United States, and the
parties will equally share the operating profits or losses arising from worldwide commercialization. Until mRNA-5671 becomes profitable, we may
elect to defer payment of our share of the commercialization and related manufacturing costs and instead reimburse Merck for such costs, plus interest,
from our share of future profits resulting from sales of mRNA-5671, if any. Subject to “back-up” supply rights granted to Merck, we will manufacture
(or have manufactured) mRNA-5671 and other SAVs for preclinical and clinical purposes. After Merck exercises its right to participate in future
development and commercialization of mRNA-5671 and other SAVs, we will grant the applicable development and commercialization licenses and
the parties are obligated to discuss responsibility for future manufacturing, giving consideration to applicable criteria.

Pursuant to the PCV/SAV Agreement, for a defined period of time, either party may propose that the parties conduct additional programs for the
research and development of SAVs directed to different shared neoantigens. If the parties agree to conduct any such programs, then we will be
responsible for conducting and funding preclinical discovery and research activities for such SAVs, and otherwise the programs would be conducted
on substantially the same terms as mRNA-5671 program. If we or Merck propose a new SAV program and the other party does not agree to conduct
such program, then the PCV/SAV Agreement includes provisions allowing the proposing party to proceed with such development, at the proposing
party’s expense. If Merck is the proposing party, we will be responsible for manufacturing and supplying material for such program at Merck’s expense.

In such case, the non-proposing party will have the right to opt-in to such SAV program any time before the proposing party commits to performing
Good Laboratory Practice (GLP)-toxicity studies. Until the expiration of a defined period of time following our completion of Phase 1 and Phase 2
clinical trials for any SAV program mutually agreed by the parties under the PCV/SAV Agreement and delivery of an associated data package to
Merck, Merck has the right to elect to participate in future development and commercialization of such SAV by making a participation payment to us.

Unless earlier terminated, the PCV/SAV Agreement will continue on a program-by-program basis until Merck terminates its participation in such
program. Following any such termination, we will retain the exclusive right to develop and commercialize PCVs or SAVs developed as a part of such
program, subject to restrictions and certain limited rights retained by Merck.

In connection with the amendment of the PCV Agreement to include the development and commercialization of mRNA-5671 and potentially other
SAVs, Merck made a $125.0 million equity investment in our Series H redeemable convertible preferred stock (Note 3).

d. 2013 Agreements with AstraZeneca, amended and restated in 2018

In March 2013, we entered into an Option Agreement and a related Services and Collaboration Agreement with AstraZeneca, which were amended and
restated in June 2018 (2018 A&R Agreements). Under the 2018 A&R Agreements, we granted AstraZeneca certain exclusive rights and licenses to
research, develop and commercialize potential therapeutic mRNA medicines directed at certain targets for the treatment of cardiovascular and
cardiometabolic diseases and cancer, and agreed to provide related services to AstraZeneca. The activities to be performed by the parties under the
2018 A&R Agreements are limited to defined biological targets in the cardiovascular and cardiometabolic fields and one defined target in the cancer
field.
Pursuant to the 2018 A&R Agreements, AstraZeneca is responsible for all research, development and commercialization activities and associated costs, while we provide specified research and manufacturing services, at AstraZeneca’s expense, during a research and evaluation period, as described below, to further AstraZeneca’s activities conducted pursuant to an agreed upon services plan. AstraZeneca may request we provide additional services, at AstraZeneca’s expense, following the end of the research and evaluation period. Subject to customary “back-up” supply rights granted to AstraZeneca, we exclusively manufacture (or have manufactured) mRNA for all research, development and commercialization purposes under the 2018 A&R Agreements until, on a product-by-product basis, the expiration of the time period for which we are entitled to receive earn-out payments with respect to such product pursuant to the 2018 A&R Agreements.

As of the effective date of the 2013 AZ Agreements, AstraZeneca acquired forty options that it may exercise to obtain exclusive rights to clinically develop and commercialize identified development candidates (and related back-up candidates) directed to specified targets that arise during the research and evaluation period. During the research and evaluation period for research candidates, AstraZeneca may select one or more research candidates as development candidates in order to continue preclinical development on such development candidates (and related back-up candidates). From such pool of development candidates designated by AstraZeneca, during a specified option exercise period, AstraZeneca may then exercise one of its options to obtain exclusive rights to clinically develop and commercialize an identified development candidate (and related back-up candidates) certain fields. If AstraZeneca does not exercise one of its options to acquire exclusive rights to clinically develop and commercialize a particular development candidate during the defined option exercise period for such development candidate, AstraZeneca’s rights to exercise an option and other rights granted under the 2018 A&R Agreements with respect to such development candidate (and related back-up candidates) will terminate, all rights to exploit such development candidate (and related back-up candidates) will be returned to us and all data and results generated by AstraZeneca with respect to such development candidate (and related back-up candidates) will be either assigned or licensed to us. Upon the earlier of termination of the 2018 A&R Agreements for any reason and a specified anniversary of the effective date of the 2013 AZ Agreements, all unexercised options, and the right to exercise any and all options if not previously exercised by AstraZeneca, will automatically terminate.

On a target-by-target basis, we and AstraZeneca have agreed to certain defined exclusivity obligations under the 2018 A&R Agreements with respect to the research, development and commercialization of mRNA medicines for such target in certain fields. In addition, we and AstraZeneca have agreed to certain defined exclusivity obligations with respect to the research, development and commercialization of mRNA medicines coding for the same polypeptide as any development candidate being developed under the 2018 A&R Agreements.

Unless earlier terminated, the 2018 A&R Agreements will continue until the expiration of AstraZeneca’s earn-out and contingent option exercise payment obligations for optioned product candidates. Either party may terminate the 2018 A&R Agreements upon the other party’s material breach, either in its entirety or in certain circumstances, with respect to relevant candidates, subject to a defined materiality threshold and specified notice and cure provisions. If AstraZeneca has the right to terminate the 2018 A&R Agreements for our material breach, then AstraZeneca may elect, in lieu of terminating the 2018 A&R Agreements, in their entirety or with respect to such candidates, to have the 2018 A&R Agreements remain in effect, subject to reductions in certain payments we are eligible to receive and certain adjustments to AstraZeneca’s obligations under the 2018 A&R Agreements. AstraZeneca may terminate the 2018 A&R Agreements in full, without cause, upon 90 days’ prior notice to us (Note 3).

e. Milestone Payment

In May 2018, we received a clinical milestone payment of $30.0 million for AZD8601 (Note 3).
f. Norwood Manufacturing Facility

In July 2018, we officially opened our Norwood manufacturing facility. We will reclassify related balances from construction in progress to their appropriate asset classes, and will start to depreciate those assets over their applicable useful lives (Note 7).

g. DARPA

In July 2018, an additional $2.4 million was committed for funding for a total commitment of $19.7 million. Additionally, the potential award was adjusted to $19.7 million.
Until [ ] (the 25th day after the date of this prospectus), all dealers that effect buy, sell or trade shares of our common stock, whether or not participating in this offering, may be required to deliver a prospectus. This is in addition to the dealers’ obligation to deliver a prospectus when acting as underwriter and with respect to their unsold allotments or subscriptions.
PART II

Information not required in Prospectus

Item 13. Other expenses of issuance and distribution.

The following table sets forth the fees and expenses, other than underwriting discounts and commissions, payable in connection with the registration of the common stock hereunder. All amounts are estimates except the SEC registration fee.

<table>
<thead>
<tr>
<th>Amount to be Paid</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEC registration fee</td>
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<tr>
<td>FINRA filing fee</td>
</tr>
<tr>
<td>Nasdaq listing fee</td>
</tr>
<tr>
<td>Printing and mailing</td>
</tr>
<tr>
<td>Legal fees and expenses</td>
</tr>
<tr>
<td>Accounting fees and expenses</td>
</tr>
<tr>
<td>Transfer agent and registrar fees and expenses</td>
</tr>
<tr>
<td>Miscellaneous</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

* To be filed by amendment.


Section 145 of the Delaware General Corporation Law, or the DGCL, authorizes a corporation to indemnify its directors and officers against liabilities arising out of actions, suits and proceedings to which they are made or threatened to be made a party by reason of the fact that they have served or are currently serving as a director or officer to a corporation. The indemnity may cover expenses (including attorneys' fees) judgments, fines and amounts paid in settlement actually and reasonably incurred by the director or officer in connection with any such action, suit or proceeding. Section 145 permits corporations to pay expenses (including attorneys' fees) incurred by directors and officers in advance of the final disposition of such action, suit or proceeding. In addition, Section 145 provides that a corporation has the power to purchase and maintain insurance on behalf of its directors and officers against any liability asserted against them and incurred by them in their capacity as a director or officer, or arising out of their status as such, whether or not the corporation would have the power to indemnify the director or officer against such liability under Section 145.

We have adopted provisions in our certificate of incorporation to be in effect upon the closing of this offering and bylaws to be in effect upon the effectiveness of the registration statement of which this prospectus is a part that limit or eliminate the personal liability of our directors to the fullest extent permitted by the DGCL, as it now exists or may in the future be amended. Consequently, a director will not be personally liable to us or our stockholders for monetary damages or breach of fiduciary duty as a director, except for liability for:

- any breach of the director's duty of loyalty to us or our stockholders;
- any act or omission not in good faith or that involves intentional misconduct or a knowing violation of law;
- any unlawful payments related to dividends or unlawful stock purchases, redemptions or other distributions; or
- any transaction from which the director derived an improper personal benefit.

These limitations of liability do not alter director liability under the federal securities laws and do not affect the availability of equitable remedies such as an injunction or rescission.
In addition, our bylaws provide that:

• we will indemnify our directors, officers and, in the discretion of our board of directors, certain employees to the fullest extent permitted by the DGCL, as it now exists or may in the future be amended; and

• we will advance reasonable expenses, including attorneys’ fees, to our directors and, in the discretion of our board of directors, to our officers and certain employees, in connection with legal proceedings relating to their service for or on behalf of us, subject to limited exceptions.

We have entered into indemnification agreements with each of our directors and intend to enter into such agreements with certain of our executive officers. These agreements provide that we will indemnify each of our directors, certain of our executive officers and, at times, their affiliates to the fullest extent permitted by Delaware law. We will advance expenses, including attorneys’ fees (but excluding judgments, fines and settlement amounts), to each indemnified director, executive officer or affiliate in connection with any proceeding in which indemnification is available and we will indemnify our directors and officers for any action or proceeding arising out of that person’s services as a director or officer brought on behalf of us or in furtherance of our rights. Additionally, certain of our directors or officers may have certain rights to indemnification, advancement of expenses or insurance provided by their affiliates or other third parties, which indemnification relates to and might apply to the same proceedings arising out of such director’s or officer’s services as a director referenced herein. Nonetheless, we have agreed in the indemnification agreements that our obligations to those same directors or officers are primary and any obligation of such affiliates or other third parties to advance expenses or to provide indemnification for the expenses or liabilities incurred by those directors are secondary.

We also maintain general liability insurance which covers certain liabilities of our directors and officers arising out of claims based on acts or omissions in their capacities as directors or officers, including liabilities under the Securities Act of 1933, as amended, or the Securities Act.

The underwriting agreement filed as Exhibit 1.1 to this registration statement provides for indemnification of us and our directors and officers by the underwriters against certain liabilities under the Securities Act and the Securities Exchange Act of 1934.

Item 15. Recent sales of unregistered securities.

The following list sets forth information regarding all unregistered securities sold by us in the past three years. No underwriters were involved in the sales and the certificates representing the securities sold and issued contain legends restricting transfer of the securities without registration under the Securities Act or an applicable exemption from registration.

(a) Reorganization

On August 10, 2016, we completed a series of transactions pursuant to which Moderna LLC, a Delaware limited liability company, merged with and into MT MergerSub, Inc., a Delaware corporation and our wholly owned subsidiary, and Moderna LLC continued to exist as the surviving corporation and our wholly owned subsidiary. We refer to this series of transactions, including the related contemporaneous ten-for-one forward stock split, as the 2016 Reorganization. As part of the transactions: (i) each issued and outstanding redeemable convertible preferred unit and common unit of Moderna LLC outstanding as of the Reorganization was exchanged for shares of redeemable convertible preferred stock and common stock, respectively, of Moderna Therapeutics, Inc.; (ii) previously outstanding incentive units of Moderna LLC were exchanged for shares of restricted common stock; (iii) previously outstanding options to purchase common units of Moderna LLC were exchanged for options to purchase common stock of Moderna Therapeutics, Inc.; and (iv) for the effects of the ten-for-one forward stock split. The 2016 Reorganization was effected pursuant to an Agreement and Plan of Merger between Moderna LLC, MergerSub and Moderna Therapeutics, Inc. and did not constitute a sale for purposes of the Securities Act.
Sales of Securities

The following list sets forth information regarding all unregistered securities sold by us since our inception on July 22, 2016 through November 9, 2018.

1. On August 10, 2016, we issued and sold an aggregate of 54,001,241 shares of our Series F preferred stock to 77 accredited investors at a per share purchase price of $8.78 for aggregate gross consideration of $474 million.

2. On January 30, 2018 and February 15, 2018, we issued and sold an aggregate of 55,666,004 shares of our Series G preferred stock to 92 accredited investors at a per share purchase price of $10.06 for aggregate gross consideration of $560 million.

3. On May 7, 2018, we issued and sold an aggregate of 5,000,000 shares of our Series H preferred stock to one accredited investor at a per share purchase price of $25.00 for aggregate gross consideration of $125 million.

4. Since July 22, 2016, we issued to certain of our employees, consultants and board members equity representing an aggregate of 15,785,549 shares of restricted common stock, issued resulting from the 2016 Reorganization, and an aggregate of 1,500,000 shares of restricted stock units.

5. Since July 22, 2016, we issued to certain of our employees, consultants and board members options to purchase an aggregate of 110,955,595 shares of our common stock, including 50,867,683 options issued resulting from the 2016 Reorganization, in exchange for their services to us.

All certificates representing the securities issued in the transactions described in this Item 15 included appropriate legends setting forth that the securities had not been offered or sold pursuant to a registration statement and describing the applicable restrictions on transfer of the securities. There were no underwriters employed in connection with any of the transactions set forth in this Item 15.

Item 16. Exhibits and financial statement schedules.

(a) Exhibits

<table>
<thead>
<tr>
<th>Exhibit No.</th>
<th>Exhibit Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1*</td>
<td>Form of Underwriting Agreement.</td>
</tr>
<tr>
<td>3.1</td>
<td>Third Amended and Restated Certificate of Incorporation of the Registrant, as amended, as currently in effect.</td>
</tr>
<tr>
<td>3.2</td>
<td>Form of Fourth Amended and Restated Certificate of Incorporation of the Registrant (to be effective upon completion of this offering).</td>
</tr>
<tr>
<td>3.3</td>
<td>By-laws of the Registrant, as currently in effect.</td>
</tr>
<tr>
<td>3.4</td>
<td>Form of Amended and Restated By-laws (to be effective upon completion of this offering).</td>
</tr>
<tr>
<td>4.1</td>
<td>Specimen Common Stock Certificate</td>
</tr>
<tr>
<td>4.2</td>
<td>Second Amended and Restated Investors’ Rights Agreement by and among the Registrant and certain of its stockholders, dated May 7, 2018.</td>
</tr>
<tr>
<td>5.1*</td>
<td>Opinion of Goodwin Procter LLP.</td>
</tr>
<tr>
<td>10.1#</td>
<td>2016 Stock Option and Grant Plan, as amended, and forms of award agreements thereunder.</td>
</tr>
<tr>
<td>10.2#</td>
<td>2018 Stock Option and Incentive Plan and forms of award agreements thereunder.</td>
</tr>
<tr>
<td>10.3#</td>
<td>Form of Indemnification Agreement between the Registrant and each of its directors.</td>
</tr>
<tr>
<td>Section</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>10.4†</td>
<td>Master Collaboration and License Agreement, by and between Moderna Therapeutics, Inc. and Merck Sharp &amp; Dohme Corp., dated as of January 12, 2015, as amended by Amendment No. 1 dated as of January 8, 2016, Amendment No. 2 dated as of June 28, 2016, Amendment No. 3 dated as of June 28, 2016, and Amendment No. 4 dated as of June 28, 2016.</td>
</tr>
<tr>
<td>10.5†</td>
<td>Amended and Restated mRNA Cancer Vaccine Collaboration and License Agreement, by and between ModernaTX, Inc. and Merck Sharp &amp; Dohme Corp., dated as of April 17, 2018.</td>
</tr>
<tr>
<td>10.6†</td>
<td>Amended and Restated Option Agreement by and between ModernaTx, Inc. and AstraZeneca AB, dated as of June 15, 2018.</td>
</tr>
<tr>
<td>10.7†</td>
<td>Amended and Restated Services and Collaboration Agreement by and between ModernaTx, Inc. and AstraZeneca AB, dated as of June 15, 2018.</td>
</tr>
<tr>
<td>10.8†</td>
<td>Patent Sublicense Agreement, by and among ModernaTx, Inc. and Cellscript, LLC and mRNA RiboTherapeutics, Inc. (solely with respect to certain provisions), dated as of June 26, 2017.</td>
</tr>
<tr>
<td>10.9</td>
<td>Lease Agreement, by and between Moderna Therapeutics, Inc. and ARE-Tech Square, LLC, dated as of May 26, 2016, as amended by Amendment No. 1 dated as of August 31, 2016, Amendment No. 2 dated as of December 31, 2016, Amendment No. 3 dated as of April 24, 2017, and Amendment No. 4 dated as of April 13, 2018.</td>
</tr>
<tr>
<td>10.10</td>
<td>Net Lease by and between Moderna Therapeutics, Inc. and Campanelli-TriGate Norwood Upland, LLC, dated as of August 29, 2016, as amended by Amendment No. 1 dated as of April 10, 2017 and Amendment No. 2 dated as of March 16, 2018.</td>
</tr>
<tr>
<td>10.11#</td>
<td>Amended and Restated Executive Severance Plan and Form of Participation Letter, as amended on November 4, 2018.</td>
</tr>
<tr>
<td>10.12#</td>
<td>Offer Letter by and between the Company and Stéphane Bancel, dated as of February 23, 2011.</td>
</tr>
<tr>
<td>10.13#</td>
<td>Offer Letter by and between the Company and Stephen Hoge, dated as of November 16, 2012.</td>
</tr>
<tr>
<td>10.14#</td>
<td>Offer Letter by and between the Company and Lorence Kim, dated as of February 20, 2014.</td>
</tr>
<tr>
<td>10.15#</td>
<td>Letter Agreement by and between the Company and Stéphane Bancel, dated as of June 13, 2018, as amended by Amendment No. 1 dated as of November 4, 2018.</td>
</tr>
<tr>
<td>10.16#</td>
<td>Letter Agreement by and between the Company and Stephen Hoge, dated as of October 17, 2017.</td>
</tr>
<tr>
<td>10.17#</td>
<td>Senior Executive Cash Incentive Bonus Plan.</td>
</tr>
<tr>
<td>10.18#</td>
<td>Non-Employee Director Compensation Policy.</td>
</tr>
<tr>
<td>10.19#</td>
<td>Form of Indemnification Agreement between the Registrant and each of its officers.</td>
</tr>
<tr>
<td>10.20#</td>
<td>2018 Employee Stock Purchase Plan.</td>
</tr>
<tr>
<td>21.1</td>
<td>Subsidiaries of the Registrant.</td>
</tr>
<tr>
<td>23.1</td>
<td>Consent of Ernst &amp; Young LLP, Independent Registered Public Accounting Firm.</td>
</tr>
<tr>
<td>23.2*</td>
<td>Consent of Goodwin Procter LLP (included in Exhibit 5.1).</td>
</tr>
<tr>
<td>24.1</td>
<td>Power of Attorney (included on signature page).</td>
</tr>
</tbody>
</table>

* To be included by amendment.
† Application has been made to the Securities and Exchange Commission for confidential treatment of certain provisions. Omitted material for which confidential treatment has been requested has been filed separately with the Securities and Exchange Commission.
# Indicates a management contract or any compensatory plan, contract or arrangement.
Item 17. Undertakings.

Insofar as indemnification for liabilities arising under the Securities Act of 1933, as amended, or the Act, may be permitted to directors, officers and controlling persons of the Registrant pursuant to the foregoing provisions, or otherwise, the Registrant has been advised that in the opinion of the Securities and Exchange Commission such indemnification is against public policy as expressed in the Act and is therefore unenforceable. In the event that a claim for indemnification against such liabilities (other than the payment by the Registrant of expenses incurred or paid by a director, officer or controlling person of the Registrant in the successful defense of any action, suit or proceeding) is asserted by such director, officer or controlling person in connection with the securities being registered, the Registrant will, unless in the opinion of its counsel the matter has been settled by controlling precedent, submit to a court of appropriate jurisdiction the question whether such indemnification by it is against public policy as expressed in the Act and will be governed by the final adjudication of such issue.

The Registrant hereby undertakes that:

(a) The Registrant will provide to the underwriter at the closing as specified in the underwriting agreement, certificates in such denominations and registered in such names as required by the underwriter to permit prompt delivery to each purchaser.

(b) For purposes of determining any liability under the Securities Act of 1933, as amended, the information omitted from a form of prospectus filed as part of this registration statement in reliance upon Rule 430A and contained in the form of prospectus filed by the Registrant pursuant to Rule 424(b)(1) or (4) or 497(h) under the Securities Act of 1933, as amended, shall be deemed to be part of this registration statement as of the time it was declared effective.

(c) For the purpose of determining any liability under the Securities Act of 1933, as amended, each post-effective amendment that contains a form of prospectus shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at that time shall be deemed to be the initial bona fide offering thereof.

II-5
SIGNATURES

Pursuant to the requirements of the Securities Act of 1933, the registrant has duly caused this Registration Statement on Form S-1 to be signed on its behalf by the undersigned, thereunto duly authorized, in the City of Cambridge, Commonwealth of Massachusetts, on the 9th day of November, 2018.

MODERNA, INC.

By: /s/ Stéphane Bancel

Stéphane Bancel
Chief Executive Officer

POWER OF ATTORNEY AND SIGNATURES

Each individual whose signature appears below hereby constitutes and appoints each of Stéphane Bancel and Lorence Kim and as such person’s true and lawful attorney-in-fact and agent with full power of substitution and resubstitution, for such person in such person’s name, place and stead, in any and all capacities, to sign any and all amendments (including post-effective amendments) to this Registration Statement (or any Registration Statement for the same offering that is to be effective upon filing pursuant to Rule 462(b) under the Securities Act of 1933), and to file the same, with all exhibits thereto, and all documents in connection therewith, with the Securities and Exchange Commission granting unto each said attorney-in-fact and agent full power and authority to do and perform each and every act and thing requisite and necessary to be done in and about the premises, as fully to all intents and purposes as such person might or could do in person, hereby ratifying and confirming all that any said attorney-in-fact and agent, or any substitute or substitutes of any of them, may lawfully do or cause to be done by virtue hereof.

Pursuant to the requirements of the Securities Act of 1933, as amended, this Registration Statement and Power of Attorney has been signed by the following person in the capacities and on the date indicated.

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>/s/ Stéphane Bancel</td>
<td>Chief Executive Officer and Director</td>
<td>November 9, 2018</td>
</tr>
<tr>
<td>Stéphane Bancel</td>
<td>(Principal Executive Officer)</td>
<td></td>
</tr>
<tr>
<td>/s/ Lorence Kim</td>
<td>Chief Financial Officer</td>
<td>November 9, 2018</td>
</tr>
<tr>
<td>Lorence Kim, M.D.</td>
<td>(Principal Financial Officer)</td>
<td></td>
</tr>
<tr>
<td>/s/ Jennifer Lee</td>
<td>Chief Accounting Officer</td>
<td>November 9, 2018</td>
</tr>
<tr>
<td>Jennifer Lee</td>
<td>(Principal Accounting Officer)</td>
<td></td>
</tr>
<tr>
<td>/s/ Noubar B. Afeyan</td>
<td>Chairman and Director</td>
<td>November 9, 2018</td>
</tr>
<tr>
<td>Noubar B. Afeyan, Ph.D.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>/s/ Stephen Berenson</td>
<td>Director</td>
<td>November 9, 2018</td>
</tr>
<tr>
<td>Stephen Berenson</td>
<td></td>
<td></td>
</tr>
<tr>
<td>/s/ Peter Barton Hutt</td>
<td>Director</td>
<td>November 9, 2018</td>
</tr>
<tr>
<td>Peter Barton Hutt, LL.M.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>/s/ Robert Langer</td>
<td>Director</td>
<td>November 9, 2018</td>
</tr>
<tr>
<td>Robert Langer, Sc.D.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signature</td>
<td>Name</td>
<td>Title</td>
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</tr>
<tr>
<td>/s/ Elizabeth Nabel</td>
<td>Elizabeth Nabel, M.D.</td>
<td>Director</td>
</tr>
<tr>
<td>/s/ Israel Ruiz</td>
<td>Israel Ruiz</td>
<td>Director</td>
</tr>
<tr>
<td>/s/ Paul Sagan</td>
<td>Paul Sagan</td>
<td>Director</td>
</tr>
<tr>
<td>/s/ Moncef Slaoui</td>
<td>Moncef Slaoui, Ph.D.</td>
<td>Director</td>
</tr>
</tbody>
</table>
Moderna Therapeutics, Inc., a corporation organized and existing under and by virtue of the provisions of the General Corporation Law of the State of Delaware (the “General Corporation Law”),

DOES HEREBY CERTIFY:

1. That the name of this corporation is Moderna Therapeutics, Inc., and that this corporation was originally incorporated pursuant to the General Corporation Law on July 22, 2016 under the name MT NewCo, Inc.

2. That the Board of Directors duly adopted resolutions proposing to amend and restate the Certificate of Incorporation of this corporation, declaring said amendment and restatement to be advisable and in the best interests of this corporation and its stockholders, and authorizing the appropriate officers of this corporation to solicit the consent of the stockholders therefor, which resolution setting forth the proposed amendment and restatement is as follows:

RESOLVED, that the Certificate of Incorporation of this corporation be amended and restated in its entirety to read as follows:

FIRST: The name of this corporation is Moderna Therapeutics, Inc. (the “Corporation”).

SECOND: The address of the registered office of the Corporation in the State of Delaware is Corporation Trust Company, 1209 Orange Street, in the City of Wilmington, County of New Castle, 19801. The name of its registered agent at such address is The Corporation Trust Company.

THIRD: The nature of the business or purposes to be conducted or promoted is to engage in any lawful act or activity for which corporations may be organized under the General Corporation Law.

FOURTH: The total number of shares of all classes of stock which the Corporation shall have authority to issue is (i) 775,000,000 shares of Common Stock, $0.0001 par value per share (“Common Stock”), and (ii) 509,352,795 shares of Preferred Stock, $0.0001 par value per share (“Preferred Stock”).

The following is a statement of the designations and the powers, privileges and rights, and the qualifications, limitations or restrictions thereof in respect of each class of capital stock of the Corporation.
A. COMMON STOCK

1. General. The voting, dividend and liquidation rights of the holders of the Common Stock are subject to and qualified by the rights, powers and preferences of the holders of the Preferred Stock set forth herein.

2. Voting. The holders of the Common Stock are entitled to one vote for each share of Common Stock held at all meetings of stockholders (and written actions in lieu of meetings). There shall be no cumulative voting. The number of authorized shares of Common Stock may be increased or decreased (but not below the number of shares thereof then outstanding) by (in addition to any vote of the holders of one or more series of Preferred Stock that may be required by the terms of this Third Amended and Restated Certificate of Incorporation) the affirmative vote of the holders of shares of capital stock of the Corporation representing a majority in voting power of the outstanding shares of capital stock of the Corporation entitled to vote, voting or consenting together as a single class, irrespective of the provisions of Section 242(b)(2) of the General Corporation Law.

B. PREFERRED STOCK

Of the 509,352,795 authorized shares of Preferred Stock, 42,000,000 shares have been designated “Series A Preferred Stock”, 122,296,280 shares have been designated “Series B Preferred Stock” (together with the Series A Preferred Stock, the “Junior Preferred Stock”), 85,669,774 shares have been designated “Series C Preferred Stock”, 63,291,156 shares have been designated “Series D Preferred Stock”, 81,428,340 shares have been designated “Series E Preferred Stock”, 54,001,241 shares have been designated “Series F Preferred Stock”, 55,666,004 shares are hereby designated “Series G Preferred Stock”, and 5,000,000 shares are hereby designated “Series H Preferred Stock” (together with the Junior Preferred Stock, Series C Preferred Stock, Series D Preferred Stock, Series E Preferred Stock, Series F Preferred Stock and Series G Preferred Stock, the “Preferred Stock”), with each series having the respective rights, preferences, powers (including voting powers, if any) and privileges, and restrictions, qualifications and limitations thereof, set forth in this Part B of this Article Fourth. Unless otherwise indicated, references to “Sections” or “Subsections” in this Part B of this Article Fourth refer to sections and subsections of Part B of this Article Fourth.
1. **Dividends.** From and after the date of the issuance of any shares of Series A Preferred Stock, dividends at the rate per annum of $0.004 per share shall accrue on such shares of Series A Preferred Stock (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series A Preferred Stock) (the "Series A Accruing Dividends"). From and after the date of the issuance of any shares of Series B Preferred Stock, dividends at the rate per annum of $0.006 per share shall accrue on such shares of Series B Preferred Stock (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series B Preferred Stock) (the "Series B Accruing Dividends"). From and after the date of the issuance of any shares of Series C Preferred Stock, dividends at the rate per annum of $0.02568 per share shall accrue on such shares of Series C Preferred Stock (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series C Preferred Stock) (the "Series C Accruing Dividends"). From and after the date of the issuance of any shares of Series D Preferred Stock, dividends at the rate per annum of $0.171 per share shall accrue on such shares of Series D Preferred Stock (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series D Preferred Stock) (the "Series D Accruing Dividends"). From and after the date of the issuance of any shares of Series E Preferred Stock, dividends at the rate per annum of $0.2568 per share shall accrue on such shares of Series E Preferred Stock (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series E Preferred Stock) (the "Series E Accruing Dividends"). From and after the date of the issuance of any shares of Series F Preferred Stock, dividends at the rate per annum of $0.2568 per share shall accrue on such shares of Series F Preferred Stock (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series F Preferred Stock) (the "Series F Accruing Dividends"). From and after the date of the issuance of any shares of Series G Preferred Stock, dividends at the rate per annum of $0.2568 per share shall accrue on such shares of Series G Preferred Stock (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series G Preferred Stock) (the "Series G Accruing Dividends"). From and after the date of the issuance of any shares of Series H Preferred Stock, dividends at the rate per annum of $0.2568 per share shall accrue on such shares of Series H Preferred Stock (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series H Preferred Stock) (the "Series H Accruing Dividends").

For purposes of this Section 1, the "date of issuance" of a share of Preferred Stock shall be (i) with respect to a share initially issued by the Corporation in exchange for a Preferred Unit of Moderna LLC pursuant to that certain Agreement and Plan of Merger, by and between the Corporation, Moderna LLC and MT MergerSub, Inc., a Delaware corporation, dated August 10, 2016 (the "Initial Merger Agreement"), the Original Issue Date of such Preferred Unit, each as defined in and determined pursuant to that certain Fifth Amended and Restated Operating Agreement of Moderna LLC, dated as of April 30, 2015, as amended (the "Unit Original Issue Date" and the "Operating Agreement", respectively), or in the case of a share originally issued in connection with the Split, the Unit Original Issue Date of the Preferred Unit that was outstanding prior to the Split and in respect of which such share was issued in connection with the Split, and (ii) with respect to any other issued shares, the date the Corporation initially issued such shares.

Accruing Dividends shall accrue from day to day, whether or not declared, and shall be cumulative. Except as set forth in the following sentence of this Section 1 or in Subsections 2.1 through 2.7, Accruing Dividends shall be payable only when, as, and if declared by the Board of Directors and the Corporation shall be under no obligation to pay such Accruing Dividends. The Corporation shall not declare, pay or set aside any dividends on shares of any class or series of capital stock of the Corporation (other than dividends on shares of Common Stock payable in shares of Common Stock or Accruing Dividends) unless (in addition to the obtaining of any consents required elsewhere in this Third Amended and Restated Certificate of Incorporation) the holders of the Junior Preferred Stock, Series C Preferred Stock, Series D Preferred Stock, Series E Preferred Stock, Series F Preferred Stock, Series G Preferred Stock, and Series H Preferred Stock then outstanding shall, on a pari passu basis, first receive, or simultaneously receive, a dividend on each outstanding share of Junior Preferred Stock, Series C Preferred Stock, Series D Preferred Stock, Series E Preferred Stock, Series F Preferred Stock, Series G Preferred Stock, and Series H Preferred Stock in an amount at least equal to the greater of (i) the amount of the aggregate Accruing Dividends then accrued on such share of Junior Preferred Stock, Series C Preferred Stock, or Series D Preferred Stock, as the case may be, and not
previously paid and (ii) (A) in the case of a dividend on Common Stock or any class or series that is convertible into Common Stock, that dividend per share of Junior Preferred Stock, Series C Preferred Stock, Series D Preferred Stock, Series E Preferred Stock, Series F Preferred Stock, Series G Preferred Stock, or Series H Preferred Stock, as the case may be, as would equal the product of (1) the dividend payable on each share of such class or series determined, if applicable, as if all shares of such class or series had been converted into Common Stock and (2) the number of shares of Common Stock issuable upon conversion of a share of Junior Preferred Stock, Series C Preferred Stock, Series D Preferred Stock, Series E Preferred Stock, Series F Preferred Stock, Series G Preferred Stock, or Series H Preferred Stock as the case may be, in each case calculated on the record date for determination of holders entitled to receive such dividend or (B) in the case of a dividend on any class or series that is not convertible into Common Stock, at a rate per share of Junior Preferred Stock, Series C Preferred Stock, Series D Preferred Stock, Series E Preferred Stock, Series F Preferred Stock, Series G Preferred Stock, or Series H Preferred Stock as the case may be, determined by (1) dividing the amount of the dividend payable on each share of such class or series of capital stock by the original issuance price of such class or series of capital stock (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to such class or series) and (2) multiplying such fraction by an amount equal to, in the case of the Series A Preferred Stock, the Series A Original Issue Price (as defined below), in the case of the Series B Preferred Stock, the Series B Original Issue Price (as defined below), in the case of the Series C Preferred Stock, the Series C Original Issue Price (as defined below), in the case of the Series D Preferred Stock, the Series D Original Issue Price (as defined below), in the case of the Series E Preferred Stock, the Series E Original Issue Price (as defined below), in the case of the Series F Preferred Stock, the Series F Original Issue Price, in the case of the Series G Preferred Stock, the Series G Original Issue Price (as defined below), and in the case of the Series H Preferred Stock, the Series H Original Issue Price (as defined below); provided that, if the Corporation declares, pays or sets aside, on the same date, a dividend on shares of more than one class or series of capital stock of the Corporation, the dividend payable to the holders of Series A Preferred Stock, Series B Preferred Stock, Series C Preferred Stock, Series D Preferred Stock, Series E Preferred Stock, Series F Preferred Stock, Series G Preferred Stock, and Series H Preferred Stock pursuant to this Section 1 shall be calculated based upon the dividend on the class or series of capital stock that would result in the highest dividend for the Series A Preferred Stock, the Series B Preferred Stock, the Series C Preferred Stock, the Series D Preferred Stock, the Series E Preferred Stock, the Series F Preferred Stock, the Series G Preferred Stock, and the Series H Preferred Stock. The “Series A Original Issue Price” shall mean $0.05 per share, subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series A Preferred Stock. The “Series B Original Issue Price” shall mean $0.075 per share, subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series B Preferred Stock. The “Series C Original Issue Price” shall mean $0.321 per share, subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series C Preferred Stock. The “Series D Original Issue Price” shall mean $2.133 per share, subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series D Preferred Stock. The “Series E Original Issue Price” shall mean $6.167 per share, subject to appropriate adjustment in the event of any stock dividend, stock split, combination or
other similar recapitalization with respect to the Series E Preferred Stock. The “Series F Original Issue Price” shall mean $8.78 per share, subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series F Preferred Stock. The “Series G Original Issue Price” shall mean $10.06 per share, subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series G Preferred Stock. The “Series H Original Issue Price” shall mean $25.00 per share, subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series H Preferred Stock. The Series A Original Issue Price, the Series B Original Issue Price, the Series C Original Issue Price, the Series D Original Issue Price, the Series E Original Issue Price, the Series F Original Issue Price, the Series G Original Issue Price, and the Series H Original Issue Price are each sometimes referred to herein as the “Applicable Original Issue Price” as the context requires.

2. Liquidation, Dissolution or Winding Up; Certain Mergers, Consolidations and Asset Sales. The payments to be made under this Section 2 in the event of any voluntary or involuntary liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event to a holder of shares of Preferred Stock or Common Stock by reason of their ownership thereof shall be reduced by the amount of any cash distributions (other than distributions of Accruing Dividends made (x) under the Operating Agreement prior to the Effective Time or (y) after the Effective Time): (i) in respect of the Preferred Units of Moderna LLC as defined in the Operating Agreement (the “Preferred Units”) that were cancelled in exchange for the applicable shares of Preferred Stock during the period beginning on the date of the original issuance of such Preferred Units and ending at the Effective Time (as appropriately adjusted to give effect to the Split), and (ii) in respect of the applicable share of Preferred Stock or Common Stock during the period beginning on the Effective Time and ending immediately prior to such liquidation, dissolution, winding up or Deemed Liquidation Event.

2.1 Preferential Payments to Holders of Series H Preferred Stock and Series G Preferred Stock. In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, the holders of shares of Series H Preferred Stock and Series G Preferred Stock then outstanding shall be entitled, on a pari passu basis, to be paid out of the assets of the Corporation available for distribution to its stockholders before any payment shall be made to the holders of the Series F Preferred Stock, the Series E Preferred Stock, the Series D Preferred Stock, the Series C Preferred Stock, the Junior Preferred Stock, and Common Stock by reason of their ownership thereof, an amount per share equal (a) in the case of the Series H Preferred Stock, to the greater of (i) the Series H Original Issue Price, plus any dividends declared but unpaid thereon, or (ii) such amount per share as would have been payable had all shares of Series H Preferred Stock been converted into Common Stock pursuant to Section 5.1 immediately prior to such liquidation, dissolution, winding up or Deemed Liquidation Event (the amount payable pursuant to this sentence is hereinafter referred to as the “Series H Liquidation Amount”), or (b) in the case of the Series G Preferred Stock, to the greater of (i) the Series G Original Issue Price plus an amount equal to any dividends declared but unpaid thereon, or (ii) such amount per share as would have been payable had all shares of Series G Preferred Stock been converted into Common Stock pursuant to Section 4 (without giving effect to any adjustment to the Applicable Conversion Ratio described in Subsection 4.1.1) immediately prior to such liquidation, dissolution, winding up or Deemed Liquidation Event (the
amount payable pursuant to this sentence is hereinafter referred to as the “Series G Liquidation Amount”). If upon any such liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, the assets of the Corporation available for distribution to its stockholders shall be insufficient to pay the holders of shares of Series H Preferred Stock and Series G Preferred Stock the full amount to which they shall be entitled under this Subsection 2.1, the holders of shares of Series H Preferred Stock and Series G Preferred Stock shall share ratably in any distribution of the assets available for distribution in proportion to the respective amounts which would otherwise be payable in respect of the shares held by them upon such distribution if all amounts payable on or with respect to such shares were paid in full.

2.2 Preferential Payments to Holders of Series F Preferred Stock. In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, after payment of the full Series H Liquidation Amount and Series G Liquidation Amount, the holders of shares of Series F Preferred Stock then outstanding shall be entitled to be paid out of the assets of the Corporation available for distribution to its stockholders before any payment shall be made to the holders of the Series E Preferred Stock, the Series D Preferred Stock, the Series C Preferred Stock, the Junior Preferred Stock, and Common Stock by reason of their ownership thereof, an amount per share equal to the greater of (i) the Series F Original Issue Price plus an amount equal to any dividends declared but unpaid thereon, or (ii) such amount per share as would have been payable had all shares of Series F Preferred Stock been converted into Common Stock pursuant to Section 4 (without giving effect to any adjustment to the Applicable Conversion Ratio described in Subsection 4.1.1) immediately prior to such liquidation, dissolution, winding up or Deemed Liquidation Event (the amount payable pursuant to this sentence is hereinafter referred to as the “Series F Liquidation Amount”). If upon any such liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, the assets of the Corporation available for distribution to its stockholders after payment of the Series H Liquidation Amount and the Series G Liquidation Amount shall be insufficient to pay the holders of shares of Series F Preferred Stock the full amount to which they shall be entitled under this Subsection 2.2, the holders of shares of Series F Preferred Stock shall share ratably in any distribution of the assets available for distribution in proportion to the respective amounts which would otherwise be payable in respect of the shares held by them upon such distribution if all amounts payable on or with respect to such shares were paid in full.

2.3 Preferential Payments to Holders of Series E Preferred Stock. In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, after payment of the full Series H Liquidation Amount, Series G Liquidation Amount and Series F Liquidation Amount, the holders of shares of Series E Preferred Stock then outstanding shall be entitled to be paid out of the assets of the Corporation available for distribution to its stockholders before any payment shall be made to the holders of the Series D Preferred Stock, the Series C Preferred Stock, the Junior Preferred Stock, and Common Stock by reason of their ownership thereof, an amount per share equal to the greater of (i) the Series E Original Issue Price plus an amount equal to any dividends declared but unpaid thereon, or (ii) such amount per share as would have been payable had all shares of Series E Preferred Stock been converted into Common Stock pursuant to Section 4 (without giving effect to any adjustment to the Applicable Conversion Ratio described in Subsection 4.1.1) immediately prior to such liquidation, dissolution, winding up or Deemed Liquidation Event (the
amount payable pursuant to this sentence is hereinafter referred to as the “Series E Liquidation Amount”). If upon any such liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, the assets of the Corporation available for distribution to its stockholders after payment of the Series H Liquidation Amount, the Series G Liquidation Amount and the Series F Liquidation Amount shall be insufficient to pay the holders of shares of Series E Preferred Stock the full amount to which they shall be entitled under this Subsection 2.3, the holders of shares of Series E Preferred Stock shall share ratably in any distribution of the assets available for distribution in proportion to the respective amounts which would otherwise be payable in respect of the shares held by them upon such distribution if all amounts payable on or with respect to such shares were paid in full.

2.4 Preferential Payments to Holders of Series D Preferred Stock. In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, after payment of the full Series H Liquidation Amount, Series G Liquidation Amount, Series F Liquidation Amount and Series E Liquidation Amount, the holders of shares of Series D Preferred Stock then outstanding shall be entitled to be paid out of the assets of the Corporation available for distribution to its stockholders before any payment shall be made to the holders of the Series C Preferred Stock, the Junior Preferred Stock, and Common Stock by reason of their ownership thereof, subject to Subsection 2.7, an amount per share equal to the Series D Original Issue Price plus an amount equal to any dividends declared but unpaid thereon (excluding the Series D Accruing Dividends, which shall be governed by Subsection 2.7) (the amount payable pursuant to this sentence is hereinafter referred to as the “Series D Senior Liquidation Amount”). If upon any such liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, the assets of the Corporation available for distribution to its stockholders after payment of the Series H Liquidation Amount, Series G Liquidation Amount, Series F Liquidation Amount and Series E Liquidation Amount shall be insufficient to pay the holders of shares of Series D Preferred Stock the full amount to which they shall be entitled under this Subsection 2.4, the holders of shares of Series D Preferred Stock shall share ratably in any distribution of the assets available for distribution in proportion to the respective amounts which would otherwise be payable in respect of the shares held by them upon such distribution if all amounts payable on or with respect to such shares were paid in full.

2.5 Preferential Payments to Holders of Series C Preferred Stock. In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, after payment of the full Series H Liquidation Amount, Series G Liquidation Amount, Series F Liquidation Amount, Series E Liquidation Amount, and Series D Senior Liquidation Amount, the holders of shares of Series C Preferred Stock then outstanding shall be entitled to be paid out of the assets of the Corporation available for distribution to its stockholders before any payment shall be made to the holders of the Junior Preferred Stock and Common Stock by reason of their ownership thereof, an amount per share equal to the greater of (i) the Series C Original Issue Price, plus any Series C Accruing Dividends accrued but unpaid thereon, whether or not declared, together with any other dividends declared but unpaid thereon or (ii) such amount per share as would have been payable had all shares of Series C Preferred Stock been converted into Common Stock pursuant to Section 4 (without giving effect to any adjustment to the Applicable Conversion Ratio described in Subsection 4.1.1) immediately prior to such liquidation, dissolution, winding up or Deemed Liquidation Event (the amount payable pursuant to this sentence is hereinafter referred to as the “Series C Liquidation Amount”). If
upon any such liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, the assets of the Corporation available for
distribution to its stockholders after payment of the Series H Liquidation Amount, Series G Liquidation Amount, Series F Liquidation Amount, Series E
Liquidation Amount, and Series D Senior Liquidation Amount, shall be insufficient to pay the holders of shares of Series C Preferred Stock the full amount to
which they shall be entitled under this Subsection 2.5, the holders of shares of Series C Preferred Stock shall share ratably in any distribution of the assets
available for distribution in proportion to the respective amounts which would otherwise be payable in respect of the shares held by them upon such
distribution if all amounts payable on or with respect to such shares were paid in full.

2.6 Preferential Payments to Holders of the Junior Preferred Stock. In the event of any voluntary or involuntary liquidation, dissolution or
winding up of the Corporation or Deemed Liquidation Event, after payment of the full Series H Liquidation Amount, Series G Liquidation Amount, Series F
Liquidation Amount, Series D Senior Liquidation Amount, and Series C Liquidation Amount, the holders of shares of the
Junior Preferred Stock then outstanding shall be entitled, on a pari passu basis, to be paid out of the assets of the Corporation available for distribution to its
stockholders before any payment shall be made to the holders of Common Stock by reason of their ownership thereof, an amount per share equal to (a) in the
case of the Series A Preferred Stock, the greater of (i) the Series A Original Issue Price, plus any Series A Accruing Dividends accrued but unpaid thereon,
whether or not declared, together with any other dividends declared but unpaid thereon or (ii) such amount per share as would have been payable had all
shares of Series A Preferred Stock been converted into Common Stock pursuant to Section 4 (without giving effect to any adjustment to the Applicable
Conversion Ratio described in Subsection 4.1.1) immediately prior to such liquidation, dissolution, winding up or Deemed Liquidation Event (the amount
payable pursuant to this clause (a) is hereinafter referred to as the “Series A Liquidation Amount”) and (b) in the case of the Series B Preferred Stock, the
greater of (i) the Series B Original Issue Price, plus any Series B Accruing Dividends accrued but unpaid thereon, whether or not declared, together with any
other dividends declared but unpaid thereon or (ii) such amount per share as would have been payable had all shares of Series B Preferred Stock been
converted into Common Stock pursuant to Section 4 (without giving effect to any adjustment to the Applicable Conversion Ratio described in Subsection
4.1.1) immediately prior to such liquidation, dissolution, winding up or Deemed Liquidation Event (the amount payable pursuant to this clause (b) is
hereinafter referred to as the “Series B Liquidation Amount”). If upon any such liquidation, dissolution or winding up of the Corporation or Deemed
Liquidation Event, the assets of the Corporation available for distribution to its stockholders after payment of the Series H Liquidation Amount, Series G
Liquidation Amount, Series F Liquidation Amount, Series E Liquidation Amount, Series D Senior Liquidation Amount and Series C Liquidation Amount
shall be insufficient to pay the holders of shares of Junior Preferred Stock the full amount to which they shall be entitled under this Subsection 2.6, the
holders of shares of Junior Preferred Stock shall share ratably in any distribution of the assets available for distribution in proportion to the respective
amounts which would otherwise be payable in respect of the shares held by them upon such distribution if all amounts payable on or with respect to such
shares were paid in full.

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2.7 **Preferential Payments to Holders of Series D Preferred Stock.** In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, after payment of the full Series H Liquidation Amount, Series G Liquidation Amount, Series F Liquidation Amount, Series E Liquidation Amount, Series D Senior Liquidation Amount, Series C Liquidation Amount, Series B Liquidation Amount and Series A Liquidation Amount, the holders of shares of the Series D Preferred Stock then outstanding shall be entitled to be paid out of the assets of the Corporation available for distribution to its stockholders before any payment shall be made to the holders of Common Stock by reason of their ownership thereof, an amount per share equal to any Series D Accruing Dividends accrued but unpaid thereon, whether or not declared; *provided, however,* that if such amount payable plus the amount payable pursuant to Section 2.4 is less than the amount per share as would have been payable had all shares of Series D Preferred Stock been converted into Common Stock pursuant to Section 4 (without giving effect to any adjustment to the Applicable Conversion Ratio described in Subsection 4.1.1) immediately prior to such liquidation, dissolution, winding up or Deemed Liquidation Event, such holders of Series D Preferred Stock shall be entitled to such amount in lieu of the amounts set forth in Section 2.4 and the immediately preceding clause of this Section 2.7. If upon any such liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, the assets of the Corporation available for distribution to its stockholders after payment of the Series H Liquidation Amount, Series G Liquidation Amount, Series F Liquidation Amount, Series E Liquidation Amount, Series D Senior Liquidation Amount, Series C Liquidation Amount, Series B Liquidation Amount and Series A Liquidation Amount shall be insufficient to pay the holders of shares of Series D Preferred Stock the full amount to which they shall be entitled under this Subsection 2.7, the holders of shares of Series D Preferred Stock shall share ratably in any distribution of the assets available for distribution in proportion to the respective amounts which would otherwise be payable in respect of the shares held by them upon such distribution if all amounts payable on or with respect to such shares were paid in full.

2.8 **Payments to Holders of Common Stock.** In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, after the payment of all preferential amounts required to be paid to the holders of shares of Preferred Stock, the remaining assets of the Corporation available for distribution to its stockholders shall be distributed among the holders of shares of Common Stock, pro rata based on the number of shares held by each such holder (after taking into account any forfeitures upon such event pursuant to any employee stock option or other equity-based incentive plan (including, without limitation, the 2016 Stock Option and Grant Plan).

2.9 **Deemed Liquidation Events.**

2.9.1 **Definition.** Each of the following events shall be considered a "Deemed Liquidation Event" unless (i) the Requisite Vote (as defined in Subsection 2.9.5(c) below) and (ii) the holders of a majority of the outstanding shares of Series F Preferred Stock and Series G Preferred Stock, voting together as a single class on an as-converted basis, elect otherwise by written notice, sent to the Corporation at least 10 days prior to the effective date of any such event:

(a) a merger or consolidation in which
   (i) the Corporation is a constituent party or

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(ii) a subsidiary of the Corporation is a constituent party and the Corporation issues shares of its capital stock pursuant to such merger or consolidation,

except any such merger or consolidation involving the Corporation or a subsidiary in which the shares of capital stock of the Corporation outstanding immediately prior to such merger or consolidation continue to represent, or are converted into or exchanged for shares of capital stock that represent, immediately following such merger or consolidation, at least a majority, by voting power, of the capital stock of (1) the surviving or resulting corporation or (2) if the surviving or resulting corporation is a wholly owned subsidiary of another corporation immediately following such merger or consolidation, the parent corporation of such surviving or resulting corporation (provided that, for the purpose of this Subsection 2.9.1, all shares of Common Stock issuable upon exercise of Options (as defined below) outstanding immediately prior to such merger or consolidation or upon conversion of Convertible Securities (as defined below) outstanding immediately prior to such merger or consolidation shall be deemed to be outstanding immediately prior to such merger or consolidation and, if applicable, converted or exchanged in such merger or consolidation on the same terms as the actual outstanding shares of Common Stock are converted or exchanged); or

(b) the sale, lease, transfer, exclusive license or other disposition, in a single transaction or series of related transactions, by the Corporation or any subsidiary of the Corporation of all or substantially all the assets of the Corporation and its subsidiaries taken as a whole, or the sale or disposition (whether by merger or otherwise) of one or more subsidiaries of the Corporation if all or substantially all of the assets of the Corporation and its subsidiaries taken as a whole are held by such subsidiary or subsidiaries, except where such sale, lease, transfer, exclusive license or other disposition is to a direct or indirect wholly-owned subsidiary of the Corporation.

2.9.2 Effecting a Deemed Liquidation Event.

(a) Unless otherwise approved by the Requisite Vote, and any other vote required by Subsection 3.4, as applicable, the Corporation shall not have the power to effect a Deemed Liquidation Event referred to in Subsection 2.9.1(a)(i) unless the agreement or plan of merger or consolidation for such transaction (the “Merger Agreement”) provides that the consideration payable to the stockholders of the Corporation shall be allocated among the holders of capital stock of the Corporation in accordance with Subsections 2.1 through 2.8. In the event of a Deemed Liquidation Event referred to in Subsection 2.9.1(a)(ii) or 2.9.1(b), if the Corporation does not effect a dissolution of the Corporation under the General Corporation Law within 90 days after such Deemed Liquidation Event, then (i) the Corporation shall send a written notice to each holder of Preferred Stock no later than the 90th day after the Deemed Liquidation Event advising such holders of their right (and the requirements to be met to secure such right) pursuant to the terms of the following clause (ii) to require the redemption of such shares of Preferred Stock and (ii) if the holders of the Requisite Vote so request in a written instrument delivered to the Corporation not later than 120 days after such Deemed Liquidation Event, the Corporation shall use the consideration received by the Corporation for such Deemed Liquidation Event (net of any retained liabilities associated
with the assets sold or technology licensed, as determined in good faith by the Board of Directors of the Corporation), together with any other assets of
the Corporation available for distribution to its stockholders, all to the extent permitted by the Delaware law governing distributions to stockholders
and redemption of shares of capital stock (the “Available Proceeds”), on the one hundred fiftieth (150th) day after such Deemed Liquidation Event, to
redeem all outstanding shares of Preferred Stock for the amounts specified in, and allocated among the holders of capital stock of the Corporation in
accordance with, Subsections 2.1 through 2.8. Notwithstanding the foregoing, in the event of a redemption pursuant to the preceding sentence, if the
Available Proceeds are not sufficient to redeem all outstanding shares of Preferred Stock, the Corporation shall (1) first, redeem, on a pari passu basis, a
pro rata portion of each holder’s shares of Series H Preferred Stock and Series G Preferred Stock to the fullest extent of such Available Proceeds, based
on the respective amounts which would otherwise be payable in respect of the shares of Series H Preferred Stock and Series G Preferred Stock to be
redeemed if the Available Proceeds were sufficient to redeem all such shares, and shall redeem the remaining shares of Series H Preferred Stock and
Series G Preferred Stock as soon as it may lawfully do so under Delaware law governing distributions to the stockholders; (2) second, after all the shares
of Series H Preferred Stock and Series G Preferred Stock have been redeemed, redeem a pro rata portion of each holder’s shares of Series F Preferred
Stock to the fullest extent of such Available Proceeds, based on the respective amounts which would otherwise be payable in respect of the shares of
Series F Preferred Stock to be redeemed if the Available Proceeds were sufficient to redeem all such shares, and shall redeem the remaining shares of
Series F Preferred Stock as soon as it may lawfully do so under Delaware law governing distributions to the stockholders; (3) third, after all the shares of
Series H Preferred Stock, Series G Preferred Stock and Series F Preferred Stock have been redeemed, redeem a pro rata portion of each holder’s shares of
Series E Preferred Stock to the fullest extent of such Available Proceeds, based on the respective amounts which would otherwise be payable in respect
of the shares of Series E Preferred Stock to be redeemed if the Available Proceeds were sufficient to redeem all such shares, and shall redeem the
remaining shares of Series E Preferred Stock as soon as it may lawfully do so under Delaware law governing distributions to the stockholders; (4) fourth,
after all the shares of Series H Preferred Stock, Series G Preferred Stock, Series F Preferred Stock and Series E Preferred Stock have been redeemed,
redeem a pro rata portion of each holder’s shares of Series D Preferred Stock to the fullest extent of such Available Proceeds, based on the respective amounts which would otherwise be payable pursuant to Section 2.4 in respect of the shares of Series D Preferred Stock to be redeemed if the
Available Proceeds were sufficient to redeem all such shares, and shall redeem the remaining shares of Series D Preferred Stock as soon as it may
lawfully do so under Delaware law governing distributions to the stockholders; provided, however, that, notwithstanding such redemptions, the
redeemed holders of Series D Preferred Stock shall continue to be entitled to receive the payment, if any, pursuant to subclause (7) of this sentence;
(5) fifth, after all the shares of Series H Preferred Stock, Series G Preferred Stock, Series F Preferred Stock, Series E Preferred Stock and Series D Preferred
Stock have been redeemed, redeem a pro rata portion of each holder’s shares of Series C Preferred Stock to the fullest extent of such Available Proceeds,
based on the respective amounts which would otherwise be payable in respect of the shares of Series C Preferred
Stock to be redeemed if the Available Proceeds were sufficient to redeem all such shares, and shall redeem the remaining shares of Series C Preferred Stock as soon as it may lawfully so under Delaware law governing distributions to the stockholders; (6) sixth, after all the shares of Series H Preferred Stock, Series G Preferred Stock, Series F Preferred Stock, Series E Preferred Stock, Series D Preferred Stock, and Series C Preferred Stock have been redeemed, redeem, on a pari passu basis, a pro rata portion of each holder’s shares of Junior Preferred Stock to the fullest extent of such Available Proceeds, based on the respective amounts which would otherwise be payable in respect of the shares of Junior Preferred Stock to be redeemed if the Available Proceeds were sufficient to redeem all such shares, and shall redeem the remaining shares of Junior Preferred Stock as soon as it may lawfully do so under Delaware law governing distributions to the stockholders; and (7) seventh, after all the shares of Series H Preferred Stock, Series G Preferred Stock, Series F Preferred Stock, Series E Preferred Stock, Series D Preferred Stock, Series C Preferred Stock and Junior Preferred Stock have been redeemed, distribute, to the fullest extent of such Available Proceeds, to each redeemed holder of Series D Preferred Stock a pro rata portion of each such holder’s aggregate Series D Accruing Dividends, accrued but unpaid thereon, whether or not declared, with respect to such holder’s redeemed Series D Preferred Stock, based on the respective amounts which would otherwise be payable pursuant to Section 2.7 in respect of the shares of redeemed Series D Preferred Stock if the Available Proceeds were sufficient to make the full distribution pursuant to Section 2.7, and shall distribute the remaining amounts otherwise payable pursuant to Section 2.7 as soon as it may lawfully do so under Delaware law governing distributions to the stockholders. Prior to the distribution or redemption provided for in Subsection 2.9.2(a), the Corporation shall not expend or dissipate the consideration received for such Deemed Liquidation Event, except to discharge expenses incurred in connection with such Deemed Liquidation Event or in the ordinary course of business. In connection with a distribution or redemption provided for in Subsection 2.9.2(a), the Corporation shall send written notice of the redemption (the “Redemption Notice”) to each holder of record of Preferred Stock, at least 10 days prior to the date of the redemption. Each Redemption Notice shall state:

i. the number of shares of Preferred Stock held by the holder that the Corporation shall redeem on the date specified in the Redemption Notice;

ii. the redemption date and the price per share at which the shares of Preferred Stock are being redeemed;

iii. for holders of shares in certificated form, that the holder is to surrender to the Corporation, in the manner and at the place designated, his, her or its certificate or certificates representing the shares of Preferred Stock to be redeemed.
Rights Subsequent to Redemption. If the Redemption Notice shall have been duly given, and if on the redemption date payment is tendered or deposited with an independent payment agent so as to be available therefor in a timely manner, then notwithstanding that any certificates evidencing any of the shares of Preferred Stock so called for redemption shall not have been surrendered, all rights with respect to such shares shall forthwith after the redemption date terminate, except only the right of the holders to receive the payment without interest upon surrender of any such certificate or certificates therefor.

2.9.3 Amount Deemed Paid or Distributed. If the amount deemed paid or distributed under this Subsection 2.9 is made in property other than in cash, the value of such distribution shall be the fair market value of such property, determined as follows:

(a) For securities not subject to investment letters or other similar restrictions on free marketability,
   (i) if traded on a securities exchange, the value shall be deemed to be the average of the closing prices of the securities on such exchange or market over the 30-period ending three days prior to the closing of such transaction;
   (ii) if actively traded over-the-counter, the value shall be deemed to be the average of the closing bid prices over the 30-day period ending three days prior to the closing of such transaction; or
   (iii) if there is no active public market, the value shall be the fair market value thereof, as determined in good faith by the Board of Directors of the Corporation.

(b) The method of valuation of securities subject to investment letters or other similar restrictions on free marketability (other than restrictions arising solely by virtue of a stockholder’s status as an affiliate or former affiliate) shall take into account an appropriate discount (as determined in good faith by the Board of Directors of the Corporation) from the market value as determined pursuant to clause (a) above so as to reflect the approximate fair market value thereof.

(c) For other assets, the value shall be the fair market value thereof, as determined in good faith by the Board of Directors of the Corporation.

2.9.4 Allocation of Escrow. In the event of a Deemed Liquidation Event pursuant to Subsection 2.9.1(a)(i) or 2.9.1(b), if any portion of the consideration payable to the stockholders of the Corporation is placed into escrow and/or is payable to the stockholders of the Corporation subject to contingencies, the Merger Agreement shall provide that (a) the portion of such consideration that is not placed in escrow and not subject to any contingencies (the “Initial Consideration”) shall be allocated among the holders of capital stock of the Corporation in accordance with Subsections 2.1 through 2.8 as if the Initial Consideration were the only consideration payable in connection with such Deemed Liquidation Event and (b) any additional consideration which becomes payable to the stockholders of the
Corporation upon release from escrow or satisfaction of contingencies shall be allocated among the holders of capital stock of the Corporation in accordance with Subsections 2.1 through 2.8 after taking into account the previous payment of the Initial Consideration as part of the same transaction.

2.9.5 Defined Terms. For purposes of this Article Fourth and Article Fifth, the following definitions shall apply:

(a) “Affiliate” means a Person who, directly or indirectly, controls, is controlled by or is under common control with another Person, including, without limitation, any general partner, managing member, officer, director, or employee of such Person or any venture capital or other investment fund now or hereafter existing that is controlled by one or more general partners or managing members of, or shares the same management company or investment advisor with, such Person.

(b) “Effective Time” means 8:58 AM Eastern Time on August 10, 2016.

(c) “Person” means an individual, firm, corporation, partnership, association, limited liability company, trust or any other entity.

(d) “Requisite Vote” means the affirmative vote of the holders of a majority in voting power of (i) the outstanding shares of Preferred Stock, plus (ii) the other outstanding voting shares of capital stock of the Corporation held by holders of shares of Preferred Stock (and their Affiliates), voting or consenting together as a single class, on an as-converted basis.


3.1 General. On any matter presented to the stockholders of the Corporation for their action or consideration at any meeting of stockholders of the Corporation (or by written consent of stockholders in lieu of meeting), each holder of outstanding shares of Preferred Stock shall be entitled to cast the number of votes equal to the number of whole shares of Common Stock into which the shares of Preferred Stock held by such holder are convertible as of the record date for determining stockholders entitled to vote on such matter. Notwithstanding the foregoing, prior to the date that is twenty-one (21) months following the date of filing of this Third Amended and Restated Certificate of Incorporation (the “Series H Adjustment Date”), the Series H Preferred Stock shall have one vote per share. Except as provided by law or by the other provisions of this Third Amended and Restated Certificate of Incorporation, holders of Preferred Stock shall vote together with the holders of Common Stock as a single class.

3.2 Election of Directors.

3.2.1 So long as any shares of Junior Preferred Stock are outstanding, the holders of record of the shares of Junior Preferred Stock, exclusively and voting together as a single class on an as-converted basis, shall be entitled to elect one (1) director of the Corporation (the “Series A/B Director”). Any Series A/B Director may be removed without
3.2.2 So long as any shares of Preferred Stock are outstanding, the holders of record of the shares of Preferred Stock, exclusively and voting together as a single class on an as-converted basis, shall be entitled to elect one (1) director of the Corporation (the “Preferred Director”). Any Preferred Director may be removed without cause by, and only by, the affirmative vote of the holders of a majority in voting power of the Preferred Stock, voting together as a single class on an as-converted basis, given either at a meeting of such stockholders duly called for that purpose or pursuant to a written consent of stockholders. If the holders of shares of Preferred Stock, voting exclusively and together as a single class on an as-converted basis, fail to elect a sufficient number of directors to fill all directorships for which they are entitled to elect directors pursuant to the first sentence of this Subsection 3.2.2, then any vacancy or newly created directorship not so filled shall remain vacant until such time as the holders of the Preferred Stock, voting together as a single class on an as-converted basis, elect a person to fill such directorship by vote or written consent in lieu of a meeting; and such directorship may not be filled by stockholders of the Corporation other than by the holders of the Preferred Stock, voting exclusively and together as a single class on an as-converted basis.

3.2.3 The holders of record of the shares of Common Stock and of any other class or series of voting stock (including the Preferred Stock), exclusively and voting together as a single class on an as-converted basis, shall be entitled to elect the balance of the total number of directors of the Corporation. At any meeting held for the purpose of electing a director, the presence in person or by proxy of the holders of a majority in voting power of the outstanding shares of the class or series entitled to elect such director shall constitute a quorum for the purpose of electing such director. Except as otherwise provided in this Subsection 3.2, a vacancy in any directorship or a newly created directorship filled by the holders of any class or series shall be filled only by vote or written consent in lieu of a meeting of the holders of such class or series or by any remaining director or directors elected by the holders of such class or series pursuant to this Subsection 3.2.

3.3 Preferred Stock Protective Provisions. At any time when any shares of Preferred Stock are outstanding, the Corporation shall not, either directly or indirectly by amendment, merger, consolidation or otherwise, do any of the following without (in addition to any other vote required by law or this Third Amended and Restated Certificate of Incorporation) the written consent or affirmative vote of the Requisite Vote given in writing or by vote at a meeting, consenting or voting (as the case may be) separately as a single class on an as-converted basis, and any such act or transaction entered into without such consent or vote shall be null and void ab initio, and of no force or effect:
(a) liquidate, dissolve or wind-up the business and affairs of the Corporation, effect any Deemed Liquidation Event or any other merger or consolidation of the Corporation, or consent to any of the foregoing;

(b) amend, alter or repeal any provision of this Third Amended and Restated Certificate of Incorporation or the Bylaws of the Corporation;

(c) except with respect to Series H Preferred Stock issued pursuant to the Series H Stock Purchase Agreement dated on or about the date of filing of this Third Amended and Restated Certificate of Incorporation, (i) create, or authorize the creation of, or issue or obligate itself to issue shares of, any additional class or series of capital stock unless the same ranks junior to the Preferred Stock, with respect to the distribution of assets on the liquidation, dissolution or winding up of the Corporation, the payment of dividends and rights of redemption, (ii) increase the authorized number of shares of the Preferred Stock (or any series thereof), or (iii) increase the authorized number of shares of any additional class or series of capital stock unless the same ranks junior to the Preferred Stock with respect to the distribution of assets on the liquidation, dissolution or winding up of the Corporation, the payment of dividends and rights of redemption;

(d) (i) reclassify, alter or amend any existing security of the Corporation that is pari passu with any series of Preferred Stock in respect of the distribution of assets on the liquidation, dissolution or winding up of the Corporation, the payment of dividends or rights of redemption, if such reclassification, alteration or amendment would render such other security senior to such series of Preferred Stock in respect of any such right, preference or privilege, or (ii) reclassify, alter or amend any existing security of the Corporation that is junior to any series of Preferred Stock in respect of the distribution of assets on the liquidation, dissolution or winding up of the Corporation, the payment of dividends or rights of redemption, if such reclassification, alteration or amendment would render such other security senior to or pari passu with such series of Preferred Stock in respect of any such right, preference or privilege;

(e) purchase or redeem (or permit any subsidiary to purchase or redeem) or pay or declare any dividend or make any distribution on, any shares of capital stock of the Corporation other than (i) redemptions of, or dividends or distributions on, the Preferred Stock as expressly authorized herein, (ii) dividends or other distributions payable on the Common Stock solely in the form of additional shares of Common Stock and (iii) repurchases or redemptions of stock from former employees, officers, directors, consultants or other persons who performed services for the Corporation or any subsidiary in connection with the cessation of such employment or service at the lower of the original issuance price or the then-current fair market value thereof;
(f) create, or authorize the creation of, or issue, or authorize the issuance of any debt security, or permit any subsidiary to take any such action with respect to any debt security if the aggregate indebtedness of the Corporation and its subsidiaries for borrowed money following such action would exceed $5,000,000, unless approved by the Board of Directors, including the approval of at least one of the Investor Directors (as such term is defined in the Amended and Restated Voting Agreement, dated on or about the date of the Original Issue Date, by and among the Corporation and certain stockholders of the Corporation, and as may be amended or restated from time to time);

(g) increase or decrease the authorized number of directors constituting the Board of Directors or change the designation of the chairman of the Board of Directors; or

(h) create or establish any new employee stock option plan or other equity-based incentive plan, or increase the number of shares of capital stock reserved for issuance under any such plan.


3.4.1 At any time when any shares of Series H Preferred Stock are outstanding, the Corporation shall not, either directly or indirectly by amendment, merger, consolidation or otherwise, without (in addition to any other vote required by law or this Third Amended and Restated Certificate of Incorporation) the written consent or affirmative vote of the holders of a majority in voting power of the Series H Preferred Stock, given in writing or by vote at a meeting, amend, alter, repeal or waive any provision of this Third Amended and Restated Certificate of Incorporation in a manner that would materially and adversely affect (i) the Series H Preferred Stock disproportionately more than and is not similarly applied to the holders of all series of Preferred Stock, (ii) the liquidation or redemption preference of the Series H Preferred Stock relative to any Common Stock or any junior series of Preferred Stock or (iii) the automatic conversion provisions of the Series H Preferred Stock in Sections 5.1.1, 5.1.2, and 5.1.3, and any such act or transaction entered into without such consent or vote shall be null and void ab initio, and of no further force or effect. For the avoidance of doubt, nothing in this Subsection 3.4.1 shall prevent the conversion of the Series H Preferred Stock upon the Requisite Vote in favor of such conversion, and nothing in (i) will prevent the conversion of Series H Preferred Stock pursuant to Section 5.1.1.

3.4.2 At any time when any shares of Series G Preferred Stock are outstanding, the Corporation shall not, either directly or indirectly by amendment, merger, consolidation or otherwise, without (in addition to any other vote required by law or this Third Amended and Restated Certificate of Incorporation) the written consent or affirmative vote of the holders of a majority in voting power of the Series G Preferred Stock, given in writing or by vote at a meeting, amend, alter, repeal or waive any provision of this Third Amended and Restated Certificate of Incorporation in a manner that would materially and adversely affect (i) the Series G Preferred Stock disproportionately more than and is not similarly applied to the holders of all series of Preferred Stock or (ii) the liquidation or redemption preference of the Series G Preferred Stock relative to any Common Stock or any junior series of Preferred Stock, and any such act or transaction entered into without such consent or vote shall be null and void ab initio, and of no further force or effect.
3.4.3 At any time when any shares of Series F Preferred Stock are outstanding, the Corporation shall not, either directly or indirectly by amendment, merger, consolidation or otherwise, without (in addition to any other vote required by law or this Third Amended and Restated Certificate of Incorporation) the written consent or affirmative vote of the holders of a majority in voting power of the Series F Preferred Stock, given in writing or by vote at a meeting, amend, alter, repeal or waive any provision of this Third Amended and Restated Certificate of Incorporation in a manner that would materially and adversely affect (i) the Series F Preferred Stock disproportionately more than and is not similarly applied to the holders of all series of Preferred Stock or (ii) the liquidation or redemption preference of the Series F Preferred Stock relative to any Common Stock or any junior series of Preferred Stock, and any such act or transaction entered into without such consent or vote shall be null and void ab initio, and of no further force or effect.

3.4.4 At any time when any shares of Series E Preferred Stock are outstanding, the Corporation shall not, either directly or indirectly by amendment, merger, consolidation or otherwise, without (in addition to any other vote required by law or this Third Amended and Restated Certificate of Incorporation) the written consent or affirmative vote of the holders of a majority in voting power of the Series E Preferred Stock, given in writing or by vote at a meeting, amend, alter, repeal or waive any provision of this Third Amended and Restated Certificate of Incorporation in a manner that would materially and adversely affect (i) the Series E Preferred Stock disproportionately more than and is not similarly applied to the holders of all series of Preferred Stock or (ii) the liquidation or redemption preference of the Series E Preferred Stock relative to any Common Stock or any junior series of Preferred Stock, and any such act or transaction entered into without such consent or vote shall be null and void ab initio, and of no further force or effect.

3.4.5 At any time when any shares of Series D Preferred Stock are outstanding, the Corporation shall not, either directly or indirectly by amendment, merger, consolidation or otherwise, without (in addition to any other vote required by law or this Third Amended and Restated Certificate of Incorporation) the written consent or affirmative vote of the holders of a majority in voting power of the Series D Preferred Stock, given in writing or by vote at a meeting, amend, alter, repeal or waive any provision of this Third Amended and Restated Certificate of Incorporation in a manner that would materially and adversely affect the Series D Preferred Stock disproportionately more than and is not similarly applied to the holders of all series of Preferred Stock, and any such act or transaction entered into without such consent or vote shall be null and void ab initio, and of no further force or effect.
4. Optional Conversion. The holders of the Preferred Stock shall have conversion rights as follows (the “Conversion Rights”):

4.1 Right to Convert.

4.1.1 Conversion Ratio. Each share of Preferred Stock (other than Series H Preferred Stock prior to the Series H Adjustment Date) shall be convertible, at the option of the holder thereof, at any time and from time to time, and without the payment of additional consideration by the holder thereof, into such number of fully paid and nonassessable shares of Common Stock as is determined by dividing the Applicable Original Issue Price by the Applicable Conversion Price (as defined below) in effect at the time of conversion (such quotient for each series of Preferred Stock, as applicable, and together with the Series H Conversion Ratio (as defined below), the “Applicable Conversion Ratio”). Except as otherwise expressly provided in Section 5.1, the Series H Preferred Stock shall not be convertible. The “Series A Conversion Price” shall initially be equal to $0.050. The “Series B Conversion Price” shall initially be equal to $0.075. The “Series C Conversion Price” shall initially be equal to $0.321. The “Series D Conversion Price” shall initially be equal to $2.133. The “Series E Conversion Price” shall initially be equal to $0.075. The “Series F Conversion Price” shall initially be equal to $2.133. The “Series G Conversion Price” shall initially be equal to $10.06. The “Series H Conversion Price” and the “Series H Conversion Ratio” shall be as described in Section 5.1.1 or 5.1.2, as applicable therein. The “Applicable Conversion Price” shall mean (a) the Series A Conversion Price, in the case of the Series A Preferred Stock, (b) the Series B Conversion Price, in the case of the Series B Preferred Stock, (c) the Series C Conversion Price, in the case of the Series C Preferred Stock, (d) the Series D Conversion Price, in the case of the Series D Preferred Stock, (e) the Series E Conversion Price, in the case of the Series E Preferred Stock, (f) the Series F Conversion Price, in the case of the Series F Preferred Stock, (g) the Series G Conversion Price, in the case of the Series G Preferred Stock, and (h) the Series H Conversion Price, in case of the Series H Preferred Stock. Such initial Applicable Conversion Price and the rate at which shares of the applicable series of Preferred Stock may be converted into shares of Common Stock, shall be subject to adjustment as provided below. Each Applicable Conversion Ratio shall be adjusted, if applicable, at the time of conversion of a share of Preferred Stock into Common Stock by increasing the Applicable Conversion Price to take into account cash distributions, if any, paid: (i) in respect of the Preferred Unit that was cancelled in exchange for such share of Preferred Stock during the period beginning on the date of the original issuance of such Preferred Unit and ending at the Effective Time (as appropriately adjusted to give effect to the Split) and (ii) in respect of such share of Preferred Stock during the period beginning on the Effective Time and ending immediately prior to such conversion, such that the number of shares of Common Stock issued upon conversion of such share of Preferred Stock is reduced by such number of shares of Common Stock, as appropriately adjusted to give effect to any stock split, stock dividend or other similar event, with a value (such fair market value as determined by the Corporation’s Board of Directors in good faith at the time of conversion), equal to the dollar amount of such cash distributions previously paid with respect to such share of Preferred Stock. Notwithstanding the foregoing, in the event of a mandatory conversion of such share of Preferred Stock upon the closing of a public offering pursuant to Subsection 5.1, such fair market value shall be deemed to equal the public offering price per share for the Common Stock set forth on the cover page of the final prospectus for such offering. Such adjustments for conversion are not applicable for purposes of voting or other rights and shall only be taken into account at the time of such conversion.

4.1.2 Termination of Conversion Rights. In the event of a liquidation, dissolution or winding up of the Corporation or a Deemed Liquidation Event, the Conversion Rights shall terminate at the close of business on the last full day preceding the date fixed for the payment of any such amounts distributable on such event to the holders of Preferred Stock.
4.2 **Fractional Shares.** No fractional shares of Common Stock shall be issued upon conversion of the Preferred Stock. In lieu of any fractional shares to which the holder would otherwise be entitled, the Corporation shall pay cash equal to such fraction multiplied by the fair market value of a share of Common Stock as determined in good faith by the Board of Directors of the Corporation. Whether or not fractional shares would be issuable upon such conversion shall be determined on the basis of the total number of shares of Preferred Stock as the case may be, the holder is at the time converting into Common Stock and the aggregate number of shares of Common Stock issuable upon such conversion.

4.3 **Mechanics of Conversion.**

4.3.1 **Notice of Conversion.** In order for a holder of Preferred Stock (other than Series H Preferred Stock prior to the Series H Adjustment Date) to voluntarily convert shares of Preferred Stock (other than Series H Preferred Stock prior to the Series H Adjustment Date) into shares of Common Stock, such holder shall surrender the certificate or certificates, if any, for such shares of Preferred Stock (or, if such registered holder alleges that such certificate has been lost, stolen or destroyed, a lost certificate affidavit and agreement reasonably acceptable to the Corporation to indemnify the Corporation against any claim that may be made against the Corporation on account of the alleged loss, theft or destruction of such certificate), at the office of the transfer agent for the Preferred Stock (or at the principal office of the Corporation if the Corporation serves as its own transfer agent), together with written notice that such holder elects to convert all or any number of the shares of the Preferred Stock represented by such certificate or certificates, if any, and, if applicable, any event on which such conversion is contingent. Such notice shall state such holder’s name or the names of the nominees in which such holder wishes the certificate or certificates for shares of Common Stock to be issued. If required by the Corporation, certificates surrendered for conversion shall be endorsed or accompanied by a written instrument or instruments of transfer, in form satisfactory to the Corporation, duly executed by the registered holder or his, her or its attorney duly authorized in writing. The close of business on the date of receipt by the transfer agent (or by the Corporation if the Corporation serves as its own transfer agent) of such certificates (or lost certificate affidavit and agreement) and notice shall be the time of conversion (the “Conversion Time”), and the shares of Common Stock issuable upon conversion of the shares represented by such certificate shall be deemed to be outstanding of record as of such date and time. The Corporation shall, as soon as practicable after the Conversion Time, (i) issue and deliver to such holder of Preferred Stock, or to his, her or its nominees, a certificate or certificates for the number of full shares of Common Stock issuable upon such conversion in accordance with the provisions hereof and a certificate for the number (if any) of the shares of Preferred Stock represented by the surrendered certificate that were not converted into Common Stock, (ii) pay in cash such amount as provided in Subsection 4.2 in lieu of any fraction of a share of Common Stock otherwise issuable upon such conversion and (iii) out of the Corporation’s funds that are then or thereafter legally available, pay all declared but unpaid dividends on the shares of Preferred Stock converted.
4.3.2 Reservation of Shares. The Corporation shall at all times when the Preferred Stock shall be outstanding, reserve and keep available out of its authorized but unissued capital stock, for the purpose of effecting the conversion of the Preferred Stock, such number of its duly authorized shares of Common Stock as shall from time to time be sufficient to effect the conversion of all outstanding Preferred Stock; and if at any time the number of authorized but unissued shares of Common Stock shall not be sufficient to effect the conversion of all then outstanding shares of the Preferred Stock, the Corporation shall take such corporate action as may be necessary to increase its authorized but unissued shares of Common Stock to such number of shares as shall be sufficient for such purposes, including, without limitation, engaging in best efforts to obtain the requisite stockholder approval of any necessary amendment to this Third Amended and Restated Certificate of Incorporation. Before taking any action which would cause an adjustment reducing the Applicable Conversion Price of a series of Preferred Stock below the then par value of the shares of Common Stock issuable upon conversion of shares of such series of Preferred Stock, the Corporation will take any corporate action which may, upon the advice of its counsel, be necessary in order that the Corporation may validly and legally issue fully paid and nonassessable shares of Common Stock at such adjusted Applicable Conversion Price.

4.3.3 Effect of Conversion. All shares of Preferred Stock which shall have been surrendered for conversion as herein provided shall no longer be deemed to be outstanding and all rights with respect to such shares shall immediately cease and terminate at the Conversion Time, except only the right of the holders thereof to receive shares of Common Stock in exchange therefor, to receive payment in lieu of any fraction of a share otherwise issuable upon such conversion as provided in Subsection 4.2 and to receive payment of any dividends declared but unpaid thereon. For the avoidance of doubt, no Accruing Dividends shall be payable, and no adjustment to any Applicable Conversion Price shall be made for any Accruing Dividends, upon conversion of the Preferred Stock if not specifically declared by the Corporation prior to such conversion. Any shares of Preferred Stock so converted shall be retired and cancelled and may not be reissued as shares of such series, and the Corporation may thereafter take such appropriate action (without the need for stockholder action other than as required by law) as may be necessary to reduce the authorized number of shares of Preferred Stock accordingly.

4.3.4 No Further Adjustment. Upon any such conversion, no adjustment to any Applicable Conversion Price shall be made for any declared but unpaid dividends on the Preferred Stock surrendered for conversion or on the Common Stock delivered upon conversion.

4.3.5 Taxes. The Corporation shall pay any and all issue and other similar taxes that may be payable in respect of any issuance or delivery of shares of Common Stock upon conversion of shares of Preferred Stock pursuant to this Section 4. The Corporation shall not, however, be required to pay any tax which may be payable in respect of any transfer involved in the issuance and delivery of shares of Common Stock in a name other than that in which the shares of Preferred Stock so converted were registered, and no such issuance or delivery shall be made unless and until the person or entity requesting such issuance has paid to the Corporation the amount of such tax or has established, to the satisfaction of the Corporation, that such tax has been paid.
4.4 Adjustments to Conversion Price for Diluting Issues

4.4.1 Special Definitions. For purposes of this Article Fourth, the following definitions shall apply:

(a) “Option” shall mean rights, options or warrants to subscribe for, purchase or otherwise acquire Common Stock or Convertible Securities.

(b) “Original Issue Date” shall mean the date on which the first share of Series H Preferred Stock was issued.

(c) “Convertible Securities” shall mean any evidences of indebtedness, shares or other securities directly or indirectly convertible into or exchangeable for Common Stock, including Preferred Stock, but excluding Options.

(d) “Additional Shares of Common Stock” shall mean all shares of Common Stock issued (or, pursuant to Subsection 4.4.3 below, deemed to be issued) by the Corporation after the Original Issue Date, other than (1) the following shares of Common Stock, (2) shares of Common Stock deemed issued pursuant to the following Options and Convertible Securities, (3) shares of Common Stock and Convertible Securities issued in connection with the conversion of Units (as defined in the Operating Agreement) pursuant to the Initial Merger Agreement, and (4) the other securities described below (clauses (1), (2), (3) and (4), collectively, “Exempted Securities”):

(i) shares of Common Stock, Options or Convertible Securities issued upon the conversion of Preferred Stock or as a dividend or distribution on Preferred Stock;

(ii) shares of Common Stock, Options or Convertible Securities issued by reason of a dividend, stock split, split-up or other distribution on shares of Common Stock that is covered by Subsection 4.5, 4.6, 4.7 or 4.8;

(iii) shares of Common Stock or Options issued to employees or directors of, or consultants or advisors to, the Corporation or any of its subsidiaries pursuant to a plan, agreement or arrangement approved by the Board of Directors of the Corporation, including at least one of the Investor Directors;

(iv) shares of Common Stock or Convertible Securities actually issued upon the exercise of Options or shares of Common Stock actually issued upon the conversion or exchange of Convertible Securities, in each case provided such issuance is pursuant to the terms of such Option or Convertible Security;

(v) shares of Common Stock, Options or Convertible Securities issued to banks, equipment lessors or other financial institutions, or to real property lessors, pursuant to a debt financing, equipment leasing or real property leasing transaction approved by the Board of Directors of the Corporation, including at least one of the Investor Directors;
(vi) shares of Common Stock, Options or Convertible Securities issued to suppliers or third party service providers in connection with the provision of goods or services pursuant to transactions approved by the Board of Directors of the Corporation, including at least one of the Investor Directors;

(vii) shares of Common Stock, Options or Convertible Securities issued in connection with sponsored research, collaboration, technology license, development, marketing or other similar agreements or strategic partnerships approved by the Board of Directors of the Corporation, including at least one of the Investor Directors;

(viii) shares of Common Stock issued in connection with the Corporation’s first underwritten public offering of its Common Stock under the Securities Act of 1933, as amended; or

(ix) shares of Common Stock, Options or Convertible Securities issued or issuable, directly or indirectly, by any subsidiary of the Corporation under any such subsidiary’s equity incentive plan(s) which may be later converted or exchanged for Common Stock, Options or Convertible Securities in connection with a consolidation, reorganization, or similar business transaction (in each case, however effected) of such subsidiary into the Corporation or an Affiliate thereof that is approved by the Board of Directors, including at least one of the Investor Directors.

4.4.2 No Adjustment of Conversion Price. No adjustment in the Series A Conversion Price shall be made as the result of the issuance or deemed issuance of Additional Shares of Common Stock if the Corporation receives written notice from the holders of at least two-thirds of the then outstanding shares of Series A Preferred Stock agreeing that no such adjustment shall be made as the result of the issuance or deemed issuance of such Additional Shares of Common Stock. No adjustment in the Series B Conversion Price shall be made as the result of the issuance or deemed issuance of Additional Shares of Common Stock if the Corporation receives written notice from the holders of at least two-thirds of the then outstanding shares of Series B Preferred Stock agreeing that no such adjustment shall be made as the result of the issuance or deemed issuance of such Additional Shares of Common Stock. No adjustment in the Series C Conversion Price shall be made as the result of the issuance or deemed issuance of Additional Shares of Common Stock if the Corporation receives written notice from the holders of a majority of the then outstanding shares of Series C Preferred Stock agreeing that no such adjustment shall be made as the result of the issuance or deemed issuance of such Additional Shares of Common Stock. No adjustment in the Series D Conversion Price shall be made as the result of the issuance or deemed issuance of Additional Shares of Common Stock if the Corporation receives written notice from the holders of a majority of the then outstanding shares of Series D Preferred Stock agreeing that no such adjustment shall be made as
the result of the issuance or deemed issuance of such Additional Shares of Common Stock. No adjustment in the Series E Conversion Price shall be made as
the result of the issuance or deemed issuance of Additional Shares of Common Stock if the Corporation receives written notice from the holders of a majority
of the then outstanding shares of Series E Preferred Stock agreeing that no such adjustment shall be made as the result of the issuance or deemed issuance of
such Additional Shares of Common Stock. No adjustment in the Series F Conversion Price shall be made as the result of the issuance or deemed issuance of
Additional Shares of Common Stock if the Corporation receives written notice from the holders of a majority of the then outstanding shares of Series F
Preferred Stock agreeing that no such adjustment shall be made as the result of the issuance or deemed issuance of such Additional Shares of Common Stock.
No adjustment in the Series G Conversion Price shall be made as the result of the issuance or deemed issuance of Additional Shares of Common Stock if the
Corporation receives written notice from the holders of a majority of the then outstanding shares of Series G Preferred Stock agreeing that no such adjustment
shall be made as the result of the issuance or deemed issuance of such Additional Shares of Common Stock.

4.4.3 Deemed Issue of Additional Shares of Common Stock.

(a) If the Corporation at any time or from time to time after the Original Issue Date shall issue any Options or Convertible
Securities (excluding Options or Convertible Securities which are themselves Exempted Securities) or shall fix a record date for the determination of
holders of any class of securities entitled to receive any such Options or Convertible Securities, then the maximum number of shares of Common Stock
(as set forth in the instrument relating thereto, assuming the satisfaction of any conditions to exercisability, convertibility or exchangeability but
without regard to any provision contained therein for a subsequent adjustment of such number) issuable upon the exercise of such Options or, in the
case of Convertible Securities and Options therefor, the conversion or exchange of such Convertible Securities, shall be deemed to be Additional
Shares of Common Stock issued as of the time of such issue or, in case such a record date shall have been fixed, as of the close of business on such
record date.

(b) If the terms of any Option or Convertible Security, the issuance of which resulted in an adjustment to any Applicable
Conversion Price pursuant to the terms of Subsection 4.4.4 are revised as a result of an amendment to such terms or any other adjustment pursuant to
the provisions of such Option or Convertible Security (but excluding automatic adjustments to such terms pursuant to anti-dilution or similar
provisions of such Option or Convertible Security) to provide for either (1) any increase or decrease in the number of shares of Common Stock issuable
upon the exercise, conversion and/or exchange of any such Option or Convertible Security or (2) any increase or decrease in the consideration payable
to the Corporation upon such exercise, conversion and/or exchange, then, effective upon such increase or decrease becoming effective, such
Applicable Conversion Price computed upon the original issue of such Option or Convertible Security (or upon the occurrence of a record date with
respect thereto) shall be readjusted to the Applicable Conversion Price as would have obtained had such revised terms been in effect upon the original
date of issuance of such Option or Convertible Security. Notwithstanding the foregoing, no readjustment pursuant to this clause (b) shall have the
effect of increasing any Applicable Conversion
Price to an amount which exceeds the lower of (i) the Applicable Conversion Price in effect immediately prior to the original adjustment made as a result of the issuance of such Option or Convertible Security, or (ii) the Applicable Conversion Price that would have resulted from any issuances of Additional Shares of Common Stock (other than deemed issuances of Additional Shares of Common Stock as a result of the issuance of such Option or Convertible Security) between the original adjustment date and such readjustment date.

(c) If the terms of any Option or Convertible Security (excluding Options or Convertible Securities which are themselves Exempted Securities), the issuance of which did not result in an adjustment to any Applicable Conversion Price pursuant to the terms of Subsection 4.4.4 (either because the consideration per share (determined pursuant to Subsection 4.4.5) of the Additional Shares of Common Stock subject thereto was equal to or greater than the Applicable Conversion Price then in effect, or because such Option or Convertible Security was issued before the Original Issue Date), are revised after the Original Issue Date as a result of an amendment to such terms or any other adjustment pursuant to the provisions of such Option or Convertible Security (but excluding automatic adjustments to such terms pursuant to anti-dilution or similar provisions of such Option or Convertible Security) to provide for either (1) any increase in the number of shares of Common Stock issuable upon the exercise, conversion or exchange of any such Option or Convertible Security or (2) any decrease in the consideration payable to the Corporation upon such exercise, conversion or exchange, then such Option or Convertible Security, as so amended or adjusted, and the Additional Shares of Common Stock subject thereto (determined in the manner provided in Subsection 4.4.3(a)) shall be deemed to have been issued effective upon such increase or decrease becoming effective.

(d) Upon the expiration or termination of any unexercised Option or unconverted or unexchanged Convertible Security (or portion thereof) which resulted (either upon its original issuance or upon a revision of its terms) in an adjustment to any Applicable Conversion Price pursuant to the terms of Subsection 4.4.4, such Applicable Conversion Price shall be readjusted to such Applicable Conversion Price as would have obtained had such Option or Convertible Security (or portion thereof) never been issued.

(e) If the number of shares of Common Stock issuable upon the exercise, conversion and/or exchange of any Option or Convertible Security, or the consideration payable to the Corporation upon such exercise, conversion and/or exchange, is calculable at the time such Option or Convertible Security is issued or amended but is subject to adjustment based upon subsequent events, any adjustment to such Applicable Conversion Price provided for in this Subsection 4.4.3 shall be effected at the time of such issuance or amendment based on such number of shares or amount of consideration without regard to any provisions for subsequent adjustments (and any subsequent adjustments shall be treated as provided in clauses (b) and (c) of this Subsection 4.4.3). If the number of shares of Common Stock issuable upon the exercise, conversion and/or exchange of any Option or Convertible Security, or the consideration payable to the Corporation upon such exercise, conversion and/or exchange, cannot be
calculated at all at the time such Option or Convertible Security is issued or amended, any adjustment to such Applicable Conversion Price that would result under the terms of this Subsection 4.4.3 at the time of such issuance or amendment shall instead be effected at the time such number of shares and/or amount of consideration is first calculable (even if subject to subsequent adjustments), assuming for purposes of calculating such adjustment to such Applicable Conversion Price that such issuance or amendment took place at the time such calculation can first be made.

4.4.4 Adjustment of Conversion Price Upon Issuance of Additional Shares of Common Stock. In the event the Corporation shall at any time after the Original Issue Date issue Additional Shares of Common Stock (including Additional Shares of Common Stock deemed to be issued pursuant to Subsection 4.4.3), without consideration or for a consideration per share less than such Applicable Conversion Price in effect immediately prior to such issue, then such Applicable Conversion Price (other than the Series H Conversion Price) shall be reduced, concurrently with such issue, to a price (calculated to the nearest one-hundredth of a cent) determined in accordance with the following formula:

\[ CP_2 = \frac{CP_1 \times (A + B)}{(A + C)} \]

For purposes of the foregoing formula, the following definitions shall apply:

(a) “CP₂” shall mean the Applicable Conversion Price in effect immediately after such issue of Additional Shares of Common Stock;

(b) “CP₁” shall mean the Applicable Conversion Price in effect immediately prior to such issue of Additional Shares of Common Stock;

(c) “A” shall mean the number of shares of Common Stock outstanding immediately prior to such issue of Additional Shares of Common Stock (treating for this purpose as outstanding all shares of Common Stock issuable upon exercise of Options outstanding immediately prior to such issue or upon conversion or exchange of Convertible Securities (including the Preferred Stock) outstanding (assuming exercise of any outstanding Options therefor) immediately prior to such issue);

(d) “B” shall mean the number of shares of Common Stock that would have been issued if such Additional Shares of Common Stock had been issued at a price per share equal to CP₁ (determined by dividing the aggregate consideration received by the Corporation in respect of such issue by CP₁); and

(e) “C” shall mean the number of such Additional Shares of Common Stock issued in such transaction.

4.4.5 Determination of Consideration. For purposes of this Subsection 4.4, the consideration received by the Corporation for the issue of any Additional Shares of Common Stock shall be computed as follows:

(a) Cash and Property: Such consideration shall:
(i) insofar as it consists of cash, be computed at the aggregate amount of cash received by the Corporation, excluding amounts paid or payable for accrued interest;

(ii) insofar as it consists of property other than cash, be computed at the fair market value thereof at the time of such issue, as determined in good faith by the Board of Directors of the Corporation; and

(iii) in the event Additional Shares of Common Stock are issued together with other shares or securities or other assets of the Corporation for consideration which covers both, be the proportion of such consideration so received, computed as provided in clauses (i) and (ii) above, as determined in good faith by the Board of Directors of the Corporation.

(b) **Options and Convertible Securities.** The consideration per share received by the Corporation for Additional Shares of Common Stock deemed to have been issued pursuant to **Subsection 4.4.3**, relating to Options and Convertible Securities, shall be determined by dividing:

(i) the total amount, if any, received or receivable by the Corporation as consideration for the issue of such Options or Convertible Securities, plus the minimum aggregate amount of additional consideration (as set forth in the instruments relating thereto, without regard to any provision contained therein for a subsequent adjustment of such consideration) payable to the Corporation upon the exercise of such Options or the conversion or exchange of such Convertible Securities, or in the case of Options for Convertible Securities, the exercise of such Options for Convertible Securities and the conversion or exchange of such Convertible Securities, by

(ii) the maximum number of shares of Common Stock (as set forth in the instruments relating thereto, without regard to any provision contained therein for a subsequent adjustment of such number) issuable upon the exercise of such Options or the conversion or exchange of such Convertible Securities, or in the case of Options for Convertible Securities, the exercise of such Options for Convertible Securities and the conversion or exchange of such Convertible Securities.

4.4.6 **Multiple Closing Dates.** In the event the Corporation shall issue on more than one date Additional Shares of Common Stock that are a part of one transaction or a series of related transactions and that would result in an adjustment to any Applicable Conversion Price pursuant to the terms of **Subsection 4.4.4**, and such issuance dates occur within a period of no more than ninety (90) days from the first such issuance to the final such issuance, then, upon the final such issuance, such Applicable Conversion Price shall be readjusted to give effect to all such issuances as if they occurred on the date of the first such issuance (and without giving effect to any additional adjustments as a result of any such subsequent issuances within such period).
4.5 Adjustment for Stock Splits and Combinations. If the Corporation shall at any time or from time to time after the Original Issue Date effect a subdivision of the outstanding Common Stock, the Applicable Conversion Price in effect immediately before that subdivision shall be proportionately decreased so that the number of shares of Common Stock issuable on conversion of each share of such series shall be increased in proportion to such increase in the aggregate number of shares of Common Stock outstanding. If the Corporation shall at any time or from time to time after the Original Issue Date combine the outstanding shares of Common Stock, the Applicable Conversion Price in effect immediately before the combination shall be proportionately increased so that the number of shares of Common Stock issuable on conversion of each share of such series shall be decreased in proportion to such decrease in the aggregate number of shares of Common Stock outstanding. Any adjustment under this subsection shall become effective at the close of business on the date the subdivision or combination becomes effective.

4.6 Adjustment for Certain Dividends and Distributions. In the event the Corporation at any time or from time to time after the Original Issue Date shall make or issue, or fix a record date for the determination of holders of Common Stock entitled to receive, a dividend or other distribution payable on the Common Stock in additional shares of Common Stock, then and in each such event the Applicable Conversion Price in effect immediately before such event shall be decreased as of the time of such issuance or, in the event such a record date shall have been fixed, as of the close of business on such record date, by multiplying the Applicable Conversion Price then in effect by a fraction:

   (1) the numerator of which shall be the total number of shares of Common Stock issued and outstanding immediately prior to the time of such issuance or the close of business on such record date, and
   
   (2) the denominator of which shall be the total number of shares of Common Stock issued and outstanding immediately prior to the time of such issuance or the close of business on such record date plus the number of shares of Common Stock issuable in payment of such dividend or distribution.

Notwithstanding the foregoing, (a) if such record date shall have been fixed and such dividend is not fully paid or if such distribution is not fully made on the date fixed therefor, the Applicable Conversion Price shall be recomputed accordingly as of the close of business on such record date and thereafter the Applicable Conversion Price shall be adjusted pursuant to this subsection as of the time of actual payment of such dividends or distributions; and (b) that no such adjustment shall be made if the holders of such series of Preferred Stock simultaneously receive a dividend or other distribution of shares of Common Stock in a number equal to the number of shares of Common Stock as they would have received if all outstanding shares of such series of Preferred Stock had been converted into Common Stock on the date of such event.

4.7 Adjustments for Other Dividends and Distributions. In the event the Corporation at any time or from time to time after the Original Issue Date shall make or issue, or fix a record date for the determination of holders of Common Stock entitled to receive, a dividend or other distribution payable in securities of the Corporation (other than a distribution of shares of Common Stock in respect of outstanding shares of Common Stock) or in other
property and the provisions of Section 1 do not apply to such dividend or distribution, then and in each such event the holders of each series of Preferred Stock shall receive, simultaneously with the distribution to the holders of Common Stock, a dividend or other distribution of such securities or other property in an amount equal to the amount of such securities or other property as they would have received if all outstanding shares of such series of Preferred Stock had been converted into Common Stock on the date of such event.

4.8 Adjustment for Merger or Reorganization, etc. Subject to the provisions of Subsection 2.9, if there shall occur any reorganization, recapitalization, reclassification, consolidation or merger involving the Corporation in which the Common Stock (but not any series of Preferred Stock) is converted into or exchanged for securities, cash or other property (other than a transaction covered by Subsections 4.4, 4.6 or 4.7), then, following any such reorganization, recapitalization, reclassification, consolidation or merger, each share of such series of Preferred Stock shall thereafter be convertible in lieu of the Common Stock into which it was convertible prior to such event into the kind and amount of securities, cash or other property which a holder of the number of shares of Common Stock of the Corporation issuable upon conversion of one share of such series of Preferred Stock immediately prior to such reorganization, recapitalization, reclassification, consolidation or merger would have been entitled to receive pursuant to such transaction; and, in such case, appropriate adjustment (as determined in good faith by the Board of Directors of the Corporation) shall be made in the application of the provisions in this Section 4 with respect to the rights and interests thereafter of the holders of such series of Preferred Stock, to the end that the provisions set forth in this Section 4 (including provisions with respect to changes in and other adjustments of the Applicable Conversion Price) shall thereafter be applicable, as nearly as reasonably may be, in relation to any securities or other property thereafter deliverable upon the conversion of such series of Preferred Stock.

4.9 Certificate as to Adjustments. Upon the occurrence of each adjustment or readjustment of the Applicable Conversion Price pursuant to this Section 4, the Corporation at its expense shall compute such adjustment or readjustment in accordance with the terms hereof and furnish to each holder of such series of Preferred Stock a certificate setting forth such adjustment or readjustment (including the kind and amount of securities, cash or other property into which such series of Preferred Stock is convertible) and showing in detail the facts upon which such adjustment or readjustment is based.

4.10 Notice of Record Date. In the event:

(a) the Corporation shall take a record of the holders of its Common Stock (or other capital stock or securities at the time issuable upon conversion of the Preferred Stock) for the purpose of entitling or enabling them to receive any dividend or other distribution, or to receive any right to subscribe for or purchase any shares of capital stock of any class or any other securities, or to receive any other security; or

(b) of any capital reorganization of the Corporation, any reclassification of the Common Stock of the Corporation, or any Deemed Liquidation Event; or
then, and in each such case, the Corporation will send or cause to be sent to the holders of each series of Preferred Stock a notice specifying, as the case may be, (i) the record date for such dividend, distribution or right, and the amount and character of such dividend, distribution or right, or (ii) the effective date on which such reorganization, reclassification, consolidation, merger, transfer, dissolution, liquidation or winding-up is proposed to take place, and the time, if any is to be fixed, as of which the holders of record of Common Stock (or such other capital stock or securities at the time issuable upon the conversion of such series of Preferred Stock) shall be entitled to exchange their shares of Common Stock (or such other capital stock or securities) for securities or other property deliverable upon such reorganization, reclassification, consolidation, merger, transfer, dissolution, liquidation or winding-up, and the amount per share and character of such exchange applicable to such series of Preferred Stock and the Common Stock. Such notice shall be sent at least 10 days prior to the record date or effective date for the event specified in such notice.

5. Mandatory Conversion.

5.1 Trigger Events. Upon either (a) the date and time, or the occurrence of an event, specified by vote or written consent of the Requisite Vote or (b) the closing of a public offering pursuant to an effective registration statement under the Securities Act of 1933, as amended, approved by the Board of Directors of the Corporation, and in connection with such offering the Common Stock is listed for trading on the Nasdaq Stock Market, the New York Stock Exchange or another domestic or foreign nationally recognized stock exchange (such public offering, the “IPO”), all outstanding shares of Preferred Stock shall automatically be converted into shares of Common Stock, at the Applicable Conversion Ratio then in effect; provided, that if such event occurs prior to the Series H Adjustment Date, outstanding shares of Series H Preferred Stock shall be automatically converted pursuant to Subsection 5.1.1. Upon the date and time, or the occurrence of an event, specified by vote or written consent of the holders of at least two-thirds of the then outstanding shares of Series A Preferred Stock, all outstanding shares of Series A Preferred Stock shall automatically be converted into shares of Common Stock, at the Applicable Conversion Ratio then in effect. Upon the date and time, or the occurrence of an event, specified by vote or written consent of the holders of at least two-thirds of the then outstanding shares of Series B Preferred Stock, all outstanding shares of Series B Preferred Stock shall automatically be converted into shares of Common Stock, at the Applicable Conversion Ratio then in effect. Upon the date and time, or the occurrence of an event, specified by vote or written consent of the holders of a majority of the then outstanding shares of Series C Preferred Stock, all outstanding shares of Series C Preferred Stock shall automatically be converted into shares of Common Stock, at the Applicable Conversion Ratio then in effect. Upon the date and time, or the occurrence of an event, specified by vote or written consent of the holders of a majority of the then outstanding shares of Series D Preferred Stock, all outstanding shares of Series D Preferred Stock shall automatically be converted into shares of Common Stock, at the Applicable Conversion Ratio then in effect. Upon the date and time, or the occurrence of an event, specified by vote or written consent of the holders of a majority of the then outstanding shares of Series E Preferred Stock, all outstanding shares of Series E Preferred Stock shall automatically be converted into shares of Common Stock, at the Applicable
Conversion Ratio then in effect. Upon the date and time, or the occurrence of an event, specified by vote or written consent of the holders of a majority of the then outstanding shares of Series F Preferred Stock, all outstanding shares of Series F Preferred Stock shall automatically be converted into shares of Common Stock, at the Applicable Conversion Ratio then in effect. Upon the date and time, or the occurrence of an event, specified by vote or written consent of the holders of a majority of the then outstanding shares of Series G Preferred Stock, all outstanding shares of Series G Preferred Stock shall automatically be converted into shares of Common Stock, at the Applicable Conversion Ratio then in effect. Upon the date and time, or the occurrence of an event, specified by vote or written consent of the holders of a majority of the then outstanding shares of Series H Preferred Stock following the Series H Adjustment Date, all outstanding shares of Series H Preferred Stock shall automatically be converted into shares of Common Stock, at the Applicable Conversion Ratio then in effect. The time of such closing or the date and time specified or the time of the event specified in any such vote or written consent pursuant to this Section 5.1 is referred to herein as the “Mandatory Conversion Time”, and after such event, such shares of each affected series of Preferred Stock may not be reissued by the Corporation. The term “Mandatory Conversion Time” shall also refer to the time of conversion of the Series H Preferred Stock pursuant to Subsections 5.1.1, 5.1.2 and 5.1.3. The provisions of Subsections 5.1.1, 5.1.2 and 5.1.3 provide the only conversion provisions with respect to the Series H Preferred Stock prior to the Series H Adjustment Date.

5.1.1 Series H Conversion Trigger Events.

(a) At any time prior to the Series H Adjustment Date, all outstanding shares of Series H Preferred Stock shall automatically be converted into shares of Common Stock upon the earlier of: (a) the date and time, or the occurrence of an event, specified by vote or written consent of holders representing the Requisite Vote, at the Series H Requisite Vote Conversion Ratio (as defined below) then in effect or (b) the closing of the IPO, at the Series H IPO Conversion Ratio (as defined below) then in effect.

(b) If, prior to the Series H Adjustment Date, the Corporation effects a liquidation, dissolution, winding up or Deemed Liquidation Event, the Series H Conversion Ratio shall be equal to the Series H Liquidation Conversion Ratio (as defined below). This subsection 5.1.1(b) shall be the only optional conversion provision for the Series H Preferred Stock prior to the Series H Adjustment Date.

5.1.2 Series H Twenty-One Month Trigger Event. On the Series H Adjustment Date, the Series H Conversion Price shall be equal to $10.06 (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Common Stock). For clarity, on or following the Series H Adjustment Date, the Series H Conversion Price shall be subject to adjustment pursuant to Subsections 4.5 through 4.10 similar to other series of Preferred Stock.
5.1.3 Definitions. For purposes of Article Fourth, the following definitions shall apply:

(a) “Discounted IPO Price” shall mean the greater of (i) the product of 0.9 multiplied by the public offering price per share of Common Stock set forth on the cover page of the final prospectus for such offering and (ii) $10.06 (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Common Stock, which, for clarity and by way of example, would mean dividing such amount by 2 in the event of a 2:1 split of the Common Stock or multiplying such amount by 2 in the event of a 1:2 reverse split of the Common Stock).

(b) “Series H Conversion Price” shall mean the applicable conversion price, as described in Subsection 5.1.1 or 5.1.2.

(c) “Series H Conversion Ratio” shall mean the Series H Requisite Vote Conversion Ratio, the Series H IPO Conversion Ratio, or the Series H Liquidation Conversion Ratio, as applicable.

(d) “Series H IPO Conversion Ratio” shall mean the quotient obtained by dividing the Series H Original Issue Price by the Discounted IPO Price.

(e) “Series H Liquidation Conversion Price” shall mean an amount equal to the greater of (i) the product of 0.9 multiplied by the consideration per share payable to the holders of Common Stock, in their capacity as such, in connection with such transaction and (ii) $10.06 (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to such Common Stock, which, for clarity and by way of example, would mean dividing such amount by 2 in the event of a 2:1 split of the Common Stock or multiplying such amount by 2 in the event of a 1:2 reverse split of the Common Stock).

(f) “Series H Liquidation Conversion Ratio” shall mean the quotient obtained by dividing the Series H Original Issue Price by the Series H Liquidation Conversion Price.

(g) “Series H Requisite Vote Conversion Ratio” shall mean the quotient obtained by dividing the Series H Original Issue Price by $10.06 (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to such Common Stock, which, for clarity and by way of example, would mean dividing such amount by 2 in the event of a 2:1 split of the Common Stock or multiplying such amount by 2 in the event of a 1:2 reverse split of the Common Stock).

5.2 Procedural Requirements. All holders of record of shares of Preferred Stock shall be sent written notice of the Mandatory Conversion Time and the place designated for mandatory conversion of all such shares of Preferred Stock pursuant to this Section 5. Such notice need not be sent in advance of the occurrence of the Mandatory Conversion Time. Upon receipt of such notice, each holder of shares of Preferred Stock shall surrender his, her or its certificate or certificates, if any, for all such shares (or, if such holder alleges that such certificate
has been lost, stolen or destroyed, a lost certificate affidavit and agreement reasonably acceptable to the Corporation to indemnify the Corporation against any claim that may be made against the Corporation on account of the alleged loss, theft or destruction of such certificate) to the Corporation at the place designated in such notice. If so required by the Corporation, certificates surrendered for conversion shall be endorsed or accompanied by written instrument or instruments of transfer, in form satisfactory to the Corporation, duly executed by the registered holder or by his, her or its attorney duly authorized in writing. All rights with respect to the Preferred Stock converted pursuant to Section 5.1, including the rights, if any, to receive notices and vote (other than as a holder of Common Stock), will terminate at the Mandatory Conversion Time (notwithstanding the failure of the holder or holders thereof to surrender the certificates at or prior to such time), except only the rights of the holders thereof, upon surrender of their certificate or certificates (or lost certificate affidavit and agreement) therefor, to receive the items provided for in the next sentence of this Subsection 5.2. As soon as practicable after the Mandatory Conversion Time and the surrender of the certificate or certificates (or lost certificate affidavit and agreement) for Preferred Stock, the Corporation shall issue and deliver to such holder, or to his, her or its nominees, a certificate or certificates for the number of full shares of Common Stock issuable on such conversion in accordance with the provisions hereof, together with cash as provided in Subsection 4.2 in lieu of any fraction of a share of Common Stock otherwise issuable upon such conversion and the payment of any declared but unpaid dividends on the shares of Preferred Stock converted. Such converted Preferred Stock shall be retired and cancelled and may not be reissued as shares of such series, and the Corporation may thereafter take such appropriate action (without the need for stockholder action other than as is required by law) as may be necessary to reduce the authorized number of shares of Preferred Stock accordingly.

6. Redeemed or Otherwise Acquired Shares. Any shares of Preferred Stock that are redeemed or otherwise acquired by the Corporation or any of its subsidiaries shall be automatically and immediately cancelled and retired and shall not be reissued, sold or transferred. Neither the Corporation nor any of its subsidiaries may exercise any voting or other rights granted to the holders of Preferred Stock following redemption. Except as set forth in Subsection 2.9.2(a), the Preferred Stock is not redeemable at the election of the holders of Preferred Stock.
7. Waiver. Subject to the specific consent rights set forth in Section 3.4, any of the rights, powers, preferences and other terms of the Preferred Stock set forth herein may be waived on behalf of all holders of Preferred Stock by the affirmative written consent or vote of the Requisite Vote; provided, that (a) any waiver with respect to the first sentence of Section 4.4.2 hereof or the second sentence of Section 5.1 hereof may be waived on behalf of all holders of Series A Preferred Stock only by the affirmative written consent or vote of the holders of at least two-thirds in voting power of the Series A Preferred Stock outstanding, (b) any waiver with respect to the second sentence of Section 4.4.2 hereof or the third sentence of Section 5.1 hereof may be waived on behalf of all holders of Series B Preferred Stock only by the affirmative written consent or vote of the holders of at least two-thirds in voting power of the Series B Preferred Stock outstanding, (c) any waiver with respect to the third sentence of Section 4.4.2 hereof or the fourth sentence of Section 5.1 hereof may be waived on behalf of all holders of Series C Preferred Stock only by the affirmative written consent or vote of the holders of at least a majority in voting power of the Series C Preferred Stock outstanding, (d) any waiver with respect to the fourth sentence of Section 4.4.2 hereof or the fifth sentence of Section 5.1 hereof may be waived on behalf of all holders of Series D Preferred Stock only by the affirmative written consent or vote of the holders of at least a majority in voting power of the Series D Preferred Stock outstanding, (e) any waiver with respect to the fifth sentence of Section 4.4.2 hereof or the sixth sentence of Section 5.1 hereof may be waived on behalf of all holders of Series E Preferred Stock only by the affirmative written consent or vote of the holders of at least a majority in voting power of the Series E Preferred Stock outstanding, (f) any waiver with respect to the sixth sentence of Section 4.4.2 hereof or the seventh sentence of Section 5.1 hereof may be waived on behalf of all holders of Series F Preferred Stock only by the affirmative written consent or vote of the holders of at least a majority in voting power of the Series F Preferred Stock outstanding, (g) any waiver with respect to the seventh sentence of Section 4.4.2 hereof or the eighth sentence of Section 5.1 hereof may be waived on behalf of all holders of Series G Preferred Stock only by the affirmative written consent or vote of the holders of at least a majority in voting power of the Series G Preferred Stock outstanding, and (h) any waiver with respect to Sections 5.1.1, 5.1.2 and 5.1.3 hereof may be waived on behalf of all holders of Series H Preferred Stock only by the affirmative written consent or vote of the holders of at least a majority in voting power of the Series H Preferred Stock outstanding.

8. Notices. Any notice required or permitted by the provisions of this Article Fourth to be given to a holder of shares of Preferred Stock shall be mailed, postage prepaid, to the post office address last shown on the records of the Corporation, or given by electronic communication in compliance with the provisions of the General Corporation Law, and shall be deemed sent upon such mailing or electronic transmission.

FIFTH: Unless otherwise indicated, the following provisions shall apply to all stockholders of the Corporation. Unless otherwise indicated, references to "Sections" or "Subsections" in this Article Fifth refer to sections or subsections of this Article Fifth.

1. Definitions. For purposes of this Article Fifth, the following definitions shall apply:
1.1 “Capital Stock” means (a) shares of Common Stock and Preferred Stock (whether now outstanding or hereafter issued in any context), (b) shares of Common Stock issued or issuable upon conversion of Preferred Stock and (c) shares of Common Stock issued or issuable upon exercise or conversion, as applicable, of stock options, warrants or other convertible securities of the Corporation, in each case now owned or subsequently acquired by any Key Holder (as defined below), any Investor (as defined below), or their respective successors or permitted transferees or assigns. For purposes of the number of shares of Capital Stock held by an Investor or Key Holder (or any other calculation based thereon), all shares of Preferred Stock shall be deemed to have been converted into Common Stock at the then-applicable conversion ratio (for the avoidance of doubt, without giving effect to any adjustment to the Applicable Conversion Ratio described in Article Fourth, Subsection 4.1.1 herein).

1.2 “Form S-1” means such form under the Securities Act as in effect on the date hereof or any successor registration form under the Securities Act subsequently adopted by the SEC.

1.3 “Form S-3” means such form under the Securities Act as in effect on the date hereof or any registration form under the Securities Act subsequently adopted by the SEC that permits incorporation of substantial information by reference to other documents filed by the Corporation with the SEC.

1.4 “Investor Notice” means written notice from an Investor notifying the Corporation and the selling Key Holder that such Investor intends to exercise its Right of First Refusal as to a portion of the Transfer Stock with respect to any Proposed Key Holder Transfer.

1.5 “Investors” means the Persons named on Schedule A, as it may be updated from time to time, attached to the Amended and Restated Right of First Refusal and Co-Sale Agreement dated as of the Original Issue Date by and among the Corporation, the Investors, and the Key Holders listed therein as it may be amended and/or restated from time to time (the “ROFR”).

1.6 “Key Holders” means the Persons named on Schedule B attached to the ROFR, as it may be updated from time to time.

1.7 “Person” means an individual, firm, corporation, partnership, association, limited liability company, trust or any other entity.

1.8 “Proposed Key Holder Transfer” means any assignment, sale, offer to sell, pledge, mortgage, hypothecation, encumbrance, disposition of or any other like transfer or encumbering of any Transfer Stock (or any interest therein) proposed by any of the Key Holders.

1.9 “Proposed Transfer Notice” means written notice from a Key Holder setting forth the terms and conditions of a Proposed Key Holder Transfer.

1.10 “Prospective Transferee” means any Person to whom a Key Holder proposes to make a Proposed Key Holder Transfer.

1.11 “Right of Co-Sale” means the right, but not an obligation, of an Investor to participate in a Proposed Key Holder Transfer on the terms and conditions specified in the Proposed Transfer Notice.
1.12 “Right of First Refusal” means the right, but not an obligation, of each Investor (excluding the Key Holder proposing to make the applicable Proposed Key Holder Transfer, if such Key Holder is also an Investor) to purchase up to its pro rata portion (based upon the total number of shares of Capital Stock then held by all Investors (excluding the Key Holder proposing to make the applicable Proposed Key Holder Transfer, if such Key Holder is also an Investor)) of any Transfer Stock not purchased pursuant to the ROFR, on the terms and conditions specified in the Proposed Transfer Notice.


1.14 “Securities Act” means the Securities Act of 1933, as amended, and the rules and regulations promulgated thereunder.

1.15 “Shares” shall mean and include any securities of the Corporation the holders of which are entitled to vote for members of the Board of Directors, including without limitation, all shares of Common Stock and Preferred Stock, by whatever name called, now owned or subsequently acquired by a stockholder, however acquired, whether through stock splits, stock dividends, reclassifications, recapitalizations, similar events or otherwise.

1.16 “Transfer Stock” means shares of Capital Stock owned by a Key Holder, or issued to a Key Holder after the date hereof (including, without limitation, in connection with any stock split, stock dividend, recapitalization, reorganization, or the like), but does not include any shares of Preferred Stock or Common Stock issued or issuable upon conversion of Preferred Stock.

1.17 “Undersubscription Notice” means written notice from an Investor notifying the Corporation and the selling Key Holder that such Investor intends to exercise its option to purchase all or any portion of the Transfer Stock not purchased pursuant to the Right of First Refusal.

2. Right of First Refusal and Co-Sale.

2.1 Right of First Refusal.

2.1.1 Right of First Refusal. Subject to the terms of Section 2.4 below, the Investors shall have a Right of First Refusal to purchase all or any portion of the Transfer Stock that any Key Holder may propose to transfer in a Proposed Key Holder Transfer, at the same price and on the same terms and conditions as those offered to the Prospective Transferee.

2.1.2 Notice. Each Key Holder proposing to make a Proposed Key Holder Transfer must deliver a Proposed Transfer Notice to the Corporation and each Investor (other than the Key Holder proposing to make the Proposed Key Holder Transfer, if such Key Holder is also an Investor) not later than forty-five (45) days prior to the consummation of such Proposed Key Holder Transfer. Such Proposed Transfer Notice shall contain the material terms and conditions (including price and form of consideration) of the Proposed Key Holder Transfer and the identity of the Prospective Transferee. To exercise its Right of First Refusal under this Section 2.1, an Investor must deliver an Investor Notice to the
selling Key Holder and the Corporation within fifteen (15) days after delivery of the Proposed Transfer Notice. In the event of a conflict between this Section 2 and any other agreement that may have been entered into by a Key Holder with the Corporation that contains a preexisting right of first refusal, other than the ROFR, the Corporation and the Key Holder acknowledge and agree that the terms of this Section 2 shall control, and the Corporation shall not exercise any preexisting right of first refusal of the Corporation without the prior written consent of the Requisite Vote (excluding any shares of Capital Stock held by the Key Holder proposing to make the Proposed Key Holder Transfer, if such Key Holder is also an Investor).

2.1.3 Undersubscription of Transfer Stock. If options to purchase have been exercised by the Investors with respect to some but not all of the Transfer Stock by the end of the 15-day period specified in Section 2.1.2 (the “Investor Notice Period”), then the Corporation shall, immediately after the expiration of the Investor Notice Period, send written notice (the “Corporation Undersubscription Notice”) to those Investors who fully exercised their Right of First Refusal within the Investor Notice Period (the “Exercising Investors”). Each Exercising Investor shall, subject to the provisions of this Section 2.1.3, have an additional option to purchase all or any part of the balance of any such remaining unsubscribed shares of Transfer Stock on the terms and conditions set forth in the Proposed Transfer Notice. To exercise such option, an Exercising Investor must deliver an Undersubscription Notice to the selling Key Holder and the Corporation within ten (10) days after the expiration of the Investor Notice Period. In the event there are two or more such Exercising Investors that choose to exercise the last-mentioned option for a total number of remaining shares in excess of the number available, the remaining shares available for purchase under this Section 2.1.3 shall be allocated to such Exercising Investors pro rata based on the number of shares of Transfer Stock such Exercising Investors have elected to purchase pursuant to Section 2.1.3 shall be allocated to such Exercising Investors pro rata based on the number of shares of Transfer Stock such Exercising Investors have elected to purchase pursuant to the Corporation Undersubscription Notice. If the options to purchase the remaining shares are exercised in full by the Exercising Investors, the Corporation shall immediately notify all of the Exercising Investors and the selling Key Holder of that fact.

2.1.4 Consideration; Closing. If the consideration proposed to be paid for the Transfer Stock is in property, services or other non-cash consideration, the fair market value of the consideration shall be as determined in good faith by the Corporation’s Board of Directors. If any Investor cannot for any reason pay for the Transfer Stock in the same form of non-cash consideration, such Investor may pay the cash value equivalent thereof, as determined in good faith by the Board of Directors. The closing of the purchase of Transfer Stock by the Investors shall take place, and all payments from the Investors shall have been delivered to the selling Key Holder, by the later of (i) the date specified in the Proposed Transfer Notice as the intended date of the Proposed Key Holder Transfer and (ii) forty-five (45) days after delivery of the Proposed Transfer Notice.
2.2 Right of Co-Sale.

2.2.1 Exercise of Right. If any Transfer Stock subject to a Proposed Key Holder Transfer is not purchased pursuant to Section 2.1 above and thereafter is to be sold to a Prospective Transferee, each respective Investor (other than the Key Holder proposing to make the Proposed Key Holder Transfer, if such Key Holder is also an Investor) may elect to exercise its Right of Co-Sale and participate on a pro rata basis in the Proposed Key Holder Transfer as set forth in Section 2.2.2 below and otherwise on the same terms and conditions specified in the Proposed Transfer Notice (provided that if an Investor wishes to sell Preferred Stock, the price set forth in the Proposed Transfer Notice shall be appropriately adjusted based on the conversion ratio of the Preferred Stock into Common Stock). Each Investor who desires to exercise its Right of Co-Sale must give the selling Key Holder written notice to that effect within fifteen (15) days after the expiration of the Investor Notice Period described above, and upon giving such notice such Investor shall be deemed to have effectively exercised the Right of Co-Sale.

2.2.2 Shares Includable. Each Investor who timely exercises such Investor's Right of Co-Sale by delivering the written notice provided for above in Section 2.2.1 may include in the Proposed Key Holder Transfer all or any part of such Investor's Capital Stock equal to the product obtained by multiplying (i) the aggregate number of shares of Transfer Stock subject to the Proposed Key Holder Transfer (excluding shares purchased by the Investors pursuant to the Right of First Refusal) by (ii) a fraction, the numerator of which is the number of shares of Capital Stock owned by such Investor immediately before consummation of the Proposed Key Holder Transfer (including any shares that such Investor has agreed to purchase pursuant to the Right of First Refusal but excluding any Transfer Stock) and the denominator of which is the total number of shares of Capital Stock owned, in the aggregate, by all Investors immediately prior to the consummation of the Proposed Key Holder Transfer (including any shares that all Investors have collectively agreed to purchase pursuant to the Right of First Refusal but excluding any Transfer Stock), plus, without duplication, the number of shares of Transfer Stock held by the selling Key Holder. To the extent one or more of the Investors exercise such right of participation in accordance with the terms and conditions set forth herein, the number of shares of Transfer Stock that the selling Key Holder may sell in the Proposed Key Holder Transfer shall be correspondingly reduced.

2.2.3 Delivery of Certificates. Each Investor shall effect its participation in the Proposed Key Holder Transfer by delivering to the transferring Key Holder, no later than fifteen (15) days after such Investor's exercise of the Right of Co-Sale, one or more stock certificates, properly endorsed for transfer to the Prospective Transferee, representing (i) the number of shares of Common Stock that such Investor elects to include in the Proposed Key Holder Transfer and/or (ii) the number of shares of Preferred Stock that is at such time convertible into the number of shares of Common Stock that such Investor elects to include in the Proposed Key Holder Transfer, provided, however, that if the Prospective Transferee objects to the delivery of convertible Preferred Stock in lieu of Common Stock, such Investor shall first convert the Preferred Stock into Common Stock and deliver Common Stock as provided above. Notwithstanding the provisions of Section 4.3 of Article Fourth, the Corporation agrees to make any such conversion pursuant to the immediately preceding clause concurrent with and contingent upon, and the Conversion Time with respect to such conversion shall be the time of, the actual transfer of such shares to the Prospective Transferee.

2.2.4 Purchase Agreement. The terms and conditions of any sale pursuant to this Section 2.2 shall be memorialized in, and governed by, a written purchase and sale agreement with customary terms and provisions for such a transaction and the parties further covenant and agree to enter into such an agreement as a condition precedent to any sale or other transfer pursuant to this Section 2.2.

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2.2.5 Deliveries. Each stock certificate an Investor delivers to the selling Key Holder pursuant to Section 2.2.3 above shall be transferred to the Prospective Transferee against payment therefor in consummation of the sale of the Transfer Stock pursuant to the terms and conditions specified in the Proposed Transfer Notice and the purchase and sale agreement, and the selling Key Holder shall concurrently therewith remit or direct payment to each Investor the portion of the sale proceeds to which such Investor is entitled by reason of its participation in such sale. If any Prospective Transferee or Transferees refuse(s) to purchase securities subject to the Right of Co-Sale from any Investor exercising its Right of Co-Sale hereunder, no Key Holder may sell any Transfer Stock to such Prospective Transferee or Transferees unless and until, simultaneously with such sale, such Key Holder purchases all securities subject to the Right of Co-Sale from such Investor on the same terms and conditions (including the proposed purchase price) as set forth in the Proposed Transfer Notice.

2.2.6 Additional Compliance. If any Proposed Key Holder Transfer is not consummated within forty-five (45) days after receipt of the Proposed Transfer Notice by the Corporation, the Key Holders proposing the Proposed Key Holder Transfer may not sell any Transfer Stock unless they first comply in full with each provision of this Section 2.2. The exercise or election not to exercise any right by any Investor hereunder shall not adversely affect its right to participate in any other sales of Transfer Stock subject to this Section 2.2.

2.3 Effect of Failure to Comply.

2.3.1 Transfer Void; Equitable Relief. Any Proposed Key Holder Transfer not made in compliance with the requirements of this Section 2 shall be null and void ab initio, shall not be recorded on the books of the Corporation or its transfer agent and shall not be recognized by the Corporation.

2.3.2 Violation of First Refusal Right. If any Key Holder becomes obligated to sell any Transfer Stock to any Investor under this Section 2 and fails to deliver such Transfer Stock in accordance with the terms of this Third Amended and Restated Certificate of Incorporation such Investor may, at its option, in addition to all other remedies it may have, send to such Key Holder the purchase price for such Transfer Stock as is herein specified and transfer to the name of such Investor (or request that the Corporation effect such transfer in the name of an Investor) on the Corporation’s books the certificate or certificates representing the Transfer Stock to be sold.

2.3.3 Violation of Co-Sale Right. If any Key Holder purports to sell any Transfer Stock in contravention of the Right of Co-Sale (a “Prohibited Transfer”), each Investor who desires to exercise its Right of Co-Sale under Section 2.2 may, in addition to such remedies as may be available by law, in equity or hereunder, require such Key Holder to purchase from such Investor the type and number of shares of Capital Stock that such Investor would have been entitled to sell to the Prospective Transferee under Section 2.2 had the Prohibited Transfer been effected pursuant to and in compliance with the terms of Section 2.2.
The sale will be made on the same terms and subject to the same conditions as would have applied had the Key Holder not made the Prohibited Transfer, except that the sale (including, without limitation, the delivery of the purchase price) must be made within ninety (90) days after the Investor learns of the Prohibited Transfer, as opposed to the timeframe proscribed in Section 2.2. Such Key Holder shall also reimburse each Investor for any and all reasonable and documented out-of-pocket fees and expenses, including reasonable legal fees and expenses, incurred pursuant to the exercise or the attempted exercise of the Investor's rights under Section 2.2.

2.4 Exempt Transfers.

2.4.1 Exempted Transfers. Notwithstanding the foregoing or anything to the contrary herein, the provisions of Sections 2.1 and 2.2 shall not apply: (a) in the case of a Key Holder that is an entity, upon a transfer by such Key Holder to its stockholders, members, partners or other equity holders, (b) to a repurchase of Transfer Stock from a Key Holder by the Corporation at a price no greater than that originally paid by such Key Holder for such Transfer Stock and pursuant to an agreement containing vesting and/or repurchase provisions approved by a majority of the Board of Directors, (c) in the case of a Key Holder that is a natural person, upon a transfer of Transfer Stock by such Key Holder made for bona fide estate planning purposes, either during his or her lifetime or on death by will or intestacy to his or her spouse, child (natural or adopted), or any other direct lineal descendant of such Key Holder (or his or her spouse) (all of the foregoing collectively referred to as “family members”), or any custodian or trustee of any trust, partnership or limited liability company for the benefit of, or the ownership interests of which are owned wholly by, such Key Holder or any such family members or (d) to a transfer of Transfer Stock to any other Person approved by the Corporation’s Board of Directors, including at least one of the Investor Directors (as defined in the Amended and Restated Voting Agreement dated as of the Original Issue Date by and among the Corporation and the other parties thereto, as such may be amended and/or restated from time to time); provided that in the case of clauses (a), (c) or (d), the Key Holder shall deliver prior written notice to the Corporation’s Board of Directors of such transfer and such shares of Transfer Stock shall at all times remain subject to the terms and restrictions set forth in this Section 2 and such transferee shall agree to be bound by all the terms and conditions of this Section 2 as a Key Holder (but only with respect to the securities so transferred to the transferee), including the obligations of a Key Holder with respect to Proposed Key Holder Transfers of such Transfer Stock pursuant to Section 2.4; and provided, further, in the case of any transfer pursuant to clause (a) or (c) above, that such transfer is made pursuant to a transaction in which there is no consideration actually paid for such transfer.

2.4.2 Exempted Offerings. Notwithstanding the foregoing or anything to the contrary herein, the provisions of Section 2 shall not apply to the sale of any Transfer Stock (a) to the public in an offering pursuant to an effective registration statement under the Securities Act of 1933, or (b) pursuant to a Deemed Liquidation Event.

2.4.3 Prohibited Transferees. Notwithstanding the foregoing, no Key Holder shall transfer any Transfer Stock to (a) any entity which, in the determination of the Corporation’s Board of Directors, directly or indirectly competes with the Corporation or (b) any customer, distributor or supplier of the Corporation, if the Corporation’s Board of Directors should determine that such transfer would result in such customer, distributor or supplier receiving information that would place the Corporation at a competitive disadvantage with respect to such customer, distributor or supplier.
2.4.4 Requirements of Transfer. The Key Holder shall establish that the Proposed Key Holder Transfer will not cause or result in any violation of law, including, without limitation, federal or state securities laws, and that the proposed transfer would not cause or require (A) the Corporation to be an investment company as defined in the Investment Company Act of 1940, as amended or (B) the registration of the Corporation’s securities under federal securities laws. Any Proposed Key Holder Transfer that the Board of Directors determines may have a consequence described in this Section 2.4.4 shall not be permitted.

3. Drag-Along Right.

3.1 Definitions. A “Sale of the Corporation” shall mean either: (a) a transaction or series of related transactions in which a Person, or a group of related Persons, acquires from stockholders of the Corporation shares representing more than fifty percent (50%) of the outstanding voting power of the Corporation (a “Stock Sale”); or (b) a transaction that qualifies as a Deemed Liquidation Event.

3.2 Actions to be Taken. In the event that (i) the Requisite Vote (such holders of Preferred Stock so consenting to or approving a Sale of the Corporation, the “Selling Investors”) and (ii) the Board of Directors approve a Sale of the Corporation in writing, specifying that this Section 3 shall apply to such transaction, then each stockholder shall:

3.2.1 if such transaction requires stockholder approval, with respect to all Shares that such stockholder owns or over which such stockholder otherwise exercises voting power, vote (in person, by proxy or by action by written consent, as applicable) all Shares in favor of, and adopt, such Sale of the Corporation (together with any related amendment to this Third Amended and Restated Certificate of Incorporation required in order to implement such Sale of the Corporation) and vote in opposition to any and all other proposals that could reasonably be expected to delay or impair the ability of the Corporation to consummate such Sale of the Corporation;

3.2.2 if such transaction is a Stock Sale, sell the same proportion of shares of capital stock of the Corporation beneficially held by such stockholder as is being sold by the Selling Investors to the Person to whom the Selling Investors propose to sell their Shares, and, except as permitted in Section 3.3 below, on the same terms and conditions as the Selling Investors;

3.2.3 execute and deliver all related documentation and take such other action in support of the Sale of the Corporation as shall reasonably be requested by the Corporation or the Selling Investors in order to carry out the terms and provision of this Section 3, including without limitation executing and delivering instruments of conveyance and transfer, and any purchase agreement, merger agreement, indemnity agreement, escrow agreement, consent, waiver, governmental filing, share certificates duly endorsed for transfer (free and clear of impermissible liens, claims and encumbrances) and any similar or related documents;
3.2.4 not deposit, and to cause their Affiliates not to deposit, except as provided in this Section 3, any Shares of the Corporation owned by such party or Affiliate in a voting trust or subject any Shares to any arrangement or agreement with respect to the voting of such Shares, unless specifically requested to do so by the acquiror in connection with the Sale of the Corporation;

3.2.5 refrain from exercising any dissenters’ rights or rights of appraisal under applicable law at any time with respect to such Sale of the Corporation; and

3.2.6 if the consideration to be paid in exchange for the Shares pursuant to this Section 3 includes any securities and due receipt thereof by any stockholder would require under applicable law (i) the registration or qualification of such securities or of any person as a broker or dealer or agent with respect to such securities or (ii) the provision to any stockholder of any information other than such information as a prudent issuer would generally furnish in an offering made solely to “accredited investors” as defined in Regulation D promulgated under the Securities Act of 1933, the Corporation may cause to be paid to any such stockholder in lieu thereof, against surrender of the Shares which would have otherwise been sold by such stockholder, an amount in cash equal to the fair value (as determined in good faith by the Corporation) of the securities which such stockholder would otherwise receive as of the date of the issuance of such securities in exchange for the Shares.

3.3 Exceptions. Notwithstanding the foregoing, a stockholder will not be required to comply with Section 3.2 above in connection with any proposed Sale of the Corporation (the “Proposed Sale”) unless:

3.3.1 any representations and warranties to be made by such stockholder in connection with the Proposed Sale are limited to representations and warranties related to authority, ownership and the ability to convey title to such Shares, including but not limited to representations and warranties that (i) the stockholder holds all right, title and interest in and to the Shares such stockholder purports to hold, free and clear of all liens and encumbrances, (ii) the obligations of the stockholder in connection with the transaction have been duly authorized, if applicable, (iii) the documents to be entered into by the stockholder have been duly executed by the stockholder and delivered to the acquirer and are enforceable against the stockholder in accordance with their respective terms and (iv) neither the execution and delivery of documents to be entered into in connection with the transaction, nor the performance of the stockholder’s obligations thereunder, will cause a breach or violation of the terms of any agreement, law or judgment, order or decree of any court or governmental agency applicable to the stockholder;

3.3.2 the stockholder shall not be liable for the inaccuracy of any representation or warranty made by any other Person in connection with the Proposed Sale, other than the Corporation (except to the extent that funds may be paid out of an escrow established to cover breach of representations, warranties and covenants of the Corporation as well as breach by any stockholder of any of identical representations, warranties and covenants provided by all stockholders).
3.3.3 the liability for indemnification, if any, of such stockholder in the Proposed Sale and for the inaccuracy of any representations and warranties made by the Corporation in connection with such Proposed Sale, is several and not joint with any other Person (except to the extent that funds may be paid out of an escrow established to cover breach of representations, warranties and covenants of the Corporation as well as breach by any stockholder of any of identical representations, warranties and covenants provided by all stockholders), and is pro rata in proportion to the amount of consideration paid to such stockholder in connection with such Proposed Sale (in accordance with the provisions of this Third Amended and Restated Certificate of Incorporation);

3.3.4 liability shall be limited to such stockholder’s applicable share (determined based on the respective proceeds payable to each stockholder in connection with such Proposed Sale in accordance with the provisions of this Third Amended and Restated Certificate of Incorporation) of a negotiated aggregate indemnification amount that applies equally to all stockholders but that in no event exceeds the amount of consideration otherwise payable to such stockholder in connection with such Proposed Sale, except with respect to claims related to fraud by such stockholder, the liability for which need not be limited as to such stockholder;

3.3.5 upon the consummation of the Proposed Sale, (i) each holder of each class or series of the Corporation’s stock will receive the same form of consideration for their shares of such class or series as is received by other holders in respect of their shares of such same class or series of stock, (ii) each holder of a series of Preferred Stock will receive the same amount of consideration per share of such series of Preferred Stock as is received by other holders in respect of their shares of such same series, (iii) each holder of Common Stock will receive the same amount of consideration per share of Common Stock as is received by other holders in respect of their shares of Common Stock, and (iv) the aggregate consideration receivable by all holders of the Preferred Stock and Common Stock shall be allocated among the holders of Preferred Stock and Common Stock on the basis of the relative liquidation preferences to which the holders of each respective series of Preferred Stock and the holders of Common Stock are entitled in a Deemed Liquidation Event (assuming for this purpose that the Proposed Sale is a Deemed Liquidation Event) in accordance with this Third Amended and Restated Certificate of Incorporation in effect immediately prior to the Proposed Sale;

3.3.6 in connection with any Proposed Sale, the stockholder, if an Investor that is not employed by or a consultant to the Corporation, shall not be obligated to enter into any non-competition agreement or covenant (whether applicable to the Corporation’s business, customers, suppliers or employees) or agree to any modification of any existing non-competition agreement or covenant (whether applicable to the Corporation’s business, customers, suppliers or employees); and

3.3.7 subject to Section 3.3.5 above, requiring the same form of consideration to be available to the holders of any single class or series of capital stock, if any holders of any capital stock of the Corporation are given an option as to the form and amount of consideration to be received as a result of the Proposed Sale, all holders of such capital stock will be given the same option.
3.4 Restrictions on Sales of Control of the Corporation. No stockholder shall be a party to any Stock Sale unless all holders of Preferred Stock are allowed to participate in such transaction and the consideration received pursuant to such transaction is allocated among the parties thereto in the manner specified in this Third Amended and Restated Certificate of Incorporation in effect immediately prior to the Stock Sale (as if such transaction were a Deemed Liquidation Event), unless the Selling Investors elect otherwise by written notice given to the Corporation at least ten (10) days prior to the effective date of any such transaction or series of related transactions.

4. Agreement to Lock-Up. No stockholder shall, without the prior written consent of the managing underwriter, during the period commencing on the date of the final prospectus relating to the registration by the Corporation of shares of Common Stock in its IPO, and ending on the date specified by the Corporation and the managing underwriter (such period not to exceed one hundred eighty (180) days (except pursuant to the terms of any agreement to which the Corporation or a subsidiary of the Corporation and any stockholder may be a party), or such other period as may be reasonably requested by the Corporation (or any successor thereto) or an underwriter to accommodate regulatory restrictions on (1) the publication or other distribution of research reports and (2) analyst recommendations and opinions), (i) lend, offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, or otherwise transfer or dispose of, directly or indirectly, any shares of Common Stock or any securities convertible into or exercisable or exchangeable (directly or indirectly) for Common Stock held immediately before the effective date of the registration statement for the IPO or (ii) enter into any swap or other arrangement that transfers to another, in whole or in part, any of the economic consequences of ownership of such securities, whether any such transaction described in clause (i) or (ii) above is to be settled by delivery of Common Stock or other securities, in cash, or otherwise. The foregoing provisions of this Section 4 shall not apply to (i) the sale of any shares to an underwriter pursuant to an underwriting agreement, (ii) transactions relating to securities acquired in the IPO or acquired in open market transactions after the date of the IPO, except as may be provided in any agreement to which the Corporation or a subsidiary of the Corporation and any stockholder may be a party, or (iii) other categories of transactions as otherwise agreed to by the Corporation in which any transferees of shares agree to identical post-IPO lock-up restrictions. The underwriters in connection with the IPO are intended third-party beneficiaries of this Section 4 and shall have the right, power, and authority to enforce the provisions hereof as though they were a party hereto. Each stockholder further agrees to execute such agreements as may be reasonably requested by the underwriters in connection with the IPO that are consistent with this Section 4 or that are necessary to give further effect thereto. Any discretionary waiver or termination of the restrictions of any or all of such agreements by the Corporation or the underwriters shall apply pro rata to all stockholders subject to such agreements, based on the number of equity securities subject to such agreements. Each certificate representing shares of Common Stock or Preferred Stock, if certificated, or the notice in lieu of a certificate, if such shares are to be uncertificated, shall bear, in addition to any other legend required by law, a legend indicating that such shares are subject to the restrictions on transfer and ownership provided in this Section 4.

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Notwithstanding the foregoing in this Article Fifth, if an Investor or Key Holder is party to the Amended and Restated Voting Agreement, dated as of the Original Issue Date, by and among the Corporation and the parties listed therein, the Amended and Restated Right of First Refusal and Co-Sale Agreement, dated as of the Original Issue Date, by and among the Corporation and the parties listed therein, and the Amended and Restated Investor Rights Agreement, dated as of the Original Issue Date, by and among the Corporation and the parties listed therein, each as may be further amended or restated in accordance with their terms (collectively, the “Stockholder Agreements”), the Stockholder Agreements shall supersede the provisions in this Article Fifth of this Third Amended and Restated Certificate of Incorporation with respect to the matters set forth therein.

SIXTH: Subject to any additional vote required by this Third Amended and Restated Certificate of Incorporation, in furtherance and not in limitation of the powers conferred by statute, the Board of Directors is expressly authorized to make, repeal, alter, amend and rescind any or all of the Bylaws of the Corporation.

SEVENTH: Subject to any additional vote required by this Third Amended and Restated Certificate of Incorporation, the number of directors of the Corporation shall be determined in the manner set forth in the Bylaws of the Corporation.

EIGHTH: Elections of directors need not be by written ballot unless the Bylaws of the Corporation shall so provide.

NINTH: Meetings of stockholders may be held within or without the State of Delaware, as the Bylaws of the Corporation may provide. The books of the Corporation may be kept outside the State of Delaware at such place or places as may be designated from time to time by the Board of Directors or in the Bylaws of the Corporation.

TENTH: To the fullest extent permitted by law, each director of the Corporation shall not be personally liable to the Corporation or its stockholders for monetary damages for breach of fiduciary duty as a director. If the General Corporation Law or any other law of the State of Delaware is hereafter amended to authorize corporate action further eliminating or limiting the personal liability of directors, then the liability of a director of the Corporation shall be eliminated or limited to the fullest extent permitted by the General Corporation Law as so amended.

Any repeal or modification of the foregoing provisions of this Article Tenth shall not adversely affect any right or protection of a director of the Corporation existing at the time of, or increase the liability of any director of the Corporation with respect to any acts or omissions of such director occurring prior to, such repeal or modification.

ELEVENTH: The following indemnification provisions shall apply to the persons enumerated below.
1. Right to Indemnification of Directors and Officers. The Corporation shall indemnify and hold harmless, to the fullest extent permitted by applicable law as it presently exists or may hereafter be amended, any person (an “Indemnified Person”) who was or is made or is threatened to be made a party or is otherwise involved in any action, suit or proceeding, whether civil, criminal, administrative or investigative (a “Proceeding”), by reason of the fact that such person, or a person for whom such person is the legal representative, is or was a director or officer of the Corporation or, while a director or officer of the Corporation, is or was serving at the request of the Corporation as a director, officer, employee or agent of another corporation or of a partnership, joint venture, limited liability company, trust, enterprise or nonprofit entity, including service with respect to employee benefit plans, against all liability and loss suffered and expenses (including attorneys’ fees) reasonably incurred by such Indemnified Person in such Proceeding. Notwithstanding the preceding sentence, except as otherwise provided in Section 3 of this Article Eleventh, the Corporation shall be required to indemnify an Indemnified Person in connection with a Proceeding (or part thereof) commenced by such Indemnified Person only if the commencement of such Proceeding (or part thereof) by the Indemnified Person was authorized in advance by the Board of Directors.

2. Prepayment of Expenses of Directors and Officers. The Corporation shall pay the expenses (including attorneys’ fees) incurred by an Indemnified Person in defending any Proceeding in advance of its final disposition, provided, however, that, to the extent required by law, such payment of expenses in advance of the final disposition of the Proceeding shall be made only upon receipt of an undertaking by the Indemnified Person to repay all amounts advanced if it should be ultimately determined that the Indemnified Person is not entitled to be indemnified under this Article Eleventh or otherwise.

3. Claims by Directors and Officers. If a claim for indemnification or advancement of expenses under this Article Eleventh is not paid in full within 30 days after a written claim therefor by the Indemnified Person has been received by the Corporation, the Indemnified Person may file suit to recover the unpaid amount of such claim and, if successful in whole or in part, shall be entitled to be paid the expense of prosecuting such claim to the fullest extent permitted by law. In any such action the Corporation shall have the burden of proving that the Indemnified Person is not entitled to the requested indemnification or advancement of expenses under applicable law.
4. **Indemnification of Employees and Agents.** The Corporation may indemnify and advance expenses to any person who was or is made or is threatened to be made or is otherwise involved in any Proceeding by reason of the fact that such person, or a person for whom such person is the legal representative, is or was an employee or agent of the Corporation or, while an employee or agent of the Corporation, is or was serving at the request of the Corporation as a director, officer, employee or agent of another corporation or of a partnership, joint venture, limited liability company, trust, enterprise or nonprofit entity, including service with respect to employee benefit plans, against all liability and loss suffered and expenses (including attorney’s fees) reasonably incurred by such person in connection with such Proceeding. The ultimate determination of entitlement to indemnification of persons who are non-director or officer employees or agents shall be made in such manner as is determined by the Board of Directors in its sole discretion. Notwithstanding the foregoing sentence, the Corporation shall not be required to indemnify a person in connection with a Proceeding initiated by such person if the Proceeding was not authorized in advance by the Board of Directors.

5. **Advancement of Expenses of Employees and Agents.** The Corporation may pay the expenses (including attorney’s fees) incurred by an employee or agent in defending any Proceeding in advance of its final disposition on such terms and conditions as may be determined by the Board of Directors.

6. **Non-Exclusivity of Rights.** The rights conferred on any person by this Article Eleventh shall not be exclusive of any other rights which such person may have or hereafter acquire under any statute, provision of this Third Amended and Restated Certificate of Incorporation, the Bylaws of the Corporation, agreement, or vote of stockholders or disinterested directors or otherwise.

7. **Other Indemnification.** The Corporation’s obligation, if any, to indemnify any person who was or is serving at its request as a director, officer or employee of another Corporation, partnership, limited liability company, joint venture, trust, organization or other enterprise shall be reduced by any amount such person may collect as indemnification from such other Corporation, partnership, limited liability company, joint venture, trust, organization or other enterprise.

8. **Insurance.** The Board of Directors may, to the full extent permitted by applicable law as it presently exists, or may hereafter be amended from time to time, authorize an appropriate officer or officers to purchase and maintain at the Corporation’s expense insurance: (a) to indemnify the Corporation for any obligation which it incurs as a result of the indemnification of directors, officers and employees under the provisions of this Article Eleventh; and (b) to indemnify or insure directors, officers and employees against liability in instances in which they may not otherwise be indemnified by the Corporation under the provisions of this Article Eleventh.

9. **Amendment or Repeal.** Any repeal or modification of the foregoing provisions of this Article Eleventh shall not adversely affect any right or protection hereunder of any person in respect of any act or omission occurring prior to the time of such repeal or modification. The rights provided hereunder shall inure to the benefit of any Indemnified Person and such person’s heirs, executors and administrators.
Any amendment, repeal or modification of the foregoing provisions of this Article Eleventh shall not adversely affect any right or protection of any director, officer or other agent of the Corporation existing at the time of such amendment, repeal or modification.

TWELFTH: To the fullest extent permitted by law, the Corporation renounces any interest or expectancy of the Corporation in, or in being offered an opportunity to participate in, any Excluded Opportunity; provided, that nothing herein is intended to diminish the fiduciary duties of any director of the Corporation. An “Excluded Opportunity” is any matter, transaction or interest that is presented to, or acquired, created or developed by, or which otherwise comes into the possession of, (i) any director of the Corporation who is not an employee of the Corporation or any of its subsidiaries, or (ii) any holder of Preferred Stock or any partner, member, director, stockholder, employee or agent of any such holder, other than someone who is an employee of the Corporation or any of its subsidiaries (collectively, “Covered Persons”), unless such matter, transaction or interest is presented to, or acquired, created or developed by, or otherwise comes into the possession of, a Covered Person expressly and solely in such Covered Person’s capacity as a director or officer of the Corporation.

THIRTEENTH: If any provision or provisions of this Third Amended and Restated Certificate of Incorporation shall be held to be invalid, illegal or unenforceable as applied to any circumstance for any reason whatsoever: (i) the validity, legality and enforceability of such provisions in any other circumstance and of the remaining provisions of this Third Amended and Restated Certificate of Incorporation (including, without limitation, each portion of any paragraph of this Third Amended and Restated Certificate of Incorporation containing any such provision held to be invalid, illegal or unenforceable that is not itself held to be invalid, illegal or unenforceable) shall not in any way be affected or impaired thereby and (ii) to the fullest extent possible, the provisions of this Third Amended and Restated Certificate of Incorporation (including, without limitation, each such portion of any paragraph of this Third Amended and Restated Certificate of Incorporation containing any such provision held to be invalid, illegal or unenforceable) shall be construed so as to permit the Corporation to protect its directors, officers, employees and agents from personal liability in respect of their good faith service or for the benefit of the Corporation to the fullest extent permitted by law.

*   *   *

3. That the foregoing amendment and restatement was approved by the holders of the requisite number of shares of this corporation in accordance with Section 228 of the General Corporation Law.

4. That this Third Amended and Restated Certificate of Incorporation, which restates and integrates and further amends the provisions of this corporation’s Certificate of Incorporation, has been duly adopted in accordance with Sections 242 and 245 of the General Corporation Law.
IN WITNESS WHEREOF, this Third Amended and Restated Certificate of Incorporation has been executed by a duly authorized officer of this corporation on this 7th day of May, 2018.

By: /s/ Stéphane Bancel

Stéphane Bancel
CEO
CERTIFICATE OF AMENDMENT
OF
THIRD AMENDED AND RESTATED CERTIFICATE OF INCORPORATION
OF
MODERNA THERAPEUTICS, INC.

Pursuant to Section 242
of the General Corporation Law of
the State of Delaware

Moderna Therapeutics, Inc. (hereinafter called the “Corporation”), organized and existing under and by virtue of the General Corporation Law of the State of Delaware, does hereby certify as follows:

By unanimous written consent of the Board of Directors of the Corporation a resolution was duly adopted, pursuant to Section 242 of the General Corporation Law of the State of Delaware, setting forth an amendment to the Certificate of Incorporation of the Corporation and declaring said amendment to be advisable. The stockholders of the Corporation duly approved said proposed amendment by written consent in accordance with Sections 228 and 242 of the General Corporation Law of the State of Delaware, and written notice of such consent will be given to all stockholders who have not consented in writing to said amendment. The resolution setting forth the amendment is as follows:

RESOLVED: That Article FIRST of the Third Amended and Restated Certificate of Incorporation of the Corporation be and hereby is deleted in its entirety and the following Article FIRST is inserted in lieu thereof:

FIRST: The name of this corporation is Moderna, Inc. (the “Corporation”).

[REMAINDER OF PAGE INTENTIONALLY LEFT BLANK]
IN WITNESS WHEREOF, the Corporation has caused this Certificate of Amendment to be executed by a duly authorized officer of this corporation on this 28th day of August, 2018.

MODERNA THERAPEUTICS, INC.

By: /s/ Stéphane Bancel
Name: Stéphane Bancel
Title: CEO

[Signature Page to Certificate of Amendment]
CERTIFICATE OF AMENDMENT
OF
THIRD AMENDED AND RESTATED CERTIFICATE OF INCORPORATION
OF
MODERNA, INC.

Moderna, Inc. (the “Corporation”), a corporation organized and existing under and by virtue of the General Corporation Law of the State of Delaware (the “General Corporation Law”),

DOES HEREBY CERTIFY:

1. That the name of this corporation is Moderna, Inc. and that this corporation was originally incorporated pursuant to the General Corporation Law on July 22, 2016 under the name MT NewCo, Inc.

2. That the Board of Directors of the Corporation duly adopted resolutions proposing to amend the Third Amended and Restated Certificate of Incorporation of the Corporation, declaring said amendment to be advisable and in the best interests of the Corporation and its stockholders, and authorizing the appropriate officers of the Corporation to solicit the consent of the stockholders therefor, which resolutions setting forth the proposed amendments are as follows:

RESOLVED, that the following is hereby inserted into Article FOURTH immediately before the first sentence therein:

“Effective upon the filing of this Certificate of Amendment to the Third Amended and Restated Certificate of Incorporation with the Secretary of State of the State of Delaware (the “Effective Time”), every 2.18 shares of Common Stock then issued and outstanding or held in the treasury of the Corporation immediately prior to the Effective Time shall automatically be combined into one (1) share of Common Stock, without any further action by the holders of such shares (the “Reverse Stock Split”). The Reverse Stock Split will be effected on a certificate-by-certificate basis, and any fractional shares resulting from such combination shall be rounded down to the nearest whole share on a certificate-by-certificate basis. No fractional shares shall be issued in connection with the Reverse Stock Split. In lieu of any fractional shares to which a holder would otherwise be entitled, the Corporation shall pay cash equal to such fraction multiplied by the fair market value of a share of Common Stock as determined in good faith by the Corporation’s Board of Directors. The Reverse Stock Split shall occur automatically without any further action by the holders of the shares of Common Stock and Preferred Stock affected thereby. All rights, preferences and privileges of the Common Stock and the Preferred Stock shall be appropriately adjusted to reflect the Reverse Stock Split in accordance with this Third Amended and Restated Certificate of Incorporation.”

3. That the foregoing amendment was approved by the holders of the requisite number of shares of the Corporation in accordance with Section 228 of the General Corporation Law.
4. That said amendment has been duly adopted in accordance with Section 242 of the General Corporation Law.

[Signature Page to Follow]
IN WITNESS WHEREOF, this Certificate of Amendment has been executed by a duly authorized officer of the Corporation on this [ ] day of November, 2018.

Name: Stéphane Bancel
Title: Chief Executive Officer

SIGNATURE PAGE TO CERTIFICATE OF AMENDMENT
Exhibit 3.2

FOURTH AMENDED AND RESTATED
CERTIFICATE OF INCORPORATION
OF
MODERNA, INC.

Moderna, Inc., a corporation organized and existing under the laws of the State of Delaware (the “Corporation”), hereby certifies as follows:

1. The name of the Corporation is Moderna, Inc. The date of the filing of its original Certificate of Incorporation with the Secretary of State of the State of Delaware was July 22, 2016 (the “Original Certificate”). The name under which the Corporation filed the Original Certificate was MT NewCo, Inc.

2. This Amended and Restated Certificate of Incorporation (the “Certificate”) amends, restates and integrates the provisions of the Amended and Restated Certificate of Incorporation that was filed with the Secretary of State of the State of Delaware on May 7, 2018, as amended on August 28, 2018 (the “Amended and Restated Certificate”), and was duly adopted in accordance with the provisions of Sections 228, 242 and 245 of the General Corporation Law of the State of Delaware (the “DGCL”).

3. The text of the Amended and Restated Certificate is hereby amended and restated in its entirety to provide as herein set forth in full.

ARTICLE I

The name of the Corporation is Moderna, Inc.

ARTICLE II

The address of the Corporation’s registered office in the State of Delaware is c/o The Corporation Trust Company, 1209 Orange Street in the City of Wilmington, County of New Castle, 19801. The name of its registered agent at such address is The Corporation Trust Company.

ARTICLE III

The purpose of the Corporation is to engage in any lawful act or activity for which corporations may be organized under the DGCL.
ARTICLE IV

CAPITAL STOCK

The total number of shares of capital stock which the Corporation shall have authority to issue is 1,762,000,000 of which (i) 1,600,000,000 shares shall be a class designated as common stock, par value $0.0001 per share (the “Common Stock”), and (ii) 162,000,000 shares shall be a class designated as undesignated preferred stock, par value $0.0001 per share (the “Undesignated Preferred Stock”).

Except as otherwise provided in any certificate of designations of any series of Undesignated Preferred Stock, the number of authorized shares of the class of Common Stock or Undesignated Preferred Stock may from time to time be increased or decreased (but not below the number of shares of such class outstanding) by the affirmative vote of the holders of a majority in voting power of the outstanding shares of capital stock of the Corporation irrespective of the provisions of Section 242(b)(2) of the DGCL.

The powers, preferences and rights of, and the qualifications, limitations and restrictions upon, each class or series of stock shall be determined in accordance with, or as set forth below in, this Article IV.

A. COMMON STOCK

Subject to all the rights, powers and preferences of the Undesignated Preferred Stock and except as provided by law or in this Certificate (or in any certificate of designations of any series of Undesignated Preferred Stock):

(a) the holders of the Common Stock shall have the exclusive right to vote for the election of directors of the Corporation (the “Directors”) and on all other matters requiring stockholder action, each outstanding share entitling the holder thereof to one vote on each matter properly submitted to the stockholders of the Corporation for their vote; provided, however, that, except as otherwise required by law, holders of Common Stock, as such, shall not be entitled to vote on any amendment to this Certificate (or on any amendment to a certificate of designations of any series of Undesignated Preferred Stock) that alters or changes the powers, preferences, rights or other terms of one or more outstanding series of Undesignated Preferred Stock if the holders of such affected series of Undesignated Preferred Stock are entitled to vote, either separately or together with the holders of one or more other such series, on such amendment pursuant to this Certificate (or pursuant to a certificate of designations of any series of Undesignated Preferred Stock) or pursuant to the DGCL;

(b) dividends may be declared and paid or set apart for payment upon the Common Stock out of any assets or funds of the Corporation legally available for the payment of dividends, but only when and as declared by the Board of Directors or any authorized committee thereof; and
(c) upon the voluntary or involuntary liquidation, dissolution or winding up of the Corporation, the net assets of the Corporation shall be distributed pro rata to the holders of the Common Stock.

B. UNDESIGNATED PREFERRED STOCK

The Board of Directors or any authorized committee thereof is expressly authorized, to the fullest extent permitted by law, to provide by resolution or resolutions for, out of the unissued shares of Undesignated Preferred Stock, the issuance of the shares of Undesignated Preferred Stock in one or more series of such stock, and by filing a certificate of designations pursuant to applicable law of the State of Delaware, to establish or change from time to time the number of shares of each such series, and to fix the designations, powers, including voting powers, full or limited, or no voting powers, preferences and the relative, participating, optional or other special rights of the shares of each series and any qualifications, limitations and restrictions thereof.

ARTICLE V

STOCKHOLDER ACTION

1. Action without Meeting. Any action required or permitted to be taken by the stockholders of the Corporation at any annual or special meeting of stockholders of the Corporation must be effected at a duly called annual or special meeting of stockholders and may not be taken or effected by a written consent of stockholders in lieu thereof. Notwithstanding anything herein to the contrary, the affirmative vote of not less than two thirds (2/3) of the outstanding shares of capital stock entitled to vote thereon, and the affirmative vote of not less than two thirds (2/3) of the outstanding shares of each class entitled to vote thereon as a class, shall be required to amend or repeal any provision of this Article V, Section 1.

2. Special Meetings. Except as otherwise required by statute and subject to the rights, if any, of the holders of any series of Undesignated Preferred Stock, special meetings of the stockholders of the Corporation may be called only by the Board of Directors acting pursuant to a resolution approved by the affirmative vote of a majority of the Directors then in office, and special meetings of stockholders may not be called by any other person or persons. Only those matters set forth in the notice of the special meeting may be considered or acted upon at a special meeting of stockholders of the Corporation.

ARTICLE VI

DIRECTORS

1. General. The business and affairs of the Corporation shall be managed by or under the direction of the Board of Directors except as otherwise provided herein or required by law.
2. Election of Directors. Election of Directors need not be by written ballot unless the By-laws of the Corporation (the “By-laws”) shall so provide.

3. Number of Directors; Term of Office. The number of Directors of the Corporation shall be fixed solely and exclusively by resolution duly adopted from time to time by the Board of Directors. The Directors, other than those who may be elected by the holders of any series of Undesignated Preferred Stock, shall be classified, with respect to the term for which they severally hold office, into three classes. The initial Class I Directors of the Corporation shall be Stéphane Bancel, Noubar Afeyan and Peter Barton Hutt; the initial Class II Directors of the Corporation shall be Stephen Berenson, Paul Sagan and Israel Ruiz; and the initial Class III Directors of the Corporation shall be Robert Langer, Elizabeth Nabel and Moncef Slaoui. The initial Class I Directors shall serve for a term expiring at the annual meeting of stockholders to be held in 2019, the initial Class II Directors shall serve for a term expiring at the annual meeting of stockholders to be held in 2020, and the initial Class III Directors shall serve for a term expiring at the annual meeting of stockholders to be held in 2021. The mailing address of each person who is to serve initially as a director is c/o Moderna, Inc., 200 Technology Square, Cambridge, Massachusetts 02139. At each annual meeting of stockholders, Directors elected to succeed those Directors whose terms expire shall be elected for a term of office to expire at the third succeeding annual meeting of stockholders after their election. Notwithstanding the foregoing, the Directors elected to each class shall hold office until their successors are duly elected and qualified or until their earlier resignation, death or removal.

Notwithstanding the foregoing, whenever, pursuant to the provisions of Article IV of this Certificate, the holders of any one or more series of Undesignated Preferred Stock shall have the right, voting separately as a series or together with holders of other such series, to elect Directors at an annual or special meeting of stockholders, the election, term of office, filling of vacancies and other features of such directorships shall be governed by the terms of this Certificate and any certificate of designations applicable to such series.

Notwithstanding anything herein to the contrary, the affirmative vote of not less than two thirds (2/3) of the outstanding shares of capital stock entitled to vote thereon, and the affirmative vote of not less than two thirds (2/3) of the outstanding shares of each class entitled to vote thereon as a class, shall be required to amend or repeal any provision of this Article VI, Section 3.

4. Vacancies. Subject to the rights, if any, of the holders of any series of Undesignated Preferred Stock to elect Directors and to fill vacancies in the Board of Directors relating thereto, any and all vacancies in the Board of Directors, however occurring, including, without limitation, by reason of an increase in the size of the Board of Directors, or the death, resignation, disqualification or removal of a Director, shall be filled solely and exclusively by the affirmative vote of a majority of the remaining Directors then in office, even if less than a quorum of the Board of Directors, and not by the stockholders. Any Director appointed in accordance with the preceding sentence shall hold office for the remainder of the full term of the class of Directors in which the new directorship was created or the vacancy occurred and until such Director’s successor shall have been duly elected and qualified or until his or her earlier resignation, death or removal. Subject to the rights, if any, of the holders of any series of
Undesignated Preferred Stock to elect Directors, when the number of Directors is increased or decreased, the Board of Directors shall, subject to Article VI, Section 3 hereof, determine the class or classes to which the increased or decreased number of Directors shall be apportioned; provided, however, that no decrease in the number of Directors shall shorten the term of any incumbent Director. In the event of a vacancy in the Board of Directors, the remaining Directors, except as otherwise provided by law, shall exercise the powers of the full Board of Directors until the vacancy is filled.

5. **Removal.** Subject to the rights, if any, of any series of Undesignated Preferred Stock to elect Directors and to remove any Director whom the holders of any such series have the right to elect, any Director (including persons elected by Directors to fill vacancies in the Board of Directors) may be removed from office (i) only with cause and (ii) only by the affirmative vote of the holders of not less than two thirds (2/3) of the outstanding shares of capital stock then entitled to vote at an election of Directors. At least forty-five (45) days prior to any annual or special meeting of stockholders at which it is proposed that any Director be removed from office, written notice of such proposed removal and the alleged grounds thereof shall be sent to the Director whose removal will be considered at the meeting.

**ARTICLE VII**

**LIMITATION OF LIABILITY**

A Director of the Corporation shall not be personally liable to the Corporation or its stockholders for monetary damages for breach of his or her fiduciary duty as a Director, except for liability (a) for any breach of the Director’s duty of loyalty to the Corporation or its stockholders, (b) for acts or omissions not in good faith or which involve intentional misconduct or a knowing violation of law, (c) under Section 174 of the DGCL or (d) for any transaction from which the Director derived an improper personal benefit. If the DGCL is amended after the effective date of this Certificate to authorize corporate action further eliminating or limiting the personal liability of Directors, then the liability of a Director of the Corporation shall be eliminated or limited to the fullest extent permitted by the DGCL, as so amended.

Any amendment, repeal or modification of this Article VII by either of (i) the stockholders of the Corporation or (ii) an amendment to the DGCL, shall not adversely affect any right or protection existing at the time of such amendment, repeal or modification with respect to any acts or omissions occurring before such amendment, repeal or modification of a person serving as a Director at the time of such amendment, repeal or modification.

Notwithstanding anything herein to the contrary, the affirmative vote of not less than two thirds (2/3) of the outstanding shares of capital stock entitled to vote thereon, and the affirmative vote of not less than two thirds (2/3) of the outstanding shares of each class entitled to vote thereon as a class, shall be required to amend or repeal any provision of this Article VII.
ARTICLE VIII

AMENDMENT OF BY-LAWS

1. Amendment by Directors. Except as otherwise provided by law, the By-laws of the Corporation may be amended or repealed by the Board of Directors by the affirmative vote of a majority of the Directors then in office.

2. Amendment by Stockholders. Except as otherwise provided therein, the By-laws of the Corporation may be amended or repealed at any annual meeting of stockholders, or special meeting of stockholders called for such purpose, by the affirmative vote of a majority of the outstanding shares of capital stock entitled to vote on such amendment or repeal, voting together as a single class.

ARTICLE IX

AMENDMENT OF CERTIFICATE OF INCORPORATION

The Corporation reserves the right to amend or repeal this Certificate in the manner now or hereafter prescribed by statute and this Certificate, and all rights conferred upon stockholders herein are granted subject to this reservation. Except as otherwise required by this Certificate or by law, whenever any vote of the holders of capital stock of the Corporation is required to amend or repeal any provision of this Certificate, such amendment or repeal shall require the affirmative vote of the majority of the outstanding shares of capital stock entitled to vote on such amendment or repeal, and the affirmative vote of the majority of the outstanding shares of each class entitled to vote thereon as a class, at a duly constituted meeting of stockholders called expressly for such purpose.

[End of Text]
THIS AMENDED AND RESTATED CERTIFICATE OF INCORPORATION is executed as of this [            ] day of [            ], 2018.

MODERNA, INC.

By: _____________________________

Name: __________________________

Title: ___________________________

Signature Page to Amended and Restated Certificate of Incorporation
BYLAWS
of
MODERNA, INC.
(the “Corporation”)

1. Stockholders

(a) Annual Meeting. The annual meeting of stockholders shall be held for the election of directors each year at such place, date and time as shall be designated by the Board of Directors. Any other proper business may be transacted at the annual meeting. If no date for the annual meeting is established or said meeting is not held on the date established as provided above, a special meeting in lieu thereof may be held or there may be action by written consent of the stockholders on matters to be voted on at the annual meeting, and such special meeting or written consent shall have for the purposes of these Bylaws or otherwise all the force and effect of an annual meeting.

(b) Special Meetings. Special meetings of stockholders may be called by the Chief Executive Officer, if one is elected, or, if there is no Chief Executive Officer, a President, by the Board of Directors, or by the Requisite Vote (as defined in the Certificate of Incorporation, as may be amended from time to time), but such special meetings may not be called by any other person or persons. The call for the meeting shall state the place, date, hour and purposes of the meeting. Only the purposes specified in the notice of special meeting shall be considered or dealt with at such special meeting.

(c) Notice of Meetings. Whenever stockholders are required or permitted to take any action at a meeting, a notice stating the place, if any, date and hour of the meeting, the means of remote communications, if any, by which stockholders and proxyholders may be deemed to be present and vote at such meeting, and, in the case of a special meeting, the purpose or purposes of the meeting, shall be given by the Secretary (or other person authorized by these Bylaws or by law) not less than ten (10) nor more than sixty (60) days before the meeting to each stockholder entitled to vote at each stockholder who, under the Certificate of Incorporation or under these Bylaws is entitled to such notice. If mailed, notice is given when deposited in the mail, postage prepaid, directed to such stockholder at such stockholder’s address as it appears in the records of the Corporation. Without limiting the manner by which notice otherwise may be effectively given to stockholders, any notice to stockholders may be given by electronic transmission in the manner provided in Section 232 of the Delaware General Corporation Law (the “DGCL”).

If a meeting is adjourned to another time or place, notice need not be given of the adjourned meeting if the time and place, if any, and the means of remote communications, if any, by which stockholders and proxyholders may be deemed to be present in person and vote at such adjourned meeting are announced at the meeting at which the adjournment is taken, except that if the adjournment is for more than thirty (30) days, or if after the adjournment a new record date is fixed for the adjourned meeting, notice of the adjourned meeting shall be given to each stockholder of record entitled to vote at the meeting.
Quorum. The holders of a majority in interest of all stock issued, outstanding and entitled to vote at a meeting, present in person or represented by proxy, shall constitute a quorum. Any meeting may be adjourned from time to time by a majority of the votes properly cast upon the question, whether or not a quorum is present. The stockholders present at a duly constituted meeting may continue to transact business until adjournment notwithstanding the withdrawal of enough stockholders to reduce the voting shares below a quorum.

Voting and Proxies. Except as otherwise provided by the Certificate of Incorporation or by law, each stockholder entitled to vote at any meeting of stockholders shall be entitled to one vote for each share of stock held by such stockholder which has voting power upon the matter in question. Each stockholder entitled to vote at a meeting of stockholders or to express consent or dissent to corporate action in writing without a meeting may authorize another person or persons to act for such stockholder by either written proxy or by a transmission permitted by Section 212(c) of the DGCL, but no proxy shall be voted or acted upon after three years from its date, unless the proxy provides for a longer period or is irrevocable and coupled with an interest. Proxies shall be filed with the Secretary of the meeting, or of any adjournment thereof. Except as otherwise limited therein, proxies shall entitle the persons authorized thereby to vote at any adjournment of such meeting.

Action at Meeting. When a quorum is present, any matter before the meeting shall be decided by vote of the holders of a majority of the shares of stock voting on such matter except where a larger vote is required by law, by the Certificate of Incorporation or by these Bylaws. Any election of directors by stockholders shall be determined by a plurality of the votes cast, except where a larger vote is required by law, by the Certificate of Incorporation or by these Bylaws. The Corporation shall not directly or indirectly vote any share of its own stock; provided, however, that the Corporation may vote shares which it holds in a fiduciary capacity to the extent permitted by law.

Presiding Officer. Meetings of stockholders shall be presided over by the Chairman of the Board, if one is elected, the Vice Chairman of the Board, if one is elected, or if neither is elected or in their absence, a President or in his or her absence, the Chief Executive Officer. The Board of Directors shall have the authority to appoint a temporary presiding officer to serve at any meeting of the stockholders if the Chairman of the Board, the Vice Chairman of the Board or a President or Chief Executive Officer is unable to do so for any reason.

Conduct of Meetings. The Board of Directors may adopt by resolution such rules and regulations for the conduct of the meeting of stockholders as it shall deem appropriate. Except to the extent inconsistent with such rules and regulations as adopted by the Board of Directors, the presiding officer of any meeting of stockholders shall have the right and authority to prescribe such rules, regulations and procedures and to do all such acts as, in the judgment of such chairman, are appropriate for the proper conduct of the meeting. Such rules, regulations or procedures, whether adopted by the Board of Directors or prescribed by the presiding officer of the meeting, may include, without limitation, the following: (i) the
establishment of an agenda or order of business for the meeting; (ii) rules and procedures for maintaining order at the meeting and the safety of those present; (iii) limitations on attendance at or participation in the meeting to stockholders of record of the Corporation, their duly authorized and constituted proxies or such other persons as the chairman of the meeting shall determine; (iv) restrictions on entry to the meeting after the time fixed for the commencement thereof; and (v) limitations on the time allotted to questions or comments by participants. Unless and to the extent determined by the Board of Directors or the presiding officer of the meeting, meetings of stockholders shall not be required to be held in accordance with the rules of parliamentary procedure.

(i) Action without a Meeting. Unless otherwise provided in the Certificate of Incorporation, any action required or permitted by law to be taken at any annual or special meeting of stockholders, may be taken without a meeting, without prior notice and without a vote, if a consent or consents in writing, setting forth the action so taken, shall be signed by the holders of outstanding stock having not less than the minimum number of votes that would be necessary to authorize or take such action at a meeting at which all shares entitled to vote thereon were present and voted and shall be delivered to the Corporation by delivery to its registered office, by hand or by certified mail, return receipt requested, or to the Corporation’s principal place of business or to the officer of the Corporation having custody of the minute book. Every written consent shall bear the date of signature and no written consent shall be effective unless, within sixty (60) days of the earliest dated consent delivered pursuant to these Bylaws, written consents signed by a sufficient number of stockholders entitled to take action are delivered to the Corporation in the manner set forth in these Bylaws. Prompt notice of the taking of the corporate action without a meeting by less than unanimous written consent shall be given to those stockholders who have not consented in writing.

(j) Stockholder Lists. The officer who has charge of the stock ledger of the Corporation shall prepare and make, at least ten (10) days before every meeting of stockholders, a complete list of the stockholders entitled to vote at the meeting, arranged in alphabetical order, and showing the address of each stockholder and the number of shares registered in the name of each stockholder. Nothing contained in this Section 1(j) shall require the Corporation to include electronic mail addresses or other electronic contact information on such list. Such list shall be open to the examination of any stockholder, for any purpose germane to the meeting, for a period of at least ten (10) days prior to the meeting in the manner provided by law. The list shall also be open to the examination of any stockholder during the whole time of the meeting as provided by law.

2. Directors

(a) Powers. The business of the Corporation shall be managed by or under the direction of a Board of Directors who may exercise all the powers of the Corporation except as otherwise provided by law, by the Certificate of Incorporation or by these Bylaws. In the event of a vacancy in the Board of Directors, the remaining directors, except as otherwise provided by law, may exercise the powers of the full Board until the vacancy is filled.

(b) Number and Qualification. Unless otherwise provided in the Certificate of Incorporation or in these Bylaws, the number of directors which shall constitute the whole board shall be determined from time to time by resolution of the Board of Directors. Directors need not be stockholders.
(c) **Vacancies; Reduction of Board.** Unless otherwise provided in the Certificate of Incorporation, a majority of the directors then in office, although less than a quorum, or a sole remaining Director, may fill vacancies in the Board of Directors occurring for any reason and newly created directorships resulting from any increase in the authorized number of directors. In lieu of filling any vacancy, the Board of Directors may reduce the number of directors, unless otherwise provided in the Certificate of Incorporation.

(d) **Tenure.** Except as otherwise provided by law, by the Certificate of Incorporation or by these Bylaws, directors shall hold office until their successors are elected and qualified or until their earlier resignation or removal. Any director may resign at any time upon notice given in writing or by electronic transmission to the Corporation. Such resignation shall be effective upon receipt unless it is specified to be effective at some other time or upon the happening of some other event.

(e) **Removal.** To the extent permitted by law, a director may be removed from office with or without cause by vote of the holders of a majority of the shares of stock entitled to vote in the election of directors.

(f) **Meetings.** Regular meetings of the Board of Directors may be held without notice at such time, date and place as the Board of Directors may from time to time determine. Special meetings of the Board of Directors may be called, orally or in writing, by the Chairman of the Board of Directors, the Chief Executive Officer, if one is elected, or, if there is no Chief Executive Officer, the President, or by two or more Directors, designating the time, date and place thereof. Directors may participate in meetings of the Board of Directors by means of conference telephone or other communications equipment by means of which all directors participating in the meeting can hear each other, and participation in a meeting in accordance herewith shall constitute presence in person at such meeting. No Director may delegate its rights and obligations to participate in and vote at any meeting of the Board of Directors.

(g) **Notice of Meetings.** Notice of the time, date and place of all special meetings of the Board of Directors shall be given to each director by the Secretary, or Assistant Secretary, or in case of the death, absence, incapacity or refusal of such persons, by the officer or one of the directors calling the meeting. Notice shall be given to each director in person, by telephone, or by facsimile, electronic mail or other form of electronic communications, sent to such director’s business or home address at least twenty-four (24) hours in advance of the meeting, or by written notice mailed to such director’s business or home address at least forty-eight (48) hours in advance of the meeting. For clarity, once notice has been given as to the time and date of any regularly scheduled Board of Directors meeting, thereafter no further notice of such meeting need be given. Notice need not be given to any Director if a written waiver of notice is executed by such Director before or after the meeting, or if communication with such Director is unlawful. The attendance of a Director at a meeting shall constitute a waiver of notice of such meeting, except where a Director attends a meeting for the express purpose of objecting at the beginning of the meeting to the transaction of any business because such meeting is not lawfully called or convened. A notice or waiver of notice of a meeting of the Board of Directors need not specify the purposes of the meeting.
(h) **Quorum.** At any meeting of the Board of Directors, a majority of the total number of directors shall constitute a quorum for the transaction of business. Less than a quorum may adjourn any meeting from time to time and the meeting may be held as adjourned without further notice.

(i) **Action at Meeting.** At any meeting of the Board of Directors at which a quorum is present, unless otherwise provided in the following sentence, a majority of the directors present may take any action on behalf of the Board of Directors, unless a larger number is required by law, by the Certificate of Incorporation or by these Bylaws. So long as there are two (2) or fewer Directors, any action to be taken by the Board of Directors shall require the approval of all Directors.

(j) **Action by Consent.** Any action required or permitted to be taken at any meeting of the Board of Directors may be taken without a meeting if all members of the Board of Directors consent thereto in writing or by electronic transmission, and the writing or writings or electronic transmission or transmissions are filed with the records of the meetings of the Board of Directors. Such filing shall be in paper form if the minutes are maintained in paper form and shall be in electronic form if the minutes are maintained in electronic form.

(k) **Committees.** The Board of Directors may, by resolution passed by a majority of the whole Board of Directors, establish one or more committees, each committee to consist of one or more directors. The Board of Directors may designate one or more directors as alternate members of any committee, who may replace any absent or disqualified member at any meeting of the committee. In the absence or disqualification of a member of a committee, the member or members thereof present at any meeting and not disqualified from voting, whether or not such member or members constitute a quorum, may unanimously appoint another member of the Board of Directors to act at the meeting in the place of any such absent or disqualified member.

Any such committee, to the extent permitted by law and to the extent provided in the resolution of the Board of Directors, shall have and may exercise all the powers and authority of the Board of Directors in the management of the business and affairs of the Corporation, and may authorize the seal of the Corporation to be affixed to all papers which may require it; but no such committee shall have the power or authority in reference to the following:

(i) approving or adopting, or recommending to the stockholders, any action or matter expressly required by the DGCL to be submitted to stockholders for approval or (ii) adopting, amending or repealing any provision of these Bylaws.

Except as the Board of Directors may otherwise determine, any such committee may make rules for the conduct of its business, but in the absence of such rules its business shall be conducted so far as possible in the same manner as is provided in these Bylaws for the Board of Directors. All members of such committees shall hold their committee offices at the pleasure of the Board of Directors, and the Board may abolish any committee at any time.
3. Officers

(a) **Enumeration.** The officers of the Corporation shall consist of one or more Presidents (who, if there is more than one, shall be referred to as Co-Presidents), a Treasurer, a Secretary, and such other officers, including, without limitation, a Chief Executive Officer and one or more Vice Presidents (including Executive Vice Presidents or Senior Vice Presidents), Assistant Vice Presidents, Assistant Treasurers and Assistant Secretaries, as the Board of Directors may determine. The Board of Directors may elect from among its members a Chairman of the Board and a Vice Chairman of the Board.

(b) **Election.** The Presidents, Treasurer and Secretary may be elected by the Board of Directors at any meeting. Other officers may be chosen by the Board of Directors at such meeting or at any other meeting.

(c) **Qualification.** No officer need be a stockholder or Director. Any two or more offices may be held by the same person. Any officer may be required by the Board of Directors to give bond for the faithful performance of such officer’s duties in such amount and with such sureties as the Board of Directors may determine.

(d) **Tenure.** Except as otherwise provided by the Certificate of Incorporation or by these Bylaws, each of the officers of the Corporation shall hold office until the first meeting of the Board of Directors following the next annual meeting of stockholders and until such officer’s successor is elected and qualified or until such officer’s earlier resignation or removal. Any officer may resign by delivering his or her written resignation to the Corporation, and such resignation shall be effective upon receipt unless it is specified to be effective at some other time or upon the happening of some other event.

(e) **Removal.** The Board of Directors may remove any officer with or without cause by a vote of a majority of the directors then in office.

(f) **Vacancies.** Any vacancy in any office may be filled for the unexpired portion of the term by the Board of Directors.

(g) **Chairman of the Board and Vice Chairman.** Unless otherwise provided by the Board of Directors, the Chairman of the Board of Directors, if one is elected, shall preside, when present, at all meetings of the stockholders and the Board of Directors. The Chairman of the Board shall have such other powers and shall perform such duties as the Board of Directors may from time to time designate.

Unless otherwise provided by the Board of Directors, in the absence of the Chairman of the Board, the Vice Chairman of the Board, if one is elected, shall preside, when present, at all meetings of the stockholders and the Board of Directors. The Vice Chairman of the Board shall have such other powers and shall perform such duties as the Board of Directors may from time to time designate.
(h) **Chief Executive Officer.** The Chief Executive Officer, if one is elected, shall have such powers and shall perform such duties as the Board of Directors may from time to time designate.

(i) **Presidents.** The Presidents shall, subject to the direction of the Board of Directors, each have general supervision and control of the Corporation’s business and any action that would typically be taken by a President may be taken by any Co-President. If there is no Chairman of the Board or Vice Chairman of the Board, a President shall preside, when present, at all meetings of stockholders and the Board of Directors. The Presidents shall have such other powers and shall perform such duties as the Board of Directors may from time to time designate.

(j) **Vice Presidents and Assistant Vice Presidents.** Any Vice President (including any Executive Vice President or Senior Vice President) and any Assistant Vice President shall have such powers and shall perform such duties as the Board of Directors may from time to time designate.

(k) **Treasurer, Chief Financial Officer and Assistant Treasurers.** The Treasurer and Chief Financial Officer shall, subject to the direction of the Board of Directors, have general charge of the financial affairs of the Corporation and shall cause to be kept accurate books of account. The Treasurer and Chief Financial Officer shall have custody of all funds, securities, and valuable documents of the Corporation, except as the Board of Directors may otherwise provide. The Treasurer and Chief Financial Officer shall have such other powers and shall perform such duties as the Board of Directors may from time to time designate.

Any Assistant Treasurer shall have such powers and perform such duties as the Board of Directors may from time to time designate.

(l) **Secretary and Assistant Secretaries.** The Secretary shall record the proceedings of all meetings of the stockholders and the Board of Directors (including committees of the Board) in books kept for that purpose. In the absence of the Secretary from any such meeting an Assistant Secretary, or if such person is absent, a temporary secretary chosen at the meeting, shall record the proceedings thereof. The Secretary shall have charge of the stock ledger (which may, however, be kept by any transfer or other agent of the Corporation) and shall have such other duties and powers as may be designated from time to time by the Board of Directors.

Any Assistant Secretary shall have such powers and perform such duties as the Board of Directors may from time to time designate.

(m) **Other Powers and Duties.** Subject to these Bylaws, each officer of the Corporation shall have in addition to the duties and powers specifically set forth in these Bylaws, such duties and powers as are customarily incident to such officer’s office, and such duties and powers as may be designated from time to time by the Board of Directors.
4. Capital Stock

(a) Certificates of Stock. Each stockholder shall be entitled to a certificate of the capital stock of the Corporation in such form as may from time to time be prescribed by the Board of Directors. Such certificate shall be signed by a President or a Vice President, and by the Treasurer or an Assistant Treasurer, or the Secretary or an Assistant Secretary. Such signatures may be a facsimile. In case any officer, transfer agent or registrar who has signed or whose facsimile signature has been placed on such certificate shall have ceased to be such officer, transfer agent or registrar before such certificate is issued, it may be issued by the Corporation with the same effect as if such person were such officer, transfer agent or registrar at the time of its issue. Every certificate for shares of stock which are subject to any restriction on transfer and every certificate issued when the Corporation is authorized to issue more than one class or series of stock shall contain such legend with respect thereto as is required by law. The Corporation shall be permitted to issue fractional shares.

(b) Transfers. Subject to any restrictions on transfer, shares of stock may be transferred on the books of the Corporation by the surrender to the Corporation or its transfer agent of the certificate therefor properly endorsed or accompanied by a written assignment or power of attorney properly executed, with transfer stamps (if necessary) affixed, and with such proof of the authenticity of signature as the Corporation or its transfer agent may reasonably require.

(c) Record Holders. Except as may otherwise be required by law, by the Certificate of Incorporation or by these Bylaws, the Corporation shall be entitled to treat the record holder of stock as shown on its books as the owner of such stock for all purposes, including the payment of dividends and the right to vote with respect thereto, regardless of any transfer, pledge or other disposition of such stock, until the shares have been transferred on the books of the Corporation in accordance with the requirements of these Bylaws.

It shall be the duty of each stockholder to notify the Corporation of such stockholder's post office address.

(d) Record Date. In order that the Corporation may determine the stockholders entitled to notice of or to vote at any meeting of stockholders or any adjournment thereof, or to consent to corporate action in writing without a meeting, or entitled to receive payment of any dividend or other distribution or allotment of any rights, or entitled to exercise any rights in respect of any change, conversion or exchange of stock or for the purpose of any other lawful action, the Board of Directors may fix, in advance, a record date, which shall not precede the date on which it is established, and which shall not be more than sixty (60) nor less than ten (10) days before the date of such meeting, more than ten (10) days after the date on which the record date for stockholder consent without a meeting is established, nor more than sixty (60) days prior to any other action. In such case only stockholders of record on such record date shall be so entitled notwithstanding any transfer of stock on the books of the Corporation after the record date.

If no record date is fixed, (i) the record date for determining stockholders entitled to notice of or to vote at a meeting of stockholders shall be at the close of business on the day next preceding the day on which notice is given, or, if notice is waived, at the close of business on the day next preceding the day on which the meeting is held, (ii) the record date for determining
stockholders entitled to consent to corporate action in writing without a meeting, when no prior action by the Board of Directors is necessary, shall be the first date on which a signed written consent setting forth the action taken or proposed to be taken is delivered to the Corporation by delivery to its registered office in this state, to its principal place of business, or to an officer or agent of the Corporation having custody of the book in which proceedings of meetings of stockholders are recorded, and (iii) the record date for determining stockholders for any other purpose shall be at the close of business on the day on which the Board of Directors adopts the resolution relating thereto.

(c) **Lost Certificates.** The Corporation may issue a new certificate of stock in the place of any certificate theretofore issued by it, alleged to have been lost, stolen or destroyed, and the Corporation may require the owner of the lost, stolen or destroyed certificate, or his legal representative, to give the Corporation a bond sufficient to indemnify it against any claim that may be made against it on account of the alleged loss, theft or destruction of any such certificate or the issuance of such new certificate.

5. **Indemnification**

(a) **Definitions.** For purposes of this Section 5:

(i) “Corporate Status” describes the status of a person who is serving or has served (A) as a Director of the Corporation, (B) as an Officer of the Corporation, (C) as a Non-Officer Employee of the Corporation, or (D) as a director, partner, trustee, officer, employee or agent of any other corporation, partnership, limited liability company, joint venture, trust, employee benefit plan, foundation, association, organization or other legal entity for which such person is or was serving at the request of the Corporation. For purposes of this Section 5(a)(i), a Director, Officer or Non-Officer Employee of the Corporation who is serving or has served as a director, partner, trustee, officer, employee or agent of a Subsidiary shall be deemed to be serving at the request of the Corporation. Notwithstanding the foregoing, “Corporate Status” shall not include the status of a person who is serving or has served as a director, officer, employee or agent of a constituent corporation absorbed in a merger or consolidation transaction with the Corporation with respect to such person’s activities prior to said transaction, unless specifically authorized by the Board of Directors or the stockholders of the Corporation;

(ii) “Director” means any person who serves or has served the Corporation as a director on the Board of Directors of the Corporation;

(iii) “Disinterested Director” means, with respect to each Proceeding in respect of which indemnification is sought hereunder, a Director of the Corporation who is not and was not a party to such Proceeding;

(iv) “Expenses” means all reasonable attorneys fees, retainers, court costs, transcript costs, fees of expert witnesses, private investigators and professional advisors (including, without limitation, accountants and investment bankers), travel expenses, duplicating costs, printing and binding costs, costs of preparation of demonstrative evidence and other courtroom presentation aids and devices, costs incurred
in connection with document review, organization, imaging and computerization, telephone charges, postage, delivery service fees, and all other disbursements, costs or expenses of the type customarily incurred in connection with prosecuting, defending, preparing to prosecute or defend, investigating, being or preparing to be a witness in, settling or otherwise participating in, a Proceeding;

(v) “Liabilities” means judgments, damages, liabilities, losses, penalties, excise taxes, fines and amounts paid in settlement;

(vi) “Non-Officer Employee” means any person who serves or has served as an employee or agent of the Corporation, but who is not or was not a Director or Officer;

(vii) “Officer” means any person who serves or has served the Corporation as an officer of the Corporation appointed by the Board of Directors of the Corporation;

(viii) “Proceeding” means any threatened, pending or completed action, suit, arbitration, alternate dispute resolution mechanism, inquiry, investigation, administrative hearing or other proceeding, whether civil, criminal, administrative, arbitral or investigatory; and

(ix) “Subsidiary” shall mean any corporation, partnership, limited liability company, joint venture, trust or other entity of which the Corporation owns (either directly or through or together with another Subsidiary of the Corporation) either (i) a general partner, managing member or other similar interest or (ii) (A) 50% or more of the voting power of the voting capital equity interests of such corporation, partnership, limited liability company, joint venture or other entity, or (B) 50% or more of the outstanding voting capital stock or other voting equity interests of such corporation, partnership, limited liability company, joint venture or other entity.

(b) Indemnification of Directors and Officers. Subject to the operation of Section 5(d) of these Bylaws, each Director and Officer shall be indemnified and held harmless by the Corporation to the fullest extent authorized by the DGCL, as the same exists or may hereafter be amended (but, in the case of any such amendment, only to the extent that such amendment permits the Corporation to provide broader indemnification rights than such law permitted the Corporation to provide prior to such amendment), and to the extent authorized in subsections (i) through (iv) of this Section 5(b).

(i) Actions, Suits and Proceedings Other than By or In the Right of the Corporation. Each Director and Officer shall be indemnified and held harmless by the Corporation against any and all Expenses and Liabilities that are incurred or paid by such Director or Officer or on such Director’s or Officer’s behalf in connection with any Proceeding or any claim, issue or matter therein (other than an action by or in the right of the Corporation), which such Director or Officer is, or is threatened to be made, a party to or participant in by reason of such Director’s or Officer’s Corporate Status, if such Director or Officer acted in good faith and in a manner such Director or Officer reasonably believed to be in or not opposed to the best interests of the Corporation and, with respect to any criminal proceeding, had no reasonable cause to believe his or her conduct was unlawful.
(ii) **Actions, Suits and Proceedings By or In the Right of the Corporation.** Each Director and Officer shall be indemnified and held harmless by the Corporation against any and all Expenses that are incurred by such Director or Officer or on such Director’s or Officer’s behalf in connection with any Proceeding or any claim, issue or matter therein by or in the right of the Corporation, which such Director or Officer is, or is threatened to be made, a party to or participant in by reason of such Director’s or Officer’s Corporate Status, if such Director or Officer acted in good faith and in a manner such Director or Officer reasonably believed to be in or not opposed to the best interests of the Corporation; provided, however, that no indemnification shall be made under this Section 5(b)(ii) in respect of any claim, issue or matter as to which such Director or Officer shall have been finally adjudged by a court of competent jurisdiction to be liable to the Corporation, unless, and only to the extent that, the Court of Chancery or another court in which such Proceeding was brought shall determine upon application that, despite adjudication of liability, but in view of all the circumstances of the case, such Director or Officer is fairly and reasonably entitled to indemnification for such Expenses that such court deems proper.

(iii) **Survival of Rights.** The rights of indemnification provided by this Section 5(b) shall continue as to a Director or Officer after he or she has ceased to be a Director or Officer and shall inure to the benefit of his or her heirs, executors, administrators and personal representatives.

(iv) **Actions by Directors or Officers.** Notwithstanding the foregoing, the Corporation shall indemnify any Director or Officer seeking indemnification in connection with a Proceeding initiated by such Director or Officer only if such Proceeding (including any parts of such Proceeding not initiated by such Director or Officer) was authorized in advance by the Board of Directors of the Corporation, unless such Proceeding was brought to enforce such Officer’s or Director’s rights to indemnification or, in the case of Directors, advancement of Expenses under these Bylaws in accordance with the provisions set forth herein.

(c) **Indemnification of Non-Officer Employees.** Subject to the operation of Section 5(d) of these Bylaws, each Non-Officer Employee may, in the discretion of the Board of Directors of the Corporation, be indemnified by the Corporation to the fullest extent authorized by the DGCL, as the same exists or may hereafter be amended, against any or all Expenses and Liabilities that are incurred by such Non-Officer Employee or on such Non-Officer Employee’s behalf in connection with any threatened, pending or completed Proceeding, or any claim, issue or matter therein, which such Non-Officer Employee is, or is threatened to be made, a party to or participant in by reason of such Non-Officer Employee’s Corporate Status, if such Non-Officer Employee acted in good faith and in a manner such Non-Officer Employee reasonably believed to be in or not opposed to the best interests of the Corporation and, with respect to any criminal proceeding, had no reasonable cause to believe his or her conduct was unlawful. The rights of indemnification provided by this Section 5(c) shall exist as to a Non-Officer Employee after he
or she has ceased to be a Non-Officer Employee and shall inure to the benefit of his or her heirs, personal representatives, executors and administrators. Notwithstanding the foregoing, the Corporation may indemnify any Non-Officer Employee seeking indemnification in connection with a Proceeding initiated by such Non-Officer Employee only if such Proceeding was authorized in advance by the Board of Directors of the Corporation.

(d) **Determination.** Unless ordered by a court, no indemnification shall be provided pursuant to this Section 5 to a Director, to an Officer or to a Non-Officer Employee unless a determination shall have been made that such person acted in good faith and in a manner such person reasonably believed to be in or not opposed to the best interests of the Corporation and, with respect to any criminal Proceeding, such person had no reasonable cause to believe his or her conduct was unlawful. Such determination shall be made by (i) a majority vote of the Disinterested Directors, even though less than a quorum of the Board of Directors, (ii) a committee comprised of Disinterested Directors, such committee having been designated by a majority vote of the Disinterested Directors (even though less than a quorum), (iii) if there are no such Disinterested Directors, or if a majority of Disinterested Directors so directs, by independent legal counsel in a written opinion, or (iv) by the stockholders of the Corporation.

(e) **Advancement of Expenses to Directors Prior to Final Disposition.**

(i) The Corporation shall advance all Expenses incurred by or on behalf of any Director in connection with any Proceeding in which such Director is involved by reason of such Director’s Corporate Status within thirty (30) days after the receipt by the Corporation of a written statement from such Director requesting such advance or advances from time to time, whether prior to or after final disposition of such Proceeding. Such statement or statements shall reasonably evidence the Expenses incurred by such Director and shall be preceded or accompanied by an undertaking by or on behalf of such Director to repay any Expenses so advanced if it shall ultimately be determined that such Director is not entitled to be indemnified against such Expenses. Notwithstanding the foregoing, the Corporation shall advance all Expenses incurred by or on behalf of any Director seeking advancement of expenses hereunder in connection with a Proceeding initiated by such Director only if such Proceeding (including any parts of such Proceeding not initiated by such Director) was (A) authorized by the Board of Directors of the Corporation, or (B) brought to enforce such Director’s rights to indemnification or advancement of Expenses under these Bylaws.

(ii) If a claim for advancement of Expenses hereunder by a Director is not paid in full by the Corporation within thirty (30) days after receipt by the Corporation of documentation of Expenses and the required undertaking, such Director may at any time thereafter bring suit against the Corporation to recover the unpaid amount of the claim and if successful in whole or in part, such Director shall also be entitled to be paid the expenses of prosecuting such claim. The failure of the Corporation (including its Board of Directors or any committee thereof, independent legal counsel, or stockholders) to make a determination concerning the permissibility of such advancement of Expenses under this Section 5 shall not be a defense to an action brought by a Director for recovery of the unpaid amount of an advancement claim and shall not create a presumption that such advancement is not permissible. The burden of proving that a Director is not entitled to an advancement of expenses shall be on the Corporation.
(iii) In any suit brought by the Corporation to recover an advancement of expenses pursuant to the terms of an undertaking, the Corporation shall be entitled to recover such expenses upon a final adjudication that the Director has not met any applicable standard for indemnification set forth in the DGCL.

(f) Advancement of Expenses to Officers and Non-Officer Employees Prior to Final Disposition.

(i) The Corporation may, at the discretion of the Board of Directors of the Corporation, advance any or all Expenses incurred by or on behalf of any Officer or any Non-Officer Employee in connection with any Proceeding in which such person is involved by reason of his or her Corporate Status as an Officer or Non-Officer Employee upon the receipt by the Corporation of a statement or statements from such Officer or Non-Officer Employee requesting such advance or advances from time to time, whether prior to or after final disposition of such Proceeding. Such statement or statements shall reasonably evidence the Expenses incurred by such Officer or Non-Officer Employee and shall be preceded or accompanied by an undertaking by or on behalf of such person to repay any Expenses so advanced if it shall ultimately be determined that such Officer or Non-Officer Employee is not entitled to be indemnified against such Expenses.

(ii) In any suit brought by the Corporation to recover an advancement of expenses pursuant to the terms of an undertaking, the Corporation shall be entitled to recover such expenses upon a final adjudication that the Officer or Non-Officer Employee has not met any applicable standard for indemnification set forth in the DGCL.

(g) Contractual Nature of Rights.

(i) The provisions of this Section 5 shall be deemed to be a contract between the Corporation and each Director and Officer entitled to the benefits hereof at any time while this Section 5 is in effect, in consideration of such person’s past or current and any future performance of services for the Corporation. Neither amendment, repeal or modification of any provision of this Section 5 nor the adoption of any provision of the Certificate of Incorporation inconsistent with this Section 5 shall eliminate or reduce any right conferred by this Section 5 in respect of any act or omission occurring, or any cause of action or claim that accrues or arises or any state of facts existing, at the time of or before such amendment, repeal, modification or adoption of an inconsistent provision (even in the case of a proceeding based on such a state of facts that is commenced after such time), and all rights to indemnification and advancement of Expenses granted herein or arising out of any act or omission shall vest at the time of the act or omission in question, regardless of when or if any proceeding with respect to such act or omission is commenced. The rights to indemnification and to advancement of expenses provided by, or granted pursuant to, this Section 5 shall continue notwithstanding that the person has ceased to be a director or officer of the Corporation and shall inure to the benefit of the estate, heirs, executors, administrators, legatees and distributees of such person.
(ii) If a claim for indemnification hereunder by a Director or Officer is not paid in full by the Corporation within sixty (60) days after receipt by the Corporation of a written claim for indemnification, such Director or Officer may at any time thereafter bring suit against the Corporation to recover the unpaid amount of the claim, and if successful in whole or in part, such Director or Officer shall also be entitled to be paid the expenses of prosecuting such claim. The failure of the Corporation (including its Board of Directors or any committee thereof, independent legal counsel, or stockholders) to make a determination concerning the permissibility of such indemnification under this Section 5 shall not be a defense to an action brought by a Director or Officer for recovery of the unpaid amount of an indemnification claim and shall not create a presumption that such indemnification is not permissible. The burden of proving that a Director or Officer is not entitled to indemnification shall be on the Corporation.

(iii) In any suit brought by a Director or Officer to enforce a right to indemnification hereunder, it shall be a defense that such Director or Officer has not met any applicable standard for indemnification set forth in the DGCL.

(h) **Non-Exclusivity of Rights.** The rights to indemnification and advancement of Expenses set forth in this Section 5 shall not be exclusive of any other right which any Director, Officer, or Non-Officer Employee may have or hereafter acquire under any statute, provision of the Certificate or these Bylaws, agreement, vote of stockholders or Disinterested Directors or otherwise.

(i) **Insurance.** The Corporation may maintain insurance, at its expense, to protect itself and any Director, Officer or Non-Officer Employee against any liability of any character asserted against or incurred by the Corporation or any such Director, Officer or Non-Officer Employee, or arising out of any such person’s Corporate Status, whether or not the Corporation would have the power to indemnify such person against such liability under the DGCL or the provisions of this Section 5.

(j) **Other Indemnification.** The Corporation’s obligation, if any, to indemnify or provide advancement of Expenses to any person under this Section 5 as a result of such person serving, at the request of the Corporation, as a director, partner, trustee, officer, employee or agent of another corporation, partnership, joint venture, trust, employee benefit plan or other enterprise shall be reduced by any amount such person may collect as indemnification or advancement of Expenses from such other corporation, partnership, joint venture, trust, employee benefit plan or enterprise (the “Primary Indemnitor”). Any indemnification or advancement of Expenses under this Section 5 owed by the Corporation as a result of a person serving, at the request of the Corporation, as a director, partner, trustee, officer, employee or agent of another corporation, partnership, joint venture, trust, employee benefit plan or other enterprise shall only be in excess of, and shall be secondary to, the indemnification or advancement of Expenses available from the applicable Primary Indemnitor(s) and any applicable insurance policies.

(a) Fiscal Year. Except as otherwise determined by the Board of Directors, the fiscal year of the Corporation shall end on December 31 of each year.

(b) Seal. The Board of Directors shall have power to adopt and alter the seal of the Corporation.

(c) Execution of Instruments. Subject to any limitations which may be set forth in a resolution of the Board of Directors, all deeds, leases, transfers, contracts, bonds, notes and other obligations to be entered into by the Corporation in the ordinary course of its business without director action may be executed on behalf of the Corporation by, a President, or by any other officer, employee or agent of the Corporation as the Board of Directors may authorize.

(d) Voting of Securities. Unless the Board of Directors otherwise provides, a President, any Vice President or the Treasurer may waive notice of and act on behalf of this Corporation, or appoint another person or persons to act as proxy or attorney in fact for this Corporation with or without discretionary power and/or power of substitution, at any meeting of stockholders or shareholders of any other corporation or organization, any of whose securities are held by this Corporation.

(e) Resident Agent. The Board of Directors may appoint a resident agent upon whom legal process may be served in any action or proceeding against the Corporation.

(f) Corporate Records. The original or attested copies of the Certificate of Incorporation, Bylaws and records of all meetings of the incorporators, stockholders and the Board of Directors and the stock and transfer records, which shall contain the names of all stockholders, their record addresses and the amount of stock held by each, shall be kept at the principal office of the Corporation, at the office of its counsel, or at an office of its transfer agent.

(g) Certificate of Incorporation. All references in these Bylaws to the Certificate of Incorporation shall be deemed to refer to the Certificate of Incorporation of the Corporation, as amended and in effect from time to time.

(h) Amendments. These Bylaws may be altered, amended or repealed, and new Bylaws may be adopted, by the stockholders or by the Board of Directors; provided, that (a) the Board of Directors may not alter, amend or repeal any provision of these Bylaws which by law, by the Certificate of Incorporation or by these Bylaws requires action by the stockholders and (b) any alteration, amendment or repeal of these Bylaws by the Board of Directors and any new By-law adopted by the Board of Directors may be altered, amended or repealed by the stockholders.
(i) **Waiver of Notice.** Whenever notice is required to be given under any provision of these Bylaws, a written waiver, signed by the person entitled to notice, or a waiver by electronic transmission by the person entitled to notice, whether before or after the time of the event for which notice is to be given, shall be deemed equivalent to notice. Attendance of a person at a meeting shall constitute a waiver of notice of such meeting, except when the person attends a meeting for the express purpose of objecting at the beginning of the meeting to the transaction of any business because the meeting is not lawfully called or convened. Neither the business to be transacted at, nor the purpose of, any meeting needs to be specified in any written waiver or any waiver by electronic transmission.

Adopted July 22, 2016
AMENDED AND RESTATED

BY-LAWS

OF

MODERNA, INC.

(the "Corporation")

ARTICLE I

Stockholders

SECTION 1. Annual Meeting. The annual meeting of stockholders (any such meeting being referred to in these By-laws as an “Annual Meeting”) shall be held at the hour, date and place within or without the United States which is fixed by the Board of Directors, which time, date and place may subsequently be changed at any time by vote of the Board of Directors. If no Annual Meeting has been held for a period of thirteen (13) months after the Corporation’s last Annual Meeting, a special meeting in lieu thereof may be held, and such special meeting shall have, for the purposes of these By-laws or otherwise, all the force and effect of an Annual Meeting. Any and all references hereafter in these By-laws to an Annual Meeting or Annual Meetings also shall be deemed to refer to any special meeting(s) in lieu thereof.

ARTICLE II

Notice of Stockholder Business and Nominations.

(a) Annual Meetings of Stockholders.

(1) Nominations of persons for election to the Board of Directors of the Corporation and the proposal of other business to be considered by the stockholders may be brought before an Annual Meeting (i) by or at the direction of the Board of Directors or (ii) by any stockholder of the Corporation who was a stockholder of record at the time of giving of notice provided for in this By-law, who is entitled to vote at such Annual Meeting and who complies with the notice procedures set forth in this By-law as to such nomination or business. For the avoidance of doubt, the foregoing clause (ii) shall be the exclusive means for a stockholder to bring nominations or business properly before an Annual Meeting (other than matters properly brought under Rule 14a-8 (or any successor rule) under the Securities Exchange Act of 1934, as amended (the “Exchange Act”)), and such stockholder must comply with the notice and other procedures set forth in Article I, Section 2(a)(2) and (3) of this By-law to bring such nominations or business properly before an Annual Meeting. In addition to the other requirements set forth in this By-law, for any proposal of business to be considered at an Annual Meeting, it must be a proper subject for action by stockholders of the Corporation under Delaware law.

(2) For nominations or other business to be properly brought before an Annual Meeting by a stockholder pursuant to clause (ii) of Article I, Section 2(a)(1) of this By-law, the stockholder must (i) have given Timely Notice (as defined below)
thereof in writing to the Secretary of the Corporation, (ii) have provided any updates or supplements to such notice at the times and in the forms required by this By-law and (iii) together with the beneficial owner(s), if any, on whose behalf the nomination or business proposal is made, have acted in accordance with the representations set forth in the Solicitation Statement (as defined below) required by this By-law. To be timely, a stockholder’s written notice shall be received by the Secretary at the principal executive offices of the Corporation not later than the close of business on the ninetieth (90th) day nor earlier than the close of business on the one hundred twentieth (120th) day prior to the one-year anniversary of the preceding year’s Annual Meeting; provided, however, that in the event the Annual Meeting is first convened more than thirty (30) days before or more than sixty (60) days after such anniversary date, or if no Annual Meeting were held in the preceding year, notice by the stockholder to be timely must be received by the Secretary of the Corporation not later than the close of business on the later of the ninetieth (90th) day prior to the scheduled date of such Annual Meeting or the tenth (10th) day following the day on which public announcement of the date of such Annual Meeting is first made (such notice within such time periods shall be referred to as “Timely Notice”). Notwithstanding anything to the contrary provided herein, for the first Annual Meeting following the initial public offering of common stock of the Corporation, a stockholder’s notice shall be timely if received by the Secretary at the principal executive offices of the Corporation not later than the close of business on the later of the ninetieth (90th) day prior to the scheduled date of such Annual Meeting or the tenth (10th) day following the day on which public announcement of the date of such Annual Meeting is first made or sent by the Corporation. Such stockholder’s Timely Notice shall set forth:

(A) as to each person whom the stockholder proposes to nominate for election or re-election as a director, (i) the name, age, business address and residence address of the nominee, (ii) the principal occupation or employment of the nominee, (iii) the class and number of shares of the Corporation that are held of record or are beneficially owned by the nominee and any derivative positions held or beneficially held by the nominee, (iv) whether and the extent to which any hedging or other transaction or series of transactions has been entered into by or on behalf of the nominee with respect to any securities of the Corporation, and a description of any other agreement, arrangement or understanding (including any short position or any borrowing or lending of shares), the effect or intent of which is to mitigate loss to, or to manage the risk or benefit of share price changes for, or to increase or decrease the voting power of the nominee, (v) a description of all arrangements or understandings between or among the stockholder and each nominee and any other person or persons (naming such person or persons) pursuant to which the nominations are to be made by the stockholder or concerning the nominee’s potential service on the Board of Directors, (vi) a written statement executed by the nominee acknowledging that as a director of the corporation, the nominee will owe fiduciary duties under Delaware law with respect to the Corporation and its stockholders, and (vii) all information relating to such person that is required to be disclosed in solicitations of proxies for election of directors in an election contest, or is otherwise required, in each case pursuant to Regulation 14A under the Exchange Act (including such person’s written consent to being named in the proxy statement as a nominee and to serving as a director if elected);
as to any other business that the stockholder proposes to bring before such Annual Meeting, a brief description of the business desired to be brought before such Annual Meeting, the reasons for conducting such business at such Annual Meeting, the text, if any, of any resolutions or By-law amendment proposed for adoption, and any material interest in such business of each Proposing Person (as defined below);

(C) (i) the name and address of the stockholder giving the notice, as they appear on the Corporation’s books, and the names and addresses of the other Proposing Persons (if any) and (ii) as to each Proposing Person, the following information: (a) the class or series and number of all shares of capital stock of the Corporation which are, directly or indirectly, owned beneficially or of record by such Proposing Person or any of its affiliates or associates (as such terms are defined in Rule 12b-2 promulgated under the Exchange Act), including any shares of any class or series of capital stock of the Corporation as to which such Proposing Person or any of its affiliates or associates has a right to acquire beneficial ownership at any time in the future, (b) all Synthetic Equity Interests (as defined below) in which such Proposing Person or any of its affiliates or associates, directly or indirectly, holds an interest including a description of the material terms of each such Synthetic Equity Interest, including without limitation, identification of the counterparty to each such Synthetic Equity Interest and disclosure, for each such Synthetic Equity Interest, as to (x) whether or not such Synthetic Equity Interest conveys any voting rights, directly or indirectly, in such shares to such Proposing Person, (y) whether or not such Synthetic Equity Interest is required to be, or is capable of being, settled through delivery of such shares and (z) whether or not such Proposing Person and/or, to the extent known, the counterparty to such Synthetic Equity Interest has entered into other transactions that hedge or mitigate the economic effect of such Synthetic Equity Interest, (c) any proxy (other than a revocable proxy given in response to a public proxy solicitation made pursuant to, and in accordance with, the Exchange Act), agreement, arrangement, understanding or relationship pursuant to which such Proposing Person has or shares a right to, directly or indirectly, vote any shares of any class or series of capital stock of the Corporation, (d) any rights to dividends or other distributions on the shares of any class or series of capital stock of the Corporation, directly or indirectly, owned beneficially by such Proposing Person that are separated or separable from the underlying shares of the Corporation, and (e) any performance-related fees (other than an asset-based fee) that such Proposing Person, directly or indirectly, is entitled to based on any increase or decrease in the value of shares of any class or series of capital stock of the Corporation or any Synthetic Equity Interests (the disclosures to be made pursuant to the foregoing clauses (a) through (e) are referred to, collectively, as “Material Ownership Interests”) and (iii) a description of the material terms of all agreements, arrangements or understandings (whether or not in writing) entered into by any Proposing Person or any of its affiliates or associates with any other person for the purpose of acquiring, holding, disposing or voting of any shares of any class or series of capital stock of the Corporation;
(D) a description of all agreements, arrangements or understandings by and among any of the Proposing Persons, or by and among any Proposing Persons and any other person (including with any proposed nominee(s)), pertaining to the nomination(s), or other business proposed to be brought before the meeting of stockholders (which description shall identify the name of each other person who is party to such an agreement, arrangement or understanding), and (ii) identification of the names and addresses of other stockholders (including beneficial owners) known by any of the Proposing Persons to support such nominations or other business proposal(s), and to the extent known the class and number of all shares of the Corporation’s capital stock owned beneficially or of record by such other stockholder(s) or other beneficial owner(s); and

(E) a statement whether or not the stockholder giving the notice and/or the other Proposing Person(s), if any, will deliver a proxy statement and form of proxy to holders of, in the case of a business proposal, at least the percentage of voting power of all of the shares of capital stock of the Corporation required under applicable law to approve the proposal or, in the case of a nomination or nominations, at least the percentage of voting power of all of the shares of capital stock of the Corporation reasonably believed by such Proposing Person to be sufficient to elect the nominee or nominees proposed to be nominated by such stockholder (such statement, the “Solicitation Statement”).

For purposes of this Article I of these By-laws, the term “Proposing Person” shall mean the following persons: (i) the stockholder of record providing the notice of nominations or business proposed to be brought before an Annual Meeting, and (ii) the beneficial owner(s), if different, on whose behalf the nominations or business proposed to be brought before an Annual Meeting is made. For purposes of this Section 2 of Article I of these By-laws, the term “Synthetic Equity Interest” shall mean any transaction, agreement or arrangement (or series of transactions, agreements or arrangements), including, without limitation, any derivative, swap, hedge, repurchase or so-called “stock borrowing” agreement or arrangement, the purpose or effect of which is to, directly or indirectly: (a) give a person or entity economic benefit and/or risk similar to ownership of shares of any class or series of capital stock of the Corporation, in whole or in part, including due to the fact that such transaction, agreement or arrangement provides, directly or indirectly, the opportunity to profit or avoid a loss from any increase or decrease in the value of any shares of any class or series of capital stock of the Corporation, (b) mitigate loss to, reduce the economic risk of or manage the risk of share price changes for, any person or entity with respect to any shares of any class or series of capital stock of the Corporation, (c) otherwise provide in any manner the opportunity to profit or avoid a loss from any decrease in the value of any shares of any class or series of capital stock of the Corporation, or (d) increase or decrease the voting power of any person or entity with respect to any shares of any class or series of capital stock of the Corporation.
A stockholder providing Timely Notice of nominations or business proposed to be brought before an Annual Meeting shall further update and supplement such Timely Notice, if necessary, so that the information (including, without limitation, the Material Ownership Interests information) provided or required to be provided in such Timely Notice pursuant to this By-law shall be true and correct as of the record date for the meeting and as of the date that is ten (10) business days prior to such Annual Meeting, and such update and supplement shall be received by the Secretary at the principal executive offices of the Corporation not later than the close of business on the fifth (5th) business day after the record date for the Annual Meeting (in the case of the update and supplement required to be made as of the record date), and not later than the close of business on the eighth (8th) business day prior to the date of the Annual Meeting (in the case of the update and supplement required to be made as of ten (10) business days prior to the meeting).

Notwithstanding anything in the second sentence of Article I, Section 2(a)(2) of this By-law to the contrary, in the event that the number of directors to be elected to the Board of Directors of the Corporation is increased and there is no public announcement naming all of the nominees for director or specifying the size of the increased Board of Directors made by the Corporation at least ten (10) days before the last day a stockholder may deliver a notice of nomination in accordance with the second sentence of Article I, Section 2(a)(2), a stockholder's notice required by this By-law shall also be considered timely, but only with respect to nominees for any new positions created by such increase, if it shall be received by the Secretary of the Corporation not later than the close of business on the tenth (10th) day following the day on which such public announcement is first made by the Corporation.

(b) General.

(1) Only such persons who are nominated in accordance with the provisions of this By-law shall be eligible for election and to serve as directors and only such business shall be conducted at an Annual Meeting as shall have been brought before the meeting in accordance with the provisions of this By-law or in accordance with Rule 14a-8 under the Exchange Act. The Board of Directors or a designated committee thereof shall have the power to determine whether a nomination or any business proposed to be brought before the meeting was made in accordance with the provisions of this By-law. If neither the Board of Directors nor such designated committee makes a determination as to whether any stockholder proposal or nomination was made in accordance with the provisions of this By-law, the presiding officer of the Annual Meeting shall have the power and duty to determine whether the stockholder proposal or nomination was made in accordance with the provisions of this By-law. If the Board of Directors or a designated committee thereof or the presiding officer, as applicable, determines that any stockholder proposal or nomination was not made in accordance with the provisions of this By-law, such proposal or nomination shall be disregarded and shall not be presented for action at the Annual Meeting.

(2) Except as otherwise required by law, nothing in this Article I, Section 2 shall obligate the Corporation or the Board of Directors to include in any proxy statement or other stockholder communication distributed on behalf of the Corporation or the Board of Directors information with respect to any nominee for director or any other matter of business submitted by a stockholder.
(3) Notwithstanding the foregoing provisions of this Article I, Section 2, if the nominating or proposing stockholder (or a qualified representative of the stockholder) does not appear at the Annual Meeting to present a nomination or any business, such nomination or business shall be disregarded, notwithstanding that proxies in respect of such vote may have been received by the Corporation. For purposes of this Article I, Section 2, to be considered a qualified representative of the proposing stockholder, a person must be authorized by a written instrument executed by such stockholder or an electronic transmission delivered by such stockholder to act for such stockholder as proxy at the Annual Meeting and such person must produce such written instrument or electronic transmission, or a reliable reproduction of the written instrument or electronic transmission, to the presiding officer at the Annual Meeting.

(4) For purposes of this By-law, “public announcement” shall mean disclosure in a press release reported by the Dow Jones News Service, Associated Press or comparable national news service or in a document publicly filed by the Corporation with the Securities and Exchange Commission pursuant to Section 13, 14 or 15(d) of the Exchange Act.

(5) Notwithstanding the foregoing provisions of this By-law, a stockholder shall also comply with all applicable requirements of the Exchange Act and the rules and regulations thereunder with respect to the matters set forth in this By-law. Nothing in this By-law shall be deemed to affect any rights of (i) stockholders to have proposals included in the Corporation’s proxy statement pursuant to Rule 14a-8 or any successor rule, as applicable, under the Exchange Act and, to the extent required by such rule, have such proposals considered and voted on at an Annual Meeting or (ii) the holders of any series of Undesignated Preferred Stock (as defined in the Certificate (as defined below)) to elect directors under specified circumstances.

(c) Notwithstanding anything herein to the contrary, the affirmative vote of not less than two thirds (2/3) of the outstanding shares of capital stock entitled to vote thereon, and the affirmative vote of not less than two thirds (2/3) of the outstanding shares of each class entitled to vote thereon as a class, shall be required to amend or repeal any provision of this Article I, Section 2; provided, however, that if the Board of Directors recommends that stockholders approve such amendment or repeal at such meeting of stockholders, such amendment or repeal shall only require the affirmative vote of a majority of the outstanding shares entitled to vote on such amendment or repeal, voting together as a single class.

SECTION 3. Special Meetings. Except as otherwise required by statute and subject to the rights, if any, of the holders of any series of Undesignated Preferred Stock, special meetings of the stockholders of the Corporation may be called only by the Board of Directors acting pursuant to a resolution approved by the affirmative vote of a majority of the Directors then in office. The Board of Directors may postpone or reschedule any previously scheduled special meeting of stockholders. Only those matters set forth in the notice of the special meeting may be
considered or acted upon at a special meeting of stockholders of the Corporation. Nominations of persons for election to the Board of Directors of the Corporation and stockholder proposals of other business shall not be brought before a special meeting of stockholders to be considered by the stockholders unless such special meeting is held in lieu of an annual meeting of stockholders in accordance with Article I, Section 1 of these By-laws, in which case such special meeting in lieu thereof shall be deemed an Annual Meeting for purposes of these By-laws and the provisions of Article I, Section 2 of these By-laws shall govern such special meeting.

Notwithstanding anything herein to the contrary, the affirmative vote of not less than two thirds (2/3) of the outstanding shares of capital stock entitled to vote thereon, and the affirmative vote of not less than two thirds (2/3) of the outstanding shares of each class entitled to vote thereon as a class, shall be required to amend or repeal any provision of this Article I, Section 3; provided, however, that if the Board of Directors recommends that stockholders approve such amendment or repeal at such meeting of stockholders, such amendment or repeal shall only require the affirmative vote of a majority of the outstanding shares entitled to vote on such amendment or repeal, voting together as a single class.

SECTION 4. Notice of Meetings; Adjournments.

(a) A notice of each Annual Meeting stating the hour, date and place, if any, of such Annual Meeting and the means of remote communication, if any, by which stockholders and proxyholders may be deemed to be present in person and vote at such meeting, shall be given not less than ten (10) days nor more than sixty (60) days before the Annual Meeting, to each stockholder entitled to vote thereat by delivering such notice to such stockholder or by mailing it, postage prepaid, addressed to such stockholder at the address of such stockholder as it appears on the Corporation’s stock transfer books. Without limiting the manner by which notice may otherwise be given to stockholders, any notice to stockholders may be given by electronic transmission in the manner provided in Section 232 of the Delaware General Corporation Law (“DGCL”).

(b) Unless otherwise required by the DGCL, notice of all special meetings of stockholders shall be given in the same manner as provided for Annual Meetings, except that the notice of all special meetings shall state the purpose or purposes for which the meeting has been called.

(c) Notice of an Annual Meeting or special meeting of stockholders need not be given to a stockholder if a waiver of notice is executed, or waiver of notice by electronic transmission is provided, before or after such meeting by such stockholder or if such stockholder attends such meeting, unless such attendance is for the express purpose of objecting at the beginning of the meeting to the transaction of any business because the meeting was not lawfully called or convened.

(d) The Board of Directors may postpone and reschedule any previously scheduled Annual Meeting or special meeting of stockholders and any record date with respect thereto, regardless of whether any notice or public disclosure with respect to any such meeting has been sent or made pursuant to Section 2 of this Article I of these By-laws or otherwise. In no event shall the public announcement of an adjournment, postponement or rescheduling of any previously scheduled meeting of stockholders commence a new time period for the giving of a stockholder’s notice under this Article I of these By-laws.
Section 5. Quorum. A majority of the outstanding shares entitled to vote, present in person or represented by proxy, shall constitute a quorum at any meeting of stockholders. If less than a quorum is present at a meeting, the holders of voting stock representing a majority of the voting power present at the meeting or the presiding officer may adjourn the meeting from time to time, and the meeting may be held as adjourned without further notice, except as provided in Section 4 of this Article I. At such adjourned meeting at which a quorum is present, any business may be transacted which might have been transacted at the original meeting. The stockholders present at a duly constituted meeting may continue to transact business until adjournment, notwithstanding the withdrawal of enough stockholders to leave less than a quorum.

Section 6. Voting and Proxies. Stockholders shall have one vote for each share of stock entitled to vote owned by them of record according to the stock ledger of the Corporation as of the record date, unless otherwise provided by law or by the Certificate. Stockholders may vote either (i) in person, (ii) by written proxy or (iii) by a transmission permitted by Section 212(c) of the DGCL. Any copy, facsimile telecommunication or other reliable reproduction of the writing or transmission permitted by Section 212(c) of the DGCL may be substituted for or used in lieu of the original writing or transmission. Proxies shall be filed in accordance with the procedures established for the meeting of stockholders. Except as otherwise limited therein or as otherwise provided by law, proxies authorizing a person to vote at a specific meeting shall entitle the persons authorized thereby to vote at any adjournment of such meeting, but they shall not be valid after final adjournment of such meeting. A proxy with respect to stock held in the name of two or more persons shall be valid if executed by or on behalf of any one of them unless at or prior to the exercise of the proxy the Corporation receives a specific written notice to the contrary from any one of them.
SECTION 7.  Action at Meeting. When a quorum is present at any meeting of stockholders, any matter before any such meeting (other than an election of a director or directors) shall be decided by a majority of the votes properly cast for and against such matter, except where a larger vote is required by law, by the Certificate or by these By-laws. Any election of directors by stockholders shall be determined by a plurality of the votes properly cast on the election of directors.

SECTION 8.  Stockholder Lists. The Secretary or an Assistant Secretary (or the Corporation’s transfer agent or other person authorized by these By-laws or by law) shall prepare and make, at least ten (10) days before every Annual Meeting or special meeting of stockholders, a complete list of the stockholders entitled to vote at the meeting, arranged in alphabetical order, and showing the address of each stockholder and the number of shares registered in the name of each stockholder. Such list shall be open to the examination of any stockholder, for a period of at least ten (10) days prior to the meeting as provided in the manner, and subject to the terms, set forth in Section 219 of the DGCL (or any successor provision). The list shall also be open to the examination of any stockholder during the whole time of the meeting as provided by law.

SECTION 9.  Presiding Officer. The Board of Directors shall designate a representative to preside over all Annual Meetings or special meetings of stockholders, provided that if the Board of Directors does not so designate such a presiding officer, then the Chairman of the Board, if one is elected, shall preside over such meetings. If the Board of Directors does not so designate such a presiding officer and there is no Chairman of the Board or the Chairman of the Board is unable to so preside or is absent, then the Chief Executive Officer, if one is elected, shall preside over such meetings, provided further that if there is no Chief Executive Officer or the Chief Executive Officer is unable to so preside or is absent, then the President shall preside over such meetings. The presiding officer at any Annual Meeting or special meeting of stockholders shall have the power, among other things, to adjourn such meeting at any time and from time to time, subject to Sections 4 and 5 of this Article I. The order of business and all other matters of procedure at any meeting of the stockholders shall be determined by the presiding officer.

SECTION 10.  Inspectors of Elections. The Corporation shall, in advance of any meeting of stockholders, appoint one or more inspectors to act at the meeting and make a written report thereof. The Corporation may designate one or more persons as alternate inspectors to replace any inspector who fails to act. If no inspector or alternate is able to act at a meeting of stockholders, the presiding officer shall appoint one or more inspectors to act at the meeting. Any inspector may, but need not, be an officer, employee or agent of the Corporation. Each inspector, before entering upon the discharge of his or her duties, shall take and sign an oath faithfully to execute the duties of inspector with strict impartiality and according to the best of his or her ability. The inspectors shall perform such duties as are required by the DGCL, including the counting of all votes and ballots. The inspectors may appoint or retain other persons or entities to assist the inspectors in the performance of the duties of the inspectors. The presiding officer may review all determinations made by the inspectors, and in so doing the
presiding officer shall be entitled to exercise his or her sole judgment and discretion and he or she shall not be bound by any determinations made by the inspectors. All determinations by the inspectors and, if applicable, the presiding officer, shall be subject to further review by any court of competent jurisdiction.

ARTICLE II

Directors

SECTION 1. Powers. The business and affairs of the Corporation shall be managed by or under the direction of the Board of Directors except as otherwise provided by the Certificate or required by law.

SECTION 2. Number and Terms. The number of directors of the Corporation shall be fixed solely and exclusively by resolution duly adopted from time to time by the Board of Directors. The directors shall hold office in the manner provided in the Certificate.

SECTION 3. Qualification. No director need be a stockholder of the Corporation.

SECTION 4. Vacancies. Vacancies in the Board of Directors shall be filled in the manner provided in the Certificate.

SECTION 5. Removal. Directors may be removed from office only in the manner provided in the Certificate.

SECTION 6. Resignation. A director may resign at any time by electronic transmission or by giving written notice to the Chairman of the Board, if one is elected, the President or the Secretary. A resignation shall be effective upon receipt, unless the resignation otherwise provides.

SECTION 7. Regular Meetings. The regular annual meeting of the Board of Directors shall be held, without notice other than this Section 7, on the same date and at the same place as the Annual Meeting following the close of such meeting of stockholders. Other regular meetings of the Board of Directors may be held at such hour, date and place as the Board of Directors may by resolution from time to time determine and publicize by means of reasonable notice given to any director who is not present at the meeting at which such resolution is adopted.

SECTION 8. Special Meetings. Special meetings of the Board of Directors may be called, orally or in writing, by or at the request of a majority of the directors, the Chairman of the Board, if one is elected, or the President. The person calling any such special meeting of the Board of Directors may fix the hour, date and place thereof.

SECTION 9. Notice of Meetings. Notice of the hour, date and place of all special meetings of the Board of Directors shall be given to each director by the Secretary or an Assistant Secretary, or in case of the death, absence, incapacity or refusal of such persons, by the Chairman of the Board, if one is elected, or the President or such other officer designated by the Chairman of the Board, if one is elected, or the President. Notice of any special meeting of the Board of Directors shall be given to each director in person, by telephone, or by facsimile,
electronic mail or other form of electronic communication, sent to his or her business or home address, at least twenty-four (24) hours in advance of the meeting, or by written notice mailed to his or her business or home address, at least forty-eight (48) hours in advance of the meeting. Such notice shall be deemed to be delivered when hand-delivered to such address, read to such director by telephone, deposited in the mail so addressed, with postage thereon prepaid if mailed, dispatched or transmitted if sent by facsimile transmission or by electronic mail or other form of electronic communications. A written waiver of notice signed or electronically transmitted before or after a meeting by a director and filed with the records of the meeting shall be deemed to be equivalent to notice of the meeting. The attendance of a director at a meeting shall constitute a waiver of notice of such meeting, except where a director attends a meeting for the express purpose of objecting at the beginning of the meeting to the transaction of any business because such meeting is not lawfully called or convened. Except as otherwise required by law, by the Certificate or by these By-laws, neither the business to be transacted at, nor the purpose of, any meeting of the Board of Directors need be specified in the notice or waiver of notice of such meeting.

SECTION 10.  **Quorum.** At any meeting of the Board of Directors, a majority of the total number of directors shall constitute a quorum for the transaction of business, but if less than a quorum is present at a meeting, a majority of the directors present may adjourn the meeting from time to time, and the meeting may be held as adjourned without further notice. Any business which might have been transacted at the meeting as originally noticed may be transacted at such adjourned meeting at which a quorum is present. For purposes of this section, the total number of directors includes any unfilled vacancies on the Board of Directors.

SECTION 11.  **Action at Meeting.** At any meeting of the Board of Directors at which a quorum is present, the vote of a majority of the directors present shall constitute action by the Board of Directors, unless otherwise required by law, by the Certificate or by these By-laws.

SECTION 12.  **Action by Consent.** Any action required or permitted to be taken at any meeting of the Board of Directors may be taken without a meeting if all members of the Board of Directors consent thereto in writing or by electronic transmission and the writing or writings or electronic transmission or transmissions are filed with the records of the meetings of the Board of Directors. Such filing shall be in paper form if the minutes are maintained in paper form and shall be in electronic form if the minutes are maintained in electronic form. Such consent shall be treated as a resolution of the Board of Directors for all purposes.

SECTION 13.  **Manner of Participation.** Directors may participate in meetings of the Board of Directors by means of conference telephone or other communications equipment by means of which all directors participating in the meeting can hear each other, and participation in a meeting in accordance herewith shall constitute presence in person at such meeting for purposes of these By-laws.

SECTION 14.  **Presiding Director.** The Board of Directors shall designate a representative to preside over all meetings of the Board of Directors, provided that if the Board of Directors does not so designate such a presiding director or such designated presiding director is unable to so preside or is absent, then the Chairman of the Board, if one is elected, shall preside over all meetings of the Board of Directors. If both the designated presiding director, if one is so designated, and the Chairman of the Board, if one is elected, are unable to preside or are absent, the Board of Directors shall designate an alternate representative to preside over a meeting of the Board of Directors.
SECTION 15. **Committees.** The Board of Directors, by vote of a majority of the directors then in office, may elect one or more committees, including, without limitation, a Compensation and Talent Committee, a Nominating and Corporate Governance Committee and an Audit Committee, and may delegate thereto some or all of its powers except those which by law, by the Certificate or by these By-laws may not be delegated. Except as the Board of Directors may otherwise determine, any such committee may make rules for the conduct of its business, but unless otherwise provided by the Board of Directors or in such rules, its business shall be conducted so far as possible in the same manner as is provided by these By-laws for the Board of Directors. All members of such committees shall hold such offices at the pleasure of the Board of Directors. The Board of Directors may abolish any such committee at any time. Any committee to which the Board of Directors delegates any of its powers or duties shall keep records of its meetings and shall report its action to the Board of Directors.

SECTION 16. **Compensation of Directors.** Directors shall receive such compensation for their services as shall be determined by a majority of the Board of Directors, or a designated committee thereof, provided that directors who are serving the Corporation as employees and who receive compensation for their services as such, shall not receive any salary or other compensation for their services as directors of the Corporation.

ARTICLE III

**Officers**

SECTION 1. **Enumeration.** The officers of the Corporation shall consist of a President, a Treasurer, a Secretary and such other officers, including, without limitation, a Chairman of the Board of Directors, a Chief Executive Officer and one or more Vice Presidents (including Executive Vice Presidents or Senior Vice Presidents), Assistant Vice Presidents, Assistant Treasurers and Assistant Secretaries, as the Board of Directors may determine.

SECTION 2. **Election.** At the regular annual meeting of the Board of Directors following the Annual Meeting, the Board of Directors shall elect the President, the Treasurer and the Secretary. Other officers may be elected by the Board of Directors at such regular annual meeting of the Board of Directors or at any other regular or special meeting.

SECTION 3. **Qualification.** No officer need be a stockholder or a director. Any person may occupy more than one office of the Corporation at any time.

SECTION 4. **Tenure.** Except as otherwise provided by the Certificate or by these By-laws, each of the officers of the Corporation shall hold office until the regular annual meeting of the Board of Directors following the next Annual Meeting and until his or her successor is elected and qualified or until his or her earlier resignation or removal.

SECTION 5. **Resignation.** Any officer may resign by delivering his or her written or electronically transmitted resignation to the Corporation addressed to the President or the Secretary, and such resignation shall be effective upon receipt, unless the resignation otherwise provides.
SECTION 6. **Removal.** Except as otherwise provided by law or by resolution of the Board of Directors, the Board of Directors may remove any officer with or without cause by the affirmative vote of a majority of the directors then in office.

SECTION 7. **Absence or Disability.** In the event of the absence or disability of any officer, the Board of Directors may designate another officer to act temporarily in place of such absent or disabled officer.

SECTION 8. **Vacancies.** Any vacancy in any office may be filled for the unexpired portion of the term by the Board of Directors.

SECTION 9. **President.** The President shall, subject to the direction of the Board of Directors, have such powers and shall perform such duties as the Board of Directors may from time to time designate.

SECTION 10. **Chairman of the Board.** The Chairman of the Board, if one is elected, shall have such powers and shall perform such duties as the Board of Directors may from time to time designate.

SECTION 11. **Chief Executive Officer.** The Chief Executive Officer, if one is elected, shall have such powers and shall perform such duties as the Board of Directors may from time to time designate.

SECTION 12. **Vice Presidents and Assistant Vice Presidents.** Any Vice President (including any Executive Vice President or Senior Vice President) and any Assistant Vice President shall have such powers and shall perform such duties as the Board of Directors or the Chief Executive Officer may from time to time designate.

SECTION 13. **Treasurer and Assistant Treasurers.** The Treasurer shall, subject to the direction of the Board of Directors and except as the Board of Directors or the Chief Executive Officer may otherwise provide, have general charge of the financial affairs of the Corporation and shall cause to be kept accurate books of account. The Treasurer shall have custody of all funds, securities, and valuable documents of the Corporation. He or she shall have such other duties and powers as may be designated from time to time by the Board of Directors or the Chief Executive Officer. Any Assistant Treasurer shall have such powers and perform such duties as the Board of Directors or the Chief Executive Officer may from time to time designate.

SECTION 14. **Secretary and Assistant Secretaries.** The Secretary shall record all the proceedings of the meetings of the stockholders and the Board of Directors (including committees of the Board of Directors) in books kept for that purpose. In his or her absence from any such meeting, a temporary secretary chosen at the meeting shall record the proceedings thereof. The Secretary shall have charge of the stock ledger (which may, however, be kept by any transfer or other agent of the Corporation). The Secretary shall have custody of the seal of the Corporation, and the Secretary, or an Assistant Secretary shall have authority to affix it to any instrument requiring it, and, when so affixed, the seal may be attested by his or her signature.
or that of an Assistant Secretary. The Secretary shall have such other duties and powers as may be designated from time to time by the Board of Directors or the Chief Executive Officer. In the absence of the Secretary, any Assistant Secretary may perform his or her duties and responsibilities. Any Assistant Secretary shall have such powers and perform such duties as the Board of Directors or the Chief Executive Officer may from time to time designate.

SECTION 15. Other Powers and Duties. Subject to these By-laws and to such limitations as the Board of Directors may from time to time prescribe, the officers of the Corporation shall each have such powers and duties as generally pertain to their respective offices, as well as such powers and duties as from time to time may be conferred by the Board of Directors or the Chief Executive Officer.

ARTICLE IV

Capital Stock

SECTION 1. Certificates of Stock. Each stockholder shall be entitled to a certificate of the capital stock of the Corporation in such form as may from time to time be prescribed by the Board of Directors. Such certificate shall be signed by any two authorized officers of the Corporation. The Corporation seal and the signatures by the Corporation’s officers, the transfer agent or the registrar may be facsimiles. In case any officer, transfer agent or registrar who has signed or whose facsimile signature has been placed on such certificate shall have ceased to be such officer, transfer agent or registrar before such certificate is issued, it may be issued by the Corporation with the same effect as if he or she were such officer, transfer agent or registrar at the time of its issue. Every certificate for shares of stock which are subject to any restriction on transfer and every certificate issued when the Corporation is authorized to issue more than one class or series of stock shall contain such legend with respect thereto as is required by law. Notwithstanding anything to the contrary provided in these By-laws, the Board of Directors of the Corporation may provide by resolution or resolutions that some or all of any or all classes or series of its stock shall be uncertificated shares (except that the foregoing shall not apply to shares represented by a certificate until such certificate is surrendered to the Corporation), and by the approval and adoption of these By-laws the Board of Directors has determined that all classes or series of the Corporation’s stock may be uncertificated, whether upon original issuance, re-issuance, or subsequent transfer.

SECTION 2. Transfers. Subject to any restrictions on transfer and unless otherwise provided by the Board of Directors, shares of stock that are represented by a certificate may be transferred on the books of the Corporation by the surrender to the Corporation or its transfer agent of the certificate theretofore properly endorsed or accompanied by a written assignment or power of attorney properly executed, with transfer stamps (if necessary) affixed, and with such proof of the authenticity of signature as the Corporation or its transfer agent may reasonably require. Shares of stock that are not represented by a certificate may be transferred on the books of the Corporation by submitting to the Corporation or its transfer agent such evidence of transfer and following such other procedures as the Corporation or its transfer agent may require.

SECTION 3. Record Holders. Except as may otherwise be required by law, by the Certificate or by these By-laws, the Corporation shall be entitled to treat the record holder of
stock as shown on its books as the owner of such stock for all purposes, including the payment of dividends and the right to vote with respect thereto, regardless of any transfer, pledge or other disposition of such stock, until the shares have been transferred on the books of the Corporation in accordance with the requirements of these By-laws.

SECTION 4. **Record Date.** In order that the Corporation may determine the stockholders entitled to notice of or to vote at any meeting of stockholders or any adjournment thereof or entitled to receive payment of any dividend or other distribution or allotment of any rights, or entitled to exercise any rights in respect of any change, conversion or exchange of stock or for the purpose of any other lawful action, the Board of Directors may fix a record date, which record date shall not precede the date upon which the resolution fixing the record date is adopted by the Board of Directors, and which record date: (a) in the case of determination of stockholders entitled to vote at any meeting of stockholders, shall, unless otherwise required by law, not be more than sixty (60) nor less than ten (10) days before the date of such meeting and (b) in the case of any other action, shall not be more than sixty (60) days prior to such other action. If no record date is fixed: (i) the record date for determining stockholders entitled to notice of or to vote at a meeting of stockholders shall be at the close of business on the day next preceding the day on which notice is given, or, if notice is waived, at the close of business on the day next preceding the day on which the meeting is held; and (ii) the record date for determining stockholders for any other purpose shall be at the close of business on the day on which the Board of Directors adopts the resolution relating thereto.

SECTION 5. **Replacement of Certificates.** In case of the alleged loss, destruction or mutilation of a certificate of stock of the Corporation, a duplicate certificate may be issued in place thereof, upon such terms as the Board of Directors may prescribe.

**ARTICLE V**

**Indemnification**

**SECTION 1. Definitions.** For purposes of this Article:

(a) “Corporate Status” describes the status of a person who is serving or has served (i) as a Director of the Corporation, (ii) as an Officer of the Corporation, (iii) as a Non-Officer Employee of the Corporation, or (iv) as a director, partner, trustee, officer, employee or agent of any other corporation, partnership, limited liability company, joint venture, trust, employee benefit plan, foundation, association, organization or other legal entity which such person is or was serving at the request of the Corporation. For purposes of this Section 1(a), a Director, Officer or Non-Officer Employee of the Corporation who is serving or has served as a director, partner, trustee, officer, employee or agent of a Subsidiary shall be deemed to be serving at the request of the Corporation. Notwithstanding the foregoing, “Corporate Status” shall not include the status of a person who is serving or has served as a director, officer, employee or agent of a constituent corporation absorbed in a merger or consolidation transaction with the Corporation with respect to such person’s activities prior to said transaction, unless specifically authorized by the Board of Directors or the stockholders of the Corporation;
(b) “Director” means any person who serves or has served the Corporation as a director on the Board of Directors of the Corporation;

(c) “Disinterested Director” means, with respect to each Proceeding in respect of which indemnification is sought hereunder, a Director of the Corporation who is not and was not a party to such Proceeding;

(d) “Expenses” means all attorneys’ fees, retainers, court costs, transcript costs, fees of expert witnesses, private investigators and professional advisors (including, without limitation, accountants and investment bankers), travel expenses, duplicating costs, printing and binding costs, costs of preparation of demonstrative evidence and other courtroom presentation aids and devices, costs incurred in connection with document review, organization, imaging and computerization, telephone charges, postage, delivery service fees, and all other disbursements, costs or expenses of the type customarily incurred in connection with prosecuting, defending, preparing to prosecute or defend, investigating, being or preparing to be a witness in, settling or otherwise participating in, a Proceeding;

(e) “Liabilities” means judgments, damages, liabilities, losses, penalties, excise taxes, fines and amounts paid in settlement;

(f) “Non-Officer Employee” means any person who serves or has served as an employee or agent of the Corporation, but who is not or was not a Director or Officer;

(g) “Officer” means any person who serves or has served the Corporation as an officer of the Corporation appointed by the Board of Directors of the Corporation;

(h) “Proceeding” means any threatened, pending or completed action, suit, arbitration, alternate dispute resolution mechanism, inquiry, investigation, administrative hearing or other proceeding, whether civil, criminal, administrative, arbitrative or investigative; and

(i) “Subsidiary” shall mean any corporation, partnership, limited liability company, joint venture, trust or other entity of which the Corporation owns (either directly or through or together with another Subsidiary of the Corporation) either (i) a general partner, managing member or other similar interest or (ii) (A) fifty percent (50%) or more of the voting power of the voting capital equity interests of such corporation, partnership, limited liability company, joint venture or other entity, or (B) fifty percent (50%) or more of the outstanding voting capital stock or other voting equity interests of such corporation, partnership, limited liability company, joint venture or other entity.
SECTION 2. Indemnification of Directors and Officers.

(a) Subject to the operation of Section 4 of this Article V of these By-laws, each Director and Officer shall be indemnified and held harmless by the Corporation to the fullest extent authorized by the DGCL, as the same exists or may hereafter be amended (but, in the case of any such amendment, only to the extent that such amendment permits the Corporation to provide broader indemnification rights than such law permitted the Corporation to provide prior to such amendment), and to the extent authorized in this Section 2.

(1) Actions, Suits and Proceedings Other than By or In the Right of the Corporation. Each Director and Officer shall be indemnified and held harmless by the Corporation against any and all Expenses and Liabilities that are incurred or paid by such Director or Officer or on such Director’s or Officer’s behalf in connection with any Proceeding or any claim, issue or matter therein (other than an action by or in the right of the Corporation), which such Director or Officer is, or is threatened to be made, a party to or participant in by reason of such Director’s or Officer’s Corporate Status, if such Director or Officer acted in good faith and in a manner such Director or Officer reasonably believed to be in or not opposed to the best interests of the Corporation and, with respect to any criminal proceeding, had no reasonable cause to believe his or her conduct was unlawful.

(2) Actions, Suits and Proceedings By or In the Right of the Corporation. Each Director and Officer shall be indemnified and held harmless by the Corporation against any and all Expenses that are incurred by such Director or Officer or on such Director’s or Officer’s behalf in connection with any Proceeding or any claim, issue or matter therein by or in the right of the Corporation, which such Director or Officer is, or is threatened to be made, a party to or participant in by reason of such Director’s or Officer’s Corporate Status, if such Director or Officer acted in good faith and in a manner such Director or Officer reasonably believed to be in or not opposed to the best interests of the Corporation; provided, however, that no indemnification shall be made under this Section 2(a)(2) in respect of any claim, issue or matter as to which such Director or Officer shall have been finally adjudged by a court of competent jurisdiction to be liable to the Corporation, unless, and only to the extent that, the Court of Chancery or another court in which such Proceeding was brought shall determine upon application that, despite adjudication of liability, but in view of all the circumstances of the case, such Director or Officer is fairly and reasonably entitled to indemnification for such Expenses that such court deems proper.

(3) Survival of Rights. The rights of indemnification provided by this Section 2 shall continue as to a Director or Officer after he or she has ceased to be a Director or Officer and shall inure to the benefit of his or her heirs, executors, administrators and personal representatives.

(4) Actions by Directors or Officers. Notwithstanding the foregoing, the Corporation shall indemnify and hold harmless any Director or Officer seeking indemnification in connection with a Proceeding initiated by such Director or Officer only if such Proceeding (including any parts of such Proceeding not initiated by such
SECTION 3. Indemnification of Non-Officer Employees. Subject to the operation of Section 4 of this Article V of these By-laws, each Non-Officer Employee may, in the discretion of the Board of Directors of the Corporation, be indemnified by the Corporation to the fullest extent authorized by the DGCL, as the same exists or may hereafter be amended, against any or all Expenses and Liabilities that are incurred by such Non-Officer Employee or on such Non-Officer Employee’s behalf in connection with any threatened, pending or completed Proceeding, or any claim, issue or matter therein, which such Non-Officer Employee is, or is threatened to be made, a party to or participant in by reason of such Non-Officer Employee’s Corporate Status, if such Non-Officer Employee acted in good faith and in a manner such Non-Officer Employee reasonably believed to be in or not opposed to the best interests of the Corporation and, with respect to any criminal proceeding, had no reasonable cause to believe his or her conduct was unlawful. The rights of indemnification provided by this Section 3 shall exist as to a Non-Officer Employee after he or she has ceased to be a Non-Officer Employee and shall inure to the benefit of his or her heirs, personal representatives, executors and administrators. Notwithstanding the foregoing, the Corporation may indemnify any Non-Officer Employee seeking indemnification in connection with a Proceeding initiated by such Non-Officer Employee only if such Proceeding was authorized in advance by the Board of Directors of the Corporation.

SECTION 4. Determination. Unless ordered by a court, no indemnification shall be provided pursuant to this Article V to a Director, to an Officer or to a Non-Officer Employee unless a determination shall have been made that such person acted in good faith and in a manner such person reasonably believed to be in or not opposed to the best interests of the Corporation and, with respect to any criminal Proceeding, such person had no reasonable cause to believe his or her conduct was unlawful. Such determination shall be made by (a) a majority vote of the Disinterested Directors, even though less than a quorum of the Board of Directors, (b) a committee comprised of Disinterested Directors, such committee having been designated by a majority vote of the Disinterested Directors (even though less than a quorum), (c) if there are no such Disinterested Directors, or if a majority of Disinterested Directors so directs, by independent legal counsel in a written opinion, or (d) by the stockholders of the Corporation.

SECTION 5. Advancement of Expenses to Directors Prior to Final Disposition.

(a) The Corporation shall advance all Expenses incurred by or on behalf of any Director in connection with any Proceeding in which such Director is involved by reason of such Director’s Corporate Status within thirty (30) days after the receipt by the Corporation of a written statement from such Director requesting such advance or advances from time to time, whether prior to or after final disposition of such Proceeding. Such statement or statements shall reasonably evidence the Expenses incurred by such Director and shall be preceded or accompanied by an undertaking by or on behalf of such Director to repay any Expenses so advanced if it shall ultimately be determined that such Director is not entitled to be indemnified against such Expenses. Notwithstanding the foregoing, the Corporation shall advance all
Expenses incurred by or on behalf of any Director seeking advancement of expenses hereunder in connection with a Proceeding initiated by such Director only if such Proceeding (including any parts of such Proceeding not initiated by such Director) was (i) authorized by the Board of Directors of the Corporation, or (ii) brought to enforce such Director’s rights to indemnification or advancement of Expenses under these By-laws.

(b) If a claim for advancement of Expenses hereunder by a Director is not paid in full by the Corporation within thirty (30) days after receipt by the Corporation of documentation of Expenses and the required undertaking, such Director may at any time thereafter bring suit against the Corporation to recover the unpaid amount of the claim and if successful in whole or in part, such Director shall also be entitled to be paid the expenses of prosecuting such claim. The failure of the Corporation (including its Board of Directors or any committee thereof, independent legal counsel, or stockholders) to make a determination concerning the permissibility of such advancement of Expenses under this Article V shall not be a defense to an action brought by a Director for recovery of the unpaid amount of an advancement claim and shall not create a presumption that such advancement is not permissible. The burden of proving that a Director is not entitled to an advancement of expenses shall be on the Corporation.

(c) In any suit brought by the Corporation to recover an advancement of expenses pursuant to the terms of an undertaking, the Corporation shall be entitled to recover such expenses upon a final adjudication that the Director has not met any applicable standard for indemnification set forth in the DGCL.

SECTION 6. Advancement of Expenses to Officers and Non-Officer Employees Prior to Final Disposition.

(a) The Corporation may, at the discretion of the Board of Directors of the Corporation, advance any or all Expenses incurred by or on behalf of any Officer or any Non-Officer Employee in connection with any Proceeding in which such person is involved by reason of his or her Corporate Status as an Officer or Non-Officer Employee upon the receipt by the Corporation of a statement or statements from such Officer or Non-Officer Employee requesting such advance or advances from time to time, whether prior to or after final disposition of such Proceeding. Such statement or statements shall reasonably evidence the Expenses incurred by such Officer or Non-Officer Employee and shall be preceded or accompanied by an undertaking by or on behalf of such person to repay any Expenses so advanced if it shall ultimately be determined that such Officer or Non-Officer Employee is not entitled to be indemnified against such Expenses.

(b) In any suit brought by the Corporation to recover an advancement of expenses pursuant to the terms of an undertaking, the Corporation shall be entitled to recover such expenses upon a final adjudication that the Officer or Non-Officer Employee has not met any applicable standard for indemnification set forth in the DGCL.


(a) The provisions of this Article V shall be deemed to be a contract between the Corporation and each Director and Officer entitled to the benefits hereof at any time while this
Article V is in effect, in consideration of such person’s past or current and any future performance of services for the Corporation. Neither amendment, repeal or modification of any provision of this Article V nor the adoption of any provision of the Certificate inconsistent with this Article V shall eliminate or reduce any right conferred by this Article V in respect of any act or omission occurring, or any cause of action or claim that accrues or arises or any state of facts existing, at the time of or before such amendment, repeal, modification or adoption of an inconsistent provision (even in the case of a proceeding based on such a state of facts that is commenced after such time), and all rights to indemnification and advancement of Expenses granted herein or arising out of any act or omission shall vest at the time of the act or omission in question, regardless of when or if any proceeding with respect to such act or omission is commenced. The rights to indemnification and to advancement of expenses provided by, or granted pursuant to, this Article V shall continue notwithstanding that the person has ceased to be a Director or Officer of the Corporation and shall inure to the benefit of the estate, heirs, executors, administrators, legatees and distributes of such person.

(b) If a claim for indemnification hereunder by a Director or Officer is not paid in full by the Corporation within sixty (60) days after receipt by the Corporation of a written claim for indemnification, such Director or Officer may at any time thereafter bring suit against the Corporation to recover the unpaid amount of the claim, and if successful in whole or in part, such Director or Officer shall also be entitled to be paid the expenses of prosecuting such claim. The failure of the Corporation (including its Board of Directors or any committee thereof, independent legal counsel, or stockholders) to make a determination concerning the permissibility of such indemnification under this Article V shall not be a defense to an action brought by a Director or Officer for recovery of the unpaid amount of an indemnification claim and shall not create a presumption that such indemnification is not permissible. The burden of proving that a Director or Officer is not entitled to indemnification shall be on the Corporation.

(c) In any suit brought by a Director or Officer to enforce a right to indemnification hereunder, it shall be a defense that such Director or Officer has not met any applicable standard for indemnification set forth in the DGCL.

SECTION 8. Non-Exclusivity of Rights. The rights to indemnification and to advancement of Expenses set forth in this Article V shall not be exclusive of any other right which any Director, Officer, or Non-Officer Employee may have or hereafter acquire under any statute, provision of the Certificate or these By-laws, agreement, vote of stockholders or Disinterested Directors or otherwise.

SECTION 9. Insurance. The Corporation may maintain insurance, at its expense, to protect itself and any Director, Officer or Non-Officer Employee against any liability of any character asserted against or incurred by the Corporation or any such Director, Officer or Non-Officer Employee, or arising out of any such person’s Corporate Status, whether or not the Corporation would have the power to indemnify such person against such liability under the DGCL or the provisions of this Article V.

SECTION 10. Other Indemnification. The Corporation’s obligation, if any, to indemnify or provide advancement of Expenses to any person under this Article V as a result of such person serving, at the request of the Corporation, as a director, partner, trustee, officer, employee or
agent of another corporation, partnership, joint venture, trust, employee benefit plan or other enterprise shall be reduced by any amount such person may collect as indemnification or advancement of Expenses from such other corporation, partnership, joint venture, trust, employee benefit plan or enterprise (the “Primary Indemnitor”). Any indemnification or advancement of Expenses under this Article V owed by the Corporation as a result of a person serving, at the request of the Corporation, as a director, partner, trustee, officer, employee or agent of another corporation, partnership, joint venture, trust, employee benefit plan or other enterprise shall only be in excess of, and shall be secondary to, the indemnification or advancement of Expenses available from the applicable Primary Indemnitor(s) and any applicable insurance policies.

ARTICLE VI

Miscellaneous Provisions

SECTION 1. Fiscal Year. The fiscal year of the Corporation shall be determined by the Board of Directors.

SECTION 2. Seal. The Board of Directors shall have power to adopt and alter the seal of the Corporation.

SECTION 3. Execution of Instruments. All deeds, leases, transfers, contracts, bonds, notes and other obligations to be entered into by the Corporation in the ordinary course of its business without director action may be executed on behalf of the Corporation by the Chairman of the Board, if one is elected, the President or the Treasurer or any other officer, employee or agent of the Corporation as the Board of Directors or the executive committee of the Board may authorize.

SECTION 4. Voting of Securities. Unless the Board of Directors otherwise provides, the Chairman of the Board, if one is elected, the President or the Treasurer may waive notice of and act on behalf of the Corporation (including with regard to voting and actions by written consent), or appoint another person or persons to act as proxy or attorney in fact for the Corporation with or without discretionary power and/or power of substitution, at any meeting of stockholders or shareholders of any other corporation or organization, any of whose securities are held by the Corporation.

SECTION 5. Resident Agent. The Board of Directors may appoint a resident agent upon whom legal process may be served in any action or proceeding against the Corporation.

SECTION 6. Corporate Records. The original or attested copies of the Certificate, By-laws and records of all meetings of the incorporators, stockholders and the Board of Directors and the stock transfer books, which shall contain the names of all stockholders, their record addresses and the amount of stock held by each, may be kept outside the State of Delaware and shall be kept at the principal office of the Corporation, at an office of its counsel, at an office of its transfer agent or at such other place or places as may be designated from time to time by the Board of Directors.
SECTION 7. Certificate. All references in these By-laws to the Certificate shall be deemed to refer to the Amended and Restated Certificate of Incorporation of the Corporation, as amended and/or restated and in effect from time to time.

SECTION 8. Exclusive Jurisdiction of Delaware Courts and the United States District Court for the District of Massachusetts for Certain Claims. Unless the Corporation consents in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware shall be the sole and exclusive forum for state law claims for (i) any derivative action or proceeding brought on behalf of the Corporation, (ii) any action asserting a claim of breach of or based on a fiduciary duty owed by any current or former director, officer or other employee of the Corporation to the Corporation or the Corporation's stockholders, (iii) any action asserting a claim against the Corporation or any current or former director, officer or other employee or stockholder of the Corporation arising pursuant to any provision of the DGCL or the Certificate or these By-laws, or (iv) any action asserting a claim against the Corporation or any current or former director or officer or other employee of the Corporation governed by the internal affairs doctrine. Unless the Corporation consents in writing to the selection of an alternative forum, the United States District Court for the District of Massachusetts shall be the sole and exclusive forum for resolving any complaint asserting a cause of action arising under the Securities Act of 1933, as amended. Any person or entity purchasing or otherwise acquiring any interest in shares of capital stock of the Corporation shall be deemed to have notice of and consented to the provisions of this Section 8.

SECTION 9. Amendment of By-laws.
(a) Amendment by Directors. Except as provided otherwise by law, these By-laws may be amended or repealed by the Board of Directors by the affirmative vote of a majority of the directors then in office.

(b) Amendment by Stockholders. Except as otherwise required by these By-laws or by law, these By-laws may be amended or repealed at any Annual Meeting, or special meeting of stockholders called for such purpose in accordance with these By-Laws, by the affirmative vote of a majority of the outstanding shares entitled to vote on such amendment or repeal, voting together as a single class. Notwithstanding the foregoing, stockholder approval shall not be required unless mandated by the Certificate, these By-laws, or other applicable law.

SECTION 10. Notices. If mailed, notice to stockholders shall be deemed given when deposited in the mail, postage prepaid, directed to the stockholder at such stockholder's address as it appears on the records of the Corporation. Without limiting the manner by which notice otherwise may be given to stockholders, any notice to stockholders may be given by electronic transmission in the manner provided in Section 232 of the DGCL.

SECTION 11. Waivers. A written waiver of any notice, signed by a stockholder or director, or waiver by electronic transmission by such person, whether given before or after the time of the event for which notice is to be given, shall be deemed equivalent to the notice required to be given to such person. Neither the business to be transacted at, nor the purpose of, any meeting need be specified in such a waiver.

The following abbreviations, when used in the inscription on the face of this certificate, shall be construed as though they were written out in full according to applicable laws or regulations:

- TEN COM - as tenants in common
- TEN ENT - as tenants by the entirety
- J T TEN - joint tenants with right of survivorship and not as tenants in common
- UNIF GIFT MIN - under Uniform Gifts to Minors Act
- UNIF TRF MIN - under Uniform Transfers to Minors Act
- Custodian - custodian (not an age)
- Trustee (not an age)

Additional abbreviations may also be used through out the above list.

For value received___________ hereby sell, assign and transfer units

PLEASE PRINT OR TYPE ALL WRITING, INCLUDING NAME, TITLE, ADDRESS, ETC.

Share

of the common stock represented by the within Certificate, and do hereby irrevocably constitute and appoint
Attorney

in transfer the said stock on the books of the within-named Company with full power of substitution in the premises.

Date:__________

Signature:

Notice: The signature to this assignment must correspond with the name as written upon the face of the certificate, in every particular, without alteration or enlargement, or in any change whatever.

The XEd require that the signed transfer agent and transfer the shares or units. If you did not specify a specific number of shares, the shares or units will be transferred to the appropriate entity. If you did not specify a specific number of shares, or if you did not specify a specific number of units, you will be billed the appropriate amount. If the share amount is not specified, the shares or units will be transferred to the appropriate entity. The shares or units will be transferred to the appropriate entity.

If you do not keep in contact with the issuer or do not have any change in your account for the time period covered by this transfer, please contact the issuer or your broker. The shares or units will be transferred to the appropriate entity. If you do not keep in contact with the issuer or do not have any change in your account for the time period covered by this transfer, please contact the issuer or your broker. The shares or units will be transferred to the appropriate entity.
MODERNA THERAPEUTICS, INC.
SECOND AMENDED AND RESTATED INVESTORS' RIGHTS AGREEMENT

THIS SECOND AMENDED AND RESTATED INVESTORS’ RIGHTS AGREEMENT (this “Agreement”) is made as of the 7th day of May, 2018, by and among Moderna Therapeutics, Inc., a Delaware corporation (the “Company”), and each of the investors listed on Schedule A hereto together with any subsequent transferees who become parties hereto as “Investors” pursuant to Section 6.1 and any subsequent purchasers of Preferred Stock who become parties hereto as “Investors” pursuant to Section 6.9 below, each of which is referred to in this Agreement as an “Investor”.

RECITALS

WHEREAS, the Company and certain of the Investors are parties to the Series H Preferred Stock Purchase Agreement dated as of April 17, 2018 (the “Purchase Agreement”);

WHEREAS, the Company and certain Investors have previously entered into that certain Amended and Restated Investors’ Rights Agreement dated as of January 31, 2018, as amended (the “Prior Agreement”);

WHEREAS, the parties hereto constitute the requisite parties to amend and restate the Prior Agreement, pursuant to Section 6.6 thereof; and

WHEREAS, to induce certain Investors to enter into the Purchase Agreement and purchase shares of Series H Preferred Stock thereunder, the Company and the other Investors desire to amend and restate the Prior Agreement and to accept the rights and obligations created pursuant hereto in lieu of the rights and obligations created under the Prior Agreement.

NOW, THEREFORE, the parties hereby agree as follows:

1. Definitions. For purposes of this Agreement:

1.1 “Advisory Investor” means any Investor (i) who, directly or indirectly, is advised by an investment advisor registered under the Investment Advisers Act of 1940, as amended, or similar requirements or restrictions under the laws of foreign jurisdictions (an “Investment Advisor”) and (ii) who holds at least 1,000,000 shares of Registrable Securities.

1.2 “Affiliate” means, with respect to any specified Person, any other Person who, directly or indirectly, controls, is controlled by, or is under common control with such Person, including, without limitation, any general partner, managing member, officer or director of such Person or any venture capital or other investment fund now or hereafter existing that is controlled by one or more general partners or managing members of, or shares the same management company or investment advisor with such Person. Without limiting the foregoing, (i) Flagship Ventures Fund IV, L.P., Flagship Ventures Fund IV-Rx, L.P., and Flagship Ventures Management, Inc. shall be deemed Affiliates of one another for purposes hereof, (ii) Stéphane Bancel, OCHA LLC, and Boston Biotech Ventures LLC shall be deemed Affiliates of one another for purposes hereof, (iii) TAS Partners, LLC and Leukon Investments, LP shall be deemed Affiliates of one another for purposes hereof, and (iv) Robert Langer, Michael D. Langer Irrevocable Trust u/d/t dated 12/14/95, Susan K. Langer Irrevocable Trust u/d/t dated 12/14/95, and Samuel A. Langer Irrevocable Trust u/d/t dated 12/14/95 shall be deemed Affiliates of one another for purposes hereof.

1.4 “Common Stock” means shares of the Company’s common stock, par value $0.0001 per share.

1.5 “Convertible Securities” means any evidences of indebtedness, shares or other securities directly or indirectly convertible into or exchangeable for Common Stock, including Preferred Stock, but excluding Options.

1.6 “Damages” means any loss, damage, claim or liability (joint or several) to which a party hereto may become subject under the Securities Act, the Exchange Act, or other federal or state law, insofar as such loss, damage, claim or liability (or any action in respect thereof) arises out of or is based upon (i) any untrue statement or alleged untrue statement of a material fact contained in any registration statement of the Company, including any preliminary prospectus or final prospectus contained therein or any amendments or supplements thereto; (ii) an omission or alleged omission to state therein a material fact required to be stated therein, or necessary to make the statements therein not misleading; or (iii) any violation or alleged violation by the indemnifying party (or any of its agents or Affiliates) of the Securities Act, the Exchange Act, any state securities law, or any rule or regulation promulgated under the Securities Act, the Exchange Act, or any state securities law.

1.7 “Derivative Securities” means any securities or rights convertible into, or exercisable or exchangeable for (in each case, directly or indirectly), Common Stock, including options and warrants.


1.9 “Excluded Registration” means (i) a registration relating to the sale of securities to employees of the Company or a subsidiary pursuant to a stock option, stock purchase, or similar plan; (ii) a registration relating to an SEC Rule 145 transaction; (iii) a registration on any form that does not include substantially the same information as would be required to be included in a registration statement covering the sale of the Registrable Securities; or (iv) a registration in which the only Common Stock being registered is Common Stock issuable upon conversion of debt securities that are also being registered.

1.10 “Fidelity” means Fidelity Management and Research Company and any successor or affiliated registered investment advisor to the Fidelity Investors.

1.11 “Fidelity Investor” means each Investor advised or subadvised by Fidelity or one of its Affiliates.
1.12 “Form S-1” means such form under the Securities Act as in effect on the date hereof or any successor registration form under the Securities Act subsequently adopted by the SEC.

1.13 “Form S-3” means such form under the Securities Act as in effect on the date hereof or any registration form under the Securities Act subsequently adopted by the SEC that permits incorporation of substantial information by reference to other documents filed by the Company with the SEC.

1.14 “GAAP” means generally accepted accounting principles in the United States.

1.15 “Holder” means any holder of Registrable Securities who is a party to this Agreement.

1.16 “Immediate Family Member” means a child, stepchild, grandchild, parent, stepparent, grandparent, spouse, sibling, mother-in-law, father-in-law, son-in-law, daughter-in-law, brother-in-law, or sister-in-law, including adoptive relationships, of a natural person referred to herein.

1.17 “Initiating Holders” means, collectively, Holders who properly initiate a registration request under this Agreement.

1.18 “Investor Director” has the meaning ascribed to such term in the Amended and Restated Voting Agreement, dated on or about the date hereof, by and among the Company and the stockholders of the Company listed therein.

1.19 “IPO” means the Company’s first underwritten public offering of its Common Stock under the Securities Act.

1.20 “Key Employee” means any executive-level employee (including division director and vice president-level positions) as well as any employee who, either alone or in concert with others, develops, invents, programs, or designs any Company Intellectual Property (as defined in the Purchase Agreement).

1.21 “Major Investor” means (a) any Investor that, individually or together with such Investor’s Affiliates, holds at least 5,000,000 shares of Registrable Securities (as adjusted for any stock split, stock dividend, combination, or other recapitalization or reclassification effected after the date hereof), (b) Zeneca Inc. and such Affiliates (“AZ”), for so long as AZ holds at least 5,000,000 shares of Registrable Securities (as adjusted for any stock split, stock dividend, combination, or other recapitalization or reclassification effected after the date hereof), (c) the Fidelity Investors, for so long as the Fidelity Investors collectively hold at least 5,000,000 shares of Registrable Securities (as adjusted for any stock split, stock dividend, combination, or other recapitalization or reclassification effected after the date hereof) and (d) Alexion Pharmaceuticals, Inc. for so long as Alexion Pharmaceuticals, Inc. holds at least 5,000,000 shares of Registrable Securities (as adjusted for any stock split, stock dividend, combination, or other recapitalization or reclassification effected after the date hereof); provided, however, notwithstanding the foregoing, the Company shall continue to provide the materials under
Section 3.1(a) and (b) to each Fidelity Investor for so long as such Fidelity Investor holds shares of Registrable Securities, subject to the Company’s right to redact or withhold certain information in accordance with Section 3.1. For the avoidance of doubt, for purposes of Sections 3.1 and 3.2, AZ shall not be considered to be a competitor of the Company so long as the Option Agreement, dated March 20, 2013, between AstraZeneca AB and ModernaTX, Inc. is in effect; Merck Sharp & Dohme Corp. ("Merck") shall not be considered to be a competitor for the Company so long as the Amended and Restated mRNA Cancer Vaccine Collaboration and License Agreement, dated April 17, 2018, between Merck and ModernaTX, Inc. is in effect; and Vertex Pharmaceuticals (Europe) Limited and Vertex Pharmaceuticals Incorporated (collectively, "Vertex") shall not be considered to be competitors of the Company for so long as the Strategic Collaboration and License Agreement, dated July 1, 2016, between Vertex and ModernaTX, Inc. is in effect. Notwithstanding the foregoing, only Registrable Securities that have been sold by the Company or any predecessor of the Company to the Investor, or are issuable upon conversion or exchange of securities that have been sold by the Company or any predecessor of the Company to the Investor, will be counted towards the thresholds required for a "Major Investor."

1.22 "New Securities" means, collectively, equity securities of the Company, whether or not currently authorized, as well as rights, options, or warrants to purchase such equity securities, or securities of any type whatsoever that are, or may become, convertible or exchangeable into or exercisable for such equity securities.

1.23 "Option" means rights, options or warrants to subscribe for, purchase or otherwise acquire Common Stock or Convertible Securities.

1.24 Participation Agreement means that certain (i) Amended and Restated Participation Agreement by and between the Moderna LLC, Zeneca Inc. and AstraZeneca PLC dated as of August 10, 2016, (ii) Participation Agreement by and between the Moderna LLC and Alexion Pharmaceuticals, Inc. dated as of January 13, 2014, (iii) Amended and Restated Agreement by and between the Company and Merck dated as of May 7, 2018, and (iv) Agreement by and between Moderna Therapeutics, Inc. and Vertex Pharmaceuticals (Europe) Limited dated as of August 10, 2016, in each case, as any such agreements were originally executed and as the same have been or may be amended and/or restated in accordance with their respective terms.

1.25 "Person" means any individual, corporation, partnership, trust, limited liability company, association or other entity.

1.26 Preferred Stock means the Series A Preferred Stock, the Series B Preferred Stock, the Series C Preferred Stock, the Series D Preferred Stock, the Series E Preferred Stock, the Series F Preferred Stock, the Series G Preferred Stock, and the Series H Preferred Stock.

1.27 Registrable Securities means (i) any Common Stock issuable or issued upon conversion of the Preferred Stock, (ii) any Common Stock, or any Common Stock issued or issuable (directly or indirectly) upon conversion and/or exercise of any other securities of the Company held by the Investors and (iii) any Common Stock issued as (or issuable upon the
conversion or exercise of any warrant, right, or other security that is issued as a dividend or other distribution with respect to, or in exchange for or in replacement of, the shares referenced in clauses (i) and (ii) above; excluding in all cases, however, any Registrable Securities sold by a Person in a transaction in which the applicable rights under this Agreement are not assigned pursuant to Section 6.1; and excluding for purposes of Section 2 any shares for which registration rights have terminated pursuant to Section 2.13 of this Agreement.

1.28 “Registrable Securities then outstanding” means the number of shares determined by adding the number of shares of outstanding Common Stock that are Registrable Securities and the number of shares of Common Stock issuable (directly or indirectly) pursuant to then exercisable and/or convertible securities that are Registrable Securities.

1.29 “Requisite Vote” has the meaning assigned to it in the Second Amended and Restated Certificate of Incorporation of the Company.

1.30 “Restricted Securities” means the securities of the Company required to bear the legend set forth in Section 2.12(b) hereof.

1.31 “SEC” means the Securities and Exchange Commission.

1.32 “SEC Rule 144” means Rule 144 promulgated by the SEC under the Securities Act.

1.33 “SEC Rule 145” means Rule 145 promulgated by the SEC under the Securities Act.

1.34 “Securities Act” means the Securities Act of 1933, as amended, and the rules and regulations promulgated thereunder.

1.35 “Selling Expenses” means all underwriting discounts, selling commissions, and stock transfer taxes applicable to the sale of Registrable Securities, and fees and disbursements of counsel for any Holder, except for the fees and disbursements of the Selling Holder Counsel borne and paid by the Company as provided in Section 2.6.

1.36 “Series A Preferred Stock” means shares of the Company’s Series A Preferred Stock, par value $0.0001 per share.

1.37 “Series B Preferred Stock” means shares of the Company’s Series B Preferred Stock, par value $0.0001 per share.

1.38 “Series C Preferred Stock” means shares of the Company’s Series C Preferred Stock, par value $0.0001 per share.

1.39 “Series D Preferred Stock” means shares of the Company’s Series D Preferred Stock, par value $0.0001 per share.

1.40 “Series E Preferred Stock” means shares of the Company’s Series E Preferred Stock, par value $0.0001 per share.

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1.41 “Series F Preferred Stock” means shares of the Company’s Series F Preferred Stock, par value $0.0001 per share.

1.42 “Series G Preferred Stock” means shares of the Company’s Series G Preferred Stock, par value $0.0001 per share.

1.43 “Series H Preferred Stock” means shares of the Company’s Series H Preferred Stock, par value $0.0001 per share.

2. Registration Rights. The Company covenants and agrees as follows:

2.1 Demand Registration.

(a) Form S-1 Demand. If at any time after one hundred eighty (180) days after the effective date of the registration statement for the IPO, the Company receives a request from Holders of a majority of the Registrable Securities then outstanding, or from AZ, that the Company file a Form S-1 registration statement with respect to Registrable Securities then outstanding having an anticipated aggregate offering price of at least $5,000,000, then the Company shall (i) within ten (10) days after the date such request is given, give notice thereof (the “Demand Notice”) to all Holders other than the Initiating Holders; and (ii) as soon as practicable, and in any event within sixty (60) days after the date such request is given by the Initiating Holders, file a Form S-1 registration statement under the Securities Act covering all Registrable Securities that the Initiating Holders requested to be registered and any additional Registrable Securities requested to be included in such registration by any other Holders, as specified by notice given by each such Holder to the Company within twenty (20) days after the date the Demand Notice is given, and in each case, subject to the limitations of Section 2.1(c) and Section 2.3.

(b) Form S-3 Demand. If at any time when it is eligible to use a Form S-3 registration statement, the Company receives a request from Holders of at least twenty percent (20%) of the Registrable Securities then outstanding that the Company file a Form S-3 registration statement with respect to outstanding Registrable Securities of such Holders having an anticipated aggregate offering price, net of Selling Expenses, of at least $2,500,000, then the Company shall (i) within ten (10) days after the date such request is given, give a Demand Notice to all Holders other than the Initiating Holders; and (ii) as soon as practicable, and in any event within forty-five (45) days after the date such request is given by the Initiating Holders, file a Form S-3 registration statement under the Securities Act covering all Registrable Securities requested to be included in such registration by any other Holders, as specified by notice given by each such Holder to the Company within twenty (20) days after the date the Demand Notice is given, and in each case, subject to the limitations of Section 2.1(c) and Section 2.3.

(c) Notwithstanding the foregoing obligations, if the Company furnishes to Holders requesting a registration pursuant to this Section 2.1 a certificate signed by the Company’s chief executive officer or other most senior executive officer stating that in the good faith judgment of the Company’s Board it would be materially detrimental to the Company and its stockholders for such registration statement to either become effective or remain effective for as long as such registration statement otherwise would be required to remain effective,
because such action would (i) materially interfere with a significant acquisition, corporate reorganization, or other similar transaction involving the Company; (ii) require premature disclosure of material information that the Company has a bona fide business purpose for preserving as confidential; or (iii) render the Company unable to comply with requirements under the Securities Act or Exchange Act, then the Company shall have the right to defer taking action with respect to such filing, and any time periods with respect to filing or effectiveness thereof shall be tolled correspondingly, for a period of not more than one hundred twenty (120) days after the request of the Initiating Holders is given; provided, however, that the Company may not invoke this right more than once in any twelve (12) month period (unless invoked with respect to any demand made by AZ pursuant to Section 2.1 within the same twelve (12) month period); and provided further that the Company shall not register any securities for its own account or that of any other stockholder during such one hundred twenty (120) day period other than an Excluded Registration.

(d) The Company shall not be obligated to effect, or to take any action to effect, any registration pursuant to Section 2.1(a) (i) during the period that is sixty (60) days before the Company’s good faith estimate of the date of filing of, and ending on a date that is one hundred eighty (180) days after the effective date of, a Company-initiated registration; provided, that the Company is actively employing in good faith commercially reasonable efforts to cause such registration statement to become effective; (ii) after the Company has effected two registrations pursuant to Section 2.1(a) with respect to Initiating Holders other than AZ; (iii) after the Company has effected one (1) registration pursuant to Section 2.1(a) that was initiated by AZ; or (iv) if the Initiating Holders propose to dispose of shares of Registrable Securities that may be immediately registered on Form S-3 pursuant to a request made pursuant to Section 2.1(b). The Company shall not be obligated to effect, or to take any action to effect, any registration pursuant to Section 2.1(b) during the period that is thirty (30) days before the Company’s good faith estimate of the date of filing of, and ending on a date that is ninety (90) days after the effective date of, a Company-initiated registration; provided that, the Company is actively employing in good faith commercially reasonable efforts to cause such registration statement to become effective; or if the Company has effected two registrations pursuant to Section 2.1(b) within the twelve (12) month period immediately preceding the date of such request. A registration shall not be counted as “effected” for purposes of this Section 2.1(d) until such time as the applicable registration statement has been declared effective by the SEC, unless the Initiating Holders withdraw their request for such registration, elect not to pay the registration expenses therefor, and forfeit their right to one demand registration statement pursuant to Section 2.6, in which case such withdrawn registration statement shall be counted as “effected” for purposes of this Section 2.1(d).

2.2 Company Registration. If the Company proposes to register (including, for this purpose, a registration effected by the Company for stockholders other than the Holders) any of its Common Stock under the Securities Act in connection with the public offering of such securities solely for cash (other than in an Excluded Registration), the Company shall, at such time, promptly give each Holder notice of such registration. Upon the request of each Holder given within twenty (20) days after such notice is given by the Company, the Company shall, subject to the provisions of Section 2.3, cause to be registered all of the Registrable Securities that each such Holder has requested to be included in such registration. The Company shall have the right to terminate or withdraw any registration initiated by it under this Section 2.2 before the effective date of such registration, whether or not any Holder has elected to include Registrable Securities in such registration. The expenses (other than Selling Expenses) of such withdrawn registration shall be borne by the Company in accordance with Section 2.6.
2.3 Underwriting Requirements

(a) If, pursuant to Section 2.1, the Initiating Holders intend to distribute the Registrable Securities covered by their request by means of an underwriting, they shall so advise the Company as a part of their request made pursuant to Section 2.1, and the Company shall include such information in the Demand Notice. The underwriter(s) will be selected by the Company and shall be reasonably acceptable to a majority in interest of the Initiating Holders (or in the case of any demand made by AZ pursuant to Section 2.1(a), reasonably acceptable to AZ). In such event, the right of any Holder to include such Holder’s Registrable Securities in such registration shall be conditioned upon such Holder’s participation in such underwriting and the inclusion of such Holder’s Registrable Securities in the underwriting to the extent provided herein. All Holders proposing to distribute their securities through such underwriting shall (together with the Company as provided in Section 2.4(e)) enter into an underwriting agreement in customary form with the underwriter(s) selected for such underwriting. Notwithstanding any other provision of this Section 2.3, if the managing underwriter(s) advise(s) the Initiating Holders in writing that marketing factors require a limitation on the number of shares to be underwritten, then the Initiating Holders shall so advise all Holders of Registrable Securities that otherwise would be underwritten pursuant hereto, and the number of Registrable Securities that may be included in the underwriting shall be allocated among such Holders of Registrable Securities, including the Initiating Holders, in proportion (as nearly as practicable) to the number of Registrable Securities owned by each Holder or in such other proportion as shall mutually be agreed to by all such selling Holders; provided, however, that the number of Registrable Securities held by the Holders to be included in such underwriting shall not be reduced unless all other securities of the Company are first entirely excluded from the underwriting. To facilitate the allocation of shares in accordance with the above provisions, the Company or the underwriters may round the number of shares allocated to any Holder to the nearest 100 shares.

(b) In connection with any offering involving an underwriting of shares of the Company’s capital stock pursuant to Section 2.2, the Company shall not be required to include any of the Holders’ Registrable Securities in such underwriting unless the Holders accept the terms of the underwriting as agreed upon between the Company and its underwriters, and then only in such quantity as the underwriters in their sole discretion determine will not jeopardize the success of the offering by the Company. If the total number of securities, including Registrable Securities, requested by stockholders to be included in such offering exceeds the number of securities to be sold (other than by the Company) that the underwriters in their reasonable discretion determine is compatible with the success of the offering, then the Company shall be required to include in the offering only that number of such securities, including Registrable Securities, which the underwriters and the Company in their sole discretion determine will not jeopardize the success of the offering. If the underwriters determine that less than all of the Registrable Securities requested to be registered can be included in such offering, then the Registrable Securities that are included in such offering shall be allocated among the selling Holders in proportion (as nearly as practicable to) the number of Registrable Securities
owned by each selling Holder or in such other proportions as shall mutually be agreed to by all such selling Holders. To facilitate the allocation of shares in accordance with the above provisions, the Company or the underwriters may round the number of shares allocated to any Holder to the nearest one hundred (100) shares. Notwithstanding the foregoing, in no event shall (i) the number of Registrable Securities included in the offering be reduced unless all other securities (other than securities to be sold by the Company) are first entirely excluded from the offering or (ii) the number of Registrable Securities included in the offering be reduced below thirty percent (30%) of the total number of securities included in such offering, unless such offering is the IPO, in which case the selling Holders may be excluded further if the underwriters make the determination described above and no other stockholder’s securities are included in such offering. For purposes of the provisions in Section 2.3(a) and this Section 2.3(b) concerning apportionment, for any selling Holder that is a partnership, limited liability company, or corporation, the partners, members, retired partners, retired members, stockholders, and Affiliates of such Holder, or the estates and Immediate Family Members of any such partners, retired partners, members, and retired members and any trusts for the benefit of any of the foregoing Persons, shall be deemed to be a single “selling Holder,” and any pro rata reduction with respect to such “selling Holder” shall be based upon the aggregate number of Registrable Securities owned by all Persons included in such “selling Holder,” as defined in this sentence.

(c) For purposes of Section 2.1, a registration shall not be counted as “effected” if, as a result of an exercise of the underwriter’s cutback provisions in Section 2.3(a), fewer than fifty percent (50%) of the total number of Registrable Securities that Holders have requested to be included in such registration statement are actually included.

2.4 Obligations of the Company. Whenever required under this Section 2 to effect the registration of any Registrable Securities, the Company shall, as expeditiously as reasonably possible:

(a) prepare and file with the SEC a registration statement with respect to such Registrable Securities and use its commercially reasonable efforts to cause such registration statement to become effective and, upon the request of the Holders of a majority of the Registrable Securities registered thereunder (or in the case of any demand made by AZ pursuant to Section 2.1(a), upon the request of AZ), keep such registration statement effective for a period of up to one hundred twenty (120) days or, if earlier, until the distribution contemplated in the registration statement has been completed; provided, however, that (i) such one hundred twenty (120) day period shall be extended for a period of time equal to the period the Holder refrains, at the request of an underwriter of Common Stock (or other securities) of the Company, from selling any securities included in such registration, and (ii) in the case of any registration of Registrable Securities on Form S-3 that are intended to be offered on a continuous or delayed basis, subject to compliance with applicable SEC rules, such one hundred twenty (120) day period shall be extended for up to sixty (60) days, if necessary, to keep the registration statement effective until all such Registrable Securities are sold;

(b) prepare and file with the SEC such amendments and supplements to such registration statement, and the prospectus used in connection with such registration statement, as may be necessary to comply with the Securities Act in order to enable the disposition of all securities covered by such registration statement;
(c) furnish to the selling Holders such numbers of copies of a prospectus, including a preliminary prospectus, as required by the Securities Act, and such other documents as the Holders may reasonably request in order to facilitate their disposition of their Registrable Securities;

(d) use its commercially reasonable efforts to register and qualify the securities covered by such registration statement under such other securities or blue-sky laws of such jurisdictions as shall be reasonably requested by the selling Holders; provided, that the Company shall not be required to qualify to do business or to file a general consent to service of process in any such states or jurisdictions, unless the Company is already subject to service in such jurisdiction and except as may be required by the Securities Act;

(e) in the event of any underwritten public offering, enter into and perform its obligations under an underwriting agreement, in usual and customary form, with the underwriter(s) of such offering;

(f) use its commercially reasonable efforts to cause all such Registrable Securities covered by such registration statement to be listed on a national securities exchange or trading system and each securities exchange and trading system (if any) on which similar securities issued by the Company are then listed;

(g) provide a transfer agent and registrar for all Registrable Securities registered pursuant to this Agreement and provide a CUSIP number for all such Registrable Securities, in each case not later than the effective date of such registration;

(h) promptly make available for inspection by the selling Holders, any managing underwriter(s) participating in any disposition pursuant to such registration statement, and any attorney or accountant or other agent retained by any such underwriter or selected by the selling Holders, all financial and other records, pertinent corporate documents, and properties of the Company, and cause the Company’s officers, directors, employees, and independent accountants to supply all information reasonably requested by any such seller, underwriter, attorney, accountant, or agent, in each case, as necessary or advisable to verify the accuracy of the information in such registration statement and to conduct appropriate due diligence in connection therewith;

(i) notify each selling Holder, promptly after the Company receives notice thereof, of the time when such registration statement has been declared effective or a supplement to any prospectus forming a part of such registration statement has been filed; and

(j) after such registration statement becomes effective, notify each selling Holder of any request by the SEC that the Company amend or supplement such registration statement or prospectus.

2.5 Furnish Information. It shall be a condition precedent to the obligations of the Company to take any action pursuant to this Section 2 with respect to the Registrable Securities of any selling Holder that such Holder shall furnish to the Company such information regarding itself, the Registrable Securities held by it, and the intended method of disposition of such securities as is reasonably required to effect the registration of such Holder’s Registrable Securities.
2.6 Expenses of Registration. All expenses (other than Selling Expenses) incurred in connection with registrations, filings, or qualifications pursuant to Section 2, including all registration, filing, and qualification fees; printers’ and accounting fees; fees and disbursements of counsel for the Company; and the reasonable fees and disbursements, not to exceed $25,000, of one counsel for the selling Holders (“Selling Holder Counsel”), shall be borne and paid by the Company; provided, however, that the Company shall not be required to pay for any expenses of any registration proceeding begun pursuant to Section 2.1 if the registration request is subsequently withdrawn at the request of the Holders of a majority of the Registrable Securities, or in the case of any demand made by AZ pursuant to Section 2.1(a), at the request of AZ, to be registered (in which case all selling Holders shall bear such expenses pro rata based upon the number of Registrable Securities that were to be included in the withdrawn registration), unless the Holders of a majority of the Registrable Securities agree to forfeit their right to one registration pursuant to Section 2.1(a) or Section 2.1(b), as the case may be; provided, further that if, at the time of such withdrawal, the Holders shall have learned of a material adverse change in the condition, business, or prospects of the Company from that known to the Holders at the time of their request and have withdrawn the request with reasonable promptness after learning of such information then the Holders shall not be required to pay any of such expenses and shall not forfeit their right to one registration pursuant to Section 2.1(a) or Section 2.1(b). All Selling Expenses relating to Registrable Securities registered pursuant to this Section 2 shall be borne and paid by the Holders pro rata on the basis of the number of Registrable Securities registered on their behalf.

2.7 Delay of Registration. No Holder shall have any right to obtain or seek an injunction restraining or otherwise delaying any registration pursuant to this Agreement as the result of any controversy that might arise with respect to the interpretation or implementation of this Section 2.

2.8 Indemnification. If any Registrable Securities are included in a registration statement under this Section 2:

(a) To the extent permitted by law, the Company will indemnify and hold harmless each selling Holder, and the partners, members, officers, directors, and stockholders of each such Holder; legal counsel, accountants and investment advisors for each such Holder; any underwriter (as defined in the Securities Act) for each such Holder; and each Person, if any, who controls such Holder or underwriter within the meaning of the Securities Act or the Exchange Act, against any Damages, and the Company will pay to each such Holder, underwriter, controlling Person, or other aforementioned Person any legal or other expenses reasonably incurred thereby in connection with investigating or defending any claim or proceeding from which Damages may result, as such expenses are incurred; provided, however, that the indemnity agreement contained in this Section 2.8(a) shall not apply to amounts paid in settlement of any such claim or proceeding if such settlement is effected without the consent of the Company, which consent shall not be unreasonably withheld, nor shall the Company be liable for any Damages to the extent that they arise out of or are based upon actions or omissions made in reliance upon and in conformity with written information furnished by or on behalf of any such Holder, underwriter, controlling Person, or other aforementioned Person expressly for use in connection with such registration.
(b) To the extent permitted by law, each selling Holder, severally and not jointly, will indemnify and hold harmless the Company, and each of its directors, each of its officers who has signed the registration statement, each Person (if any), who controls the Company within the meaning of the Securities Act, legal counsel and accountants for the Company, any underwriter (as defined in the Securities Act), any other Holder selling securities in such registration statement, and any controlling Person of any such underwriter or other Holder, against any Damages, in each case only to the extent that such Damages arise out of or are based upon actions or omissions made in reliance upon and in conformity with written information furnished by or on behalf of such selling Holder expressly for use in connection with such registration; and each such selling Holder will pay to the Company and each other aforementioned Person any legal or other expenses reasonably incurred thereby in connection with investigating or defending any claim or proceeding from which Damages may result, as such expenses are incurred; provided, however, that the indemnity agreement contained in this Section 2.8(b) shall not apply to amounts paid in settlement of any such claim or proceeding if such settlement is effected without the consent of the Holder, which consent shall not be unreasonably withheld; and provided, further that in no event shall the aggregate amounts payable by any Holder by way of indemnity or contribution under Sections 2.8(b) and 2.8(d) exceed the proceeds from the offering received by such Holder (net of any Selling Expenses paid by such Holder), except in the case of fraud or willful misconduct by such Holder.

(c) Promptly after receipt by an indemnified party under this Section 2.8 of notice of the commencement of any action (including any governmental action) for which a party may be entitled to indemnification hereunder, such indemnified party will, if a claim in respect thereof is to be made against any indemnifying party under this Section 2.8, give the indemnifying party notice of the commencement thereof. The indemnifying party shall have the right to participate in such action and, to the extent the indemnifying party so desires, participate jointly with any other indemnifying party to which notice has been given, and to assume the defense thereof with counsel mutually satisfactory to the parties; provided, however, that an indemnified party (together with all other indemnified parties that may be represented without conflict by one counsel) shall have the right to retain one separate counsel, with the fees and expenses to be paid by the indemnifying party, if representation of such indemnified party by the counsel retained by the indemnifying party would be inappropriate due to actual or potential differing interests between such indemnified party and any other party represented by such counsel in such action. The failure to give notice to the indemnifying party within a reasonable time of the commencement of any such action shall relieve such indemnifying party of all liability to the indemnified party under this Section 2.8, to the extent that such failure materially prejudices the indemnifying party’s ability to defend such action. The failure to give notice to the indemnifying party will not relieve it of any liability that it may have to any indemnified party otherwise than under this Section 2.8.

(d) To provide for just and equitable contribution to joint liability under the Securities Act in any case in which either (i) any party otherwise entitled to indemnification hereunder makes a claim for indemnification pursuant to this Section 2.8 but it is judicially determined (by the entry of a final judgment or decree by a court of competent
jurisdiction and the expiration of time to appeal or the denial of the last right of appeal) that such indemnification may not be enforced in such case, notwithstanding the fact that this Section 2.8 provides for indemnification in such case, or (ii) contribution under the Securities Act may be required on the part of any party hereto for which indemnification is provided under this Section 2.8, then, and in each such case, such parties will contribute to the aggregate losses, claims, damages, liabilities, or expenses to which they may be subject (after contribution from others) in such proportion as is appropriate to reflect the relative fault of each of the indemnifying party and the indemnified party in connection with the statements, omissions, or other actions that resulted in such loss, claim, damage, liability, or expense, as well as to reflect any other relevant equitable considerations. The relative fault of the indemnifying party and of the indemnified party shall be determined by reference to, among other things, whether the untrue or allegedly untrue statement of a material fact, or the omission or alleged omission of a material fact, relates to information supplied by the indemnifying party or by the indemnified party and the parties’ relative intent, knowledge, access to information, and opportunity to correct or prevent such statement or omission; provided, however, that, in any such case, (x) no Holder will be required to contribute any amount in excess of the public offering price of all such Registrable Securities offered and sold by such Holder pursuant to such registration statement, and (y) no Person guilty of fraudulent misrepresentation (within the meaning of Section 11(f) of the Securities Act) will be entitled to contribution from any Person who was not guilty of such fraudulent misrepresentation; and provided, further, that in no event shall a Holder’s liability pursuant to this Section 2.8(d), when combined with the amounts paid or payable by such Holder pursuant to Section 2.8(b), exceed the proceeds from the offering received by such Holder (net of any Selling Expenses paid by such Holder), except in the case of willful misconduct or fraud by such Holder.

(e) Notwithstanding the foregoing, to the extent that the provisions on indemnification and contribution contained in the underwriting agreement entered into in connection with the underwritten public offering are in conflict with the foregoing provisions, the provisions in the underwriting agreement shall control.

(f) Unless otherwise superseded by an underwriting agreement entered into in connection with the underwritten public offering, the obligations of the Company and Holders under this Section 2.8 shall survive the completion of any offering of Registrable Securities in a registration under this Section 2, and otherwise shall survive the termination of this Agreement or the AZ Participation Agreement.

2.9 Reports Under Exchange Act. With a view to making available to the Holders the benefits of SEC Rule 144 and any other rule or regulation of the SEC that may at any time permit a Holder to sell securities of the Company to the public without registration or pursuant to a registration on Form S-3, the Company shall:

(a) make and keep available adequate current public information, as those terms are understood and defined in SEC Rule 144, at all times after the effective date of the registration statement filed by the Company for the IPO;

(b) use commercially reasonable efforts to file with the SEC in a timely manner all reports and other documents required of the Company under the Securities Act and the Exchange Act (at any time after the Company has become subject to such reporting requirements); and
2.10 Limitations on Subsequent Registration Rights. From and after the date of this Agreement, the Company shall not, without the prior written consent of the Holders of a majority of the Registrable Securities then outstanding, enter into any agreement with any holder or prospective holder of any securities of the Company that would (i) provide to such holder the right to include securities in any registration on other than on a subordinate basis after all Holders have had the opportunity to include in the registration and offering all shares of Registrable Securities that they wish to so include or (ii) allow such holder or prospective holder to initiate a demand for registration of any securities held by such holder or prospective holder.

2.11 Agreement to Lock-Up. Each Holder hereby agrees that it will not, without the prior written consent of the managing underwriter, during the period commencing on the date of the final prospectus relating to the registration by the Company of shares of Common Stock in its IPO, and ending on the date specified by the Company and the managing underwriter (such period not to exceed one hundred eighty (180) days (except, with respect to a particular Holder, pursuant to the terms of any Participation Agreements or pursuant to any other agreement to which the Company or a subsidiary of the Company and such Holder may be a party), or such other period as may be reasonably requested by the Company (or any successor thereto) or an underwriter to accommodate regulatory restrictions on (1) the publication or other distribution of research reports and (2) analyst recommendations and opinions), or any successor provisions or amendments thereto), (i) lend, offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any Option, or otherwise transfer or dispose of, directly or indirectly, any shares of Common Stock or any securities convertible into or exercisable or exchangeable (directly or indirectly) for Common Stock held immediately before the effective date of the registration statement for the IPO or (ii) enter into any swap or other arrangement that transfers to another, in whole or in part, any of the economic consequences of ownership of such securities, whether any such transaction described in clause (i) or (ii) above is to be settled by delivery of Common Stock or other securities, in cash, or otherwise. The foregoing provisions of this Section 2.11 shall not apply to (i) the sale of any shares to an underwriter pursuant to an underwriting agreement, (ii) transactions relating to securities acquired in the IPO or acquired in open market transactions after the date of the IPO.
2.11 Restrictions on Transfer.
(a) The Preferred Stock and the Registrable Securities shall not be sold, pledged, or otherwise transferred, and the Company shall not recognize and shall issue stop-transfer instructions to its transfer agent with respect to any such sale, pledge, or transfer, except upon the conditions specified in this Agreement, which conditions are intended to ensure compliance with the provisions of the Securities Act. A transferring Holder will cause any proposed purchaser, pledgee, or transferee of the Preferred Stock and the Registrable Securities held by such Holder to agree to take and hold such securities subject to the provisions and upon the conditions specified in this Agreement.

(b) Each certificate, instrument or book entry representing (i) the Preferred Stock, (ii) Registrable Securities and (iii) any other securities issued in respect of the securities referenced in clause (i) and (ii), upon any stock split, stock dividend, recapitalization, merger, consolidation, or similar event, shall (unless otherwise permitted by the provisions of Section 2.12(c)) be stamped or otherwise imprinted with a legend substantially in the following form:

"THE SECURITIES REPRESENTED HEREBY HAVE BEEN ACQUIRED FOR INVESTMENT AND HAVE NOT BEEN REGISTERED UNDER THE SECURITIES ACT OF 1933. SUCH SHARES MAY NOT BE SOLD, PLEDGED, OR TRANSFERRED IN THE ABSENCE OF SUCH REGISTRATION OR A VALID EXEMPTION FROM THE REGISTRATION AND PROSPECTUS DELIVERY REQUIREMENTS OF SAID ACT.
THE SECURITIES REPRESENTED HEREBY MAY BE TRANSFERRED ONLY IN ACCORDANCE WITH THE TERMS OF AN AGREEMENT BETWEEN THE COMPANY AND THE STOCKHOLDER, A COPY OF WHICH IS ON FILE WITH THE SECRETARY OF THE COMPANY."
The Holders consent to the Company making a notation in its records and giving instructions to any transfer agent of the Restricted Securities in order to implement the restrictions on transfer set forth in this Section 2.12.

(c) The holder of each certificate representing Restricted Securities, by acceptance thereof, agrees to comply in all respects with the provisions of this Section 2. Before any proposed sale, pledge, or transfer of any Restricted Securities, unless there is in effect a registration statement under the Securities Act covering the proposed transaction, the Holder thereof shall give notice to the Company of such Holder’s intention to effect such sale, pledge, or transfer. Each such notice shall describe the manner and circumstances of the proposed sale, pledge, or transfer in sufficient detail and, if reasonably requested by the Company, shall be accompanied at such Holder’s expense by either (i) a written opinion of legal counsel who shall, and whose legal opinion shall be reasonably satisfactory to the Company, addressed to the Company, to the effect that the proposed transaction may be effected without registration under the Securities Act; (ii) a “no action” letter from the SEC to the effect that the proposed sale, pledge, or transfer of such Restricted Securities without registration will not result in a recommendation by the staff of the SEC that action be taken with respect thereto; or (iii) any other evidence reasonably satisfactory to counsel to the Company to the effect that the proposed sale, pledge, or transfer of the Restricted Securities may be effected without registration under the Securities Act, whereupon the Holder of such Restricted Securities shall be entitled to sell, pledge, or transfer such Restricted Securities in accordance with the terms of the notice given by the Holder to the Company. The Company will not require such a legal opinion or “no action” letter (x) in any transaction in compliance with SEC Rule 144 or (y) in any transaction in which such Holder distributes or transfers Restricted Securities to an Affiliate of such Holder for no consideration; provided that each transferee agrees in writing to be subject to the terms of this Section 2.12. Each certificate, instrument or book entry evidencing the Restricted Securities transferred as above provided shall bear, except if such transfer is made pursuant to SEC Rule 144, the appropriate restrictive legend set forth in Section 2.12(b), except that such certificate shall not bear such restrictive legend if, in the opinion of counsel for such Holder and the Company, such legend is not required in order to establish compliance with any provisions of the Securities Act.

2.13 Termination of Registration Rights. The right of any Holder to request registration or inclusion of Registrable Securities in any registration pursuant to Section 2.1 or Section 2.2 shall terminate upon the earliest to occur of:

(a) the closing of a Deemed Liquidation Event, as such term is defined in the Company’s Certificate of Incorporation, and the distribution of proceeds to or escrow for the benefit of the Company’s stockholders in accordance with the Certificate of Incorporation;

(b) as to such Holder, such earlier time after the IPO at which such Holder (i) can sell all shares held by it in compliance with SEC Rule 144(b)(1)(i) or (ii) holds one percent (1%) or less of the Company’s outstanding Common Stock and all Registrable Securities held by such Holder (together with any affiliate of the Holder with whom such Holder
must aggregate its sales under SEC Rule 144) can be sold in any three (3)-month period without registration in compliance with SEC Rule 144 (in each case, without the requirement for the Company to be in compliance with the current public information required under Rule 144(c)(1));

(c) the fifth (5th) anniversary of the consummation of the IPO; or

(d) the closing of any merger or other transaction in which all outstanding shares of capital stock of the Company are exchanged for securities registered under the Exchange Act.

3. Information and Observer Rights

3.1 Delivery of Financial Statements. The Company shall deliver to each Major Investor, provided that the Board has not reasonably determined that such Major Investor is a competitor of the Company:

(a) as soon as practicable, but in any event within one hundred fifty (150) days after the end of each fiscal year of the Company, (i) a balance sheet as of the end of such year, (ii) statements of income and of cash flows for such year, and a comparison between the actual amounts as of and for such fiscal year and the comparable amounts for the prior year and (iii) a statement of stockholders’ equity as of the end of such year, all such financial statements audited and certified by independent public accountants of nationally recognized standing selected by the Company;

(b) as soon as practicable, but in any event within sixty (60) days after the end of each of the first three (3) quarters of each fiscal year of the Company, unaudited statements of income for such fiscal quarter and an unaudited balance sheet as of the end of such fiscal quarter, all prepared in accordance with GAAP (except that such financial statements may (i) be subject to normal year-end audit adjustments and (ii) not contain all notes thereto that may be required in accordance with GAAP);

(c) as soon as practicable, but in any event within sixty (60) days after the end of each of the first three (3) quarters of each fiscal year of the Company, a statement showing the number of shares of each class and series of capital stock and securities convertible into or exercisable for shares of capital stock outstanding at the end of the period, the Common Stock issuable upon conversion or exercise of any outstanding securities convertible or exercisable for Common Stock and the exchange ratio or exercise price applicable thereto, and the number of shares of issued stock options and stock options not yet issued but reserved for issuance, if any, all in sufficient detail as to permit the Major Investors to calculate their respective percentage equity ownership in the Company;

(d) such other information relating to the financial condition, business, prospects, or corporate affairs of the Company as any Major Investor may from time to time reasonably request; provided, however, that the Company shall not be obligated under this Section 3.1 to provide information and/or may redact or withhold certain information (i) that the Company reasonably determines in good faith to be a trade secret or confidential information (unless covered by an enforceable confidentiality agreement, in form acceptable to the
If, for any period, the Company has any subsidiary whose accounts are consolidated with those of the Company, then in respect of such period the financial statements delivered pursuant to the foregoing sections shall be the consolidated and consolidating financial statements of the Company and all such consolidated subsidiaries.

Notwithstanding anything else in this Section 3.1 to the contrary, the Company may cease providing the information set forth in this Section 3.1 during the period starting with the date thirty (30) days before the Company’s good-faith estimate of the date of filing of a registration statement if it reasonably concludes it must do so to comply with the SEC rules applicable to such registration statement and related offering; provided that the Company’s covenants under this Section 3.1 shall be reinstated at such time as the Company is no longer actively employing its commercially reasonable efforts to cause such registration statement to become effective.

3.2 Inspection. The Company shall permit each Major Investor (provided that the Board has not reasonably determined that such Major Investor is a competitor of the Company), at such Major Investor’s expense, to visit and inspect the Company’s properties; examine its books of account and records; and discuss the Company’s affairs, finances, and accounts with its officers, during normal business hours of the Company as may be reasonably requested by the Major Investor; provided, however, that the Company shall not be obligated pursuant to this Section 3.2 to provide access to any information and/or may redact or withhold certain information (i) that it reasonably and in good faith considers to be a trade secret or confidential information (unless covered by an enforceable confidentiality agreement, in form acceptable to the Company), (ii) the disclosure of which would adversely affect the attorney-client privilege between the Company and its counsel, or (iii) that the Company reasonably determines in good faith to be competitively sensitive information with respect to such Major Investor who is receiving information pursuant to this Section 3.2.

3.3 Termination of Information Rights. The covenants set forth in Sections 3.1 and 3.2 shall terminate and be of no further force or effect (i) immediately before the consummation of the IPO, (ii) when the Company first becomes subject to the periodic reporting requirements of Section 12(g) or 15(d) of the Exchange Act, (iii) upon a Deemed Liquidation Event, as such term is defined in the Company’s Certificate of Incorporation, and the distribution of proceeds to or escrow for the benefit of the Company’s stockholders, in accordance with the Certificate of Incorporation, or (iv) upon the closing of any merger or other transaction in which all outstanding shares of capital stock of the Company are exchanged for securities registered under the Exchange Act, whichever event described in clauses (i) to (iv) occurs first.

3.4 Confidentiality. Each Investor agrees that such Investor will keep confidential and will not disclose, divulge, or use for any purpose (other than to monitor its investment in the Company) any confidential information obtained from the Company pursuant to the terms of this Agreement (including notice of the Company’s intention to file a registration
statement), unless such confidential information (a) is known or becomes known to the general public (other than as a result of a breach of this Section 3.4 by such Investor), (b) is or has been independently developed or conceived by the Investor without use of the Company’s confidential information, or (c) is or has been made known or disclosed to the Investor by a third party without a breach of any obligation of confidentiality such third party may have to the Company; provided, however, that an Investor may disclose confidential information (i) to its attorneys, accountants, consultants, and other professionals to the extent necessary to obtain their services in connection with monitoring its investment in the Company; (ii) to any prospective purchaser of any Registrable Securities from such Investor, if such prospective purchaser agrees to be bound by the provisions of this Section 3.4; (iii) to any Affiliate, partner (and partners of such partner), member, stockholder, or wholly owned subsidiary of such Investor in the ordinary course of business, provided that such Investor informs such Person that such information is confidential and directs such Person to maintain the confidentiality of such information; or (iv) as may otherwise be required by law, provided that such Investor promptly notifies the Company of such disclosure and takes reasonable steps to minimize the extent of any such required disclosure. Notwithstanding the foregoing, in the case of any Advisory Investor, such Advisory Investor may identify the Company and the value of such Advisory Investor’s security holdings in the Company in accordance with applicable investment reporting and disclosure regulations and respond to routine examinations, demands, requests or reporting requirements of a regulator; provided that in the case of demands or requests of a regulator the Advisory Investor gives the Company (to the extent permitted by applicable law) prompt written notice following the Advisory Investor’s disclosure of such confidential information.

4. Rights to Future Stock Issuances

4.1 Right of First Offer. Subject to the terms and conditions of this Section 4.1 and applicable securities laws, if the Company proposes to offer or sell any New Securities, the Company shall first offer such New Securities to each Major Investor. A Major Investor shall be entitled to apportion the right of first offer hereby granted to it among itself and its Affiliates in such proportions as it deems appropriate.

(a) The Company shall give notice (the “Offer Notice”) to each Major Investor, stating (i) its bona fide intention to offer such New Securities, (ii) the number of such New Securities to be offered, and (iii) the price and terms, if any, upon which it proposes to offer such New Securities.

(b) By notification to the Company within thirty (30) days after the Offer Notice is given, each Major Investor may elect to purchase or otherwise acquire, at the price and on the terms specified in the Offer Notice, up to that portion of such New Securities which equals the proportion that the Common Stock issued and held, or issuable (directly or indirectly) upon conversion and/or exercise, as applicable, of the Preferred Stock and any Derivative Securities then held, by such Major Investor bears to the total Common Stock of the Company then outstanding (assuming full conversion and/or exercise, as applicable, of all Preferred Stock and any Derivative Securities); provided, that shares of Series H Preferred Stock shall not be included in the above calculation until the twenty-one (21) month anniversary of the Closing (as defined in the Purchase Agreement). At the expiration of such thirty (30) day period, the Company shall promptly notify each Major Investor that elects to purchase or acquire all the
shares available to it (each, a “Fully Exercising Investor”) of any other Major Investor’s failure to do likewise. During the ten (10) day period commencing after the Company has given such notice, each Fully Exercising Investor may, by giving notice to the Company, elect to purchase or acquire, in addition to the number of shares specified above, up to that portion of the New Securities for which Major Investors were entitled to subscribe but that were not subscribed for by the Major Investors which is equal to the proportion that the Common Stock issued and held, or issuable (directly or indirectly) upon conversion and/or exercise, as applicable, of the Preferred Stock and any Derivative Securities then held, by such Fully Exercising Investor bears to the Common Stock issued and held, or issuable (directly or indirectly) upon conversion and/or exercise, as applicable, of the Preferred Stock and any Derivative Securities then held, by all Fully Exercising Investors who wish to purchase such unsubscribed shares. The closing of any sale pursuant to this Section 4.1(b) shall occur within the later of one hundred and twenty (120) days after the date that the Offer Notice is given and the date of initial sale of New Securities pursuant to Section 4.1(c).

(c) If all New Securities referred to in the Offer Notice are not elected to be purchased or acquired as provided in Section 4.1(b), the Company may, during the ninety (90) day period following the expiration of the periods provided in Section 4.1(b), offer and sell the remaining unsubscribed portion of such New Securities to any Person or Persons at a price not less than, and upon terms no more favorable to the offeree than, those specified in the Offer Notice. If the Company does not enter into an agreement for the sale of the New Securities within such period, or if such agreement is not consummated within thirty (30) days after the execution thereof, the right provided hereunder shall be deemed to be revived and such New Securities shall not be offered unless first reoffered to the Major Investors in accordance with this Section 4.1.

(d) The right of first offer in this Section 4.1 shall not be applicable to (i) Exempted Securities (as defined in the Company’s Certificate of Incorporation), (ii) shares of Common Stock issued in the IPO, (iii) equity securities issued pursuant to any Participation Agreement, and (iv) any shares of Series H Preferred Stock issued under the Purchase Agreement.

4.2 Termination. The covenants set forth in Section 4.1 shall terminate and be of no further force or effect (i) immediately before the consummation of the IPO, (ii) upon a Deemed Liquidation Event, as such term is defined in the Company’s Certificate of Incorporation, and the distribution of proceeds to or escrow for the benefit of the Company’s stockholders in accordance with the Certificate of Incorporation, or (iii) upon the closing of any merger or other transaction in which all outstanding shares of capital stock of the Company are exchanged for securities registered under the Exchange Act, whichever event described in clauses (i) to (iii) occurs first.

5. Additional Covenants.

5.1 Insurance. The Company shall use commercially reasonable efforts to cause their Directors and Officers liability insurance policy to be maintained until such time as the Board determines that such insurance should be discontinued. The policy shall not be cancelable by the Company without prior approval by the Board, including one of the Investor Directors.
5.2 **Employee Agreements.** The Company will cause (i) each person now or hereafter employed by it or by any subsidiary (or engaged by the Company or any subsidiary as a consultant or independent contractor) with access to confidential information and/or trade secrets to enter into a nondisclosure and proprietary rights assignment agreement and (ii) each Key Employee to enter into a one (1) year noncompetition and nonsolicitation agreement, substantially in the form approved by the Board. In addition, the Company shall not amend, modify, terminate, waive, or otherwise alter, in whole or in part, any of the above-referenced agreements or any restricted stock agreement between the Company and any employee, without the approval of the Board, including one of the Investor Directors.

5.3 **Employee Stock.** Unless otherwise approved by the Board, including one of the Investor Directors, all future employees and consultants of the Company who purchase, receive options to purchase, or receive awards of shares of the Company’s capital stock after the date hereof shall be required to execute restricted stock or option agreements, as applicable, providing for (i) vesting of shares over a four (4) year period, with the first twenty-five percent (25%) of such shares vesting following twelve (12) months of continued employment or service, and the remaining shares vesting in equal quarterly installments over the following twelve (12) quarters, and (ii) a market stand-off provision substantially similar to that in Section 2.11. In addition, unless otherwise approved by the Board, including one of the Investor Directors, the Company shall retain a “right of first refusal” on employee transfers until the Company’s IPO and shall have the right to repurchase unvested shares at cost upon termination of employment of a holder of restricted stock.

5.4 **Matters Requiring Investor Director Approval.** So long as any holders of Preferred Stock are entitled to elect one or both of the Investor Directors, the Company hereby covenants and agrees with each of the Investors that it shall not, without approval of the Board, which approval must include the affirmative vote of at least one of the Investor Directors:

(a) make, or permit any subsidiary to make, any loan or advance to, or own any stock or other securities of, any subsidiary or other corporation, partnership, or other entity unless it is wholly owned by the Company;

(b) make, or permit any subsidiary to make, any loan or advance to any Person, including, without limitation, any employee or director of the Company or any subsidiary, except advances and similar expenditures in the ordinary course of business or under the terms of an employee stock or option plan approved by the Board;

(c) guarantee, directly or indirectly, or permit any subsidiary to guarantee, directly or indirectly, any indebtedness except for trade accounts of the Company or any subsidiary arising in the ordinary course of business;

(d) make any investment inconsistent with any investment policy approved by the Board;
(e) incur any aggregate indebtedness in excess of $5,000,000 that is not already included in a budget approved by the Board, other than trade credit incurred in the ordinary course of business;

(f) otherwise enter into or be a party to any transaction with any director, officer, or employee of the Company or any “associate” (as defined in Rule 12b-2 promulgated under the Exchange Act) of any such Person, except for transactions contemplated by this Agreement and the Purchase Agreement;

(g) hire, terminate, or change the compensation of any director or executive officer of the Company, including approving or amending the terms of any option grants, stock awards or equity-based compensation to directors or executive officers;

(h) grant or amend the terms of any stock options, stock awards or other equity-based compensation to any employee or consultant of the Company;

(i) change the principal business of the Company, enter new lines of business, or exit the current line of business;

(j) sell, assign, license, pledge, or encumber material technology or intellectual property, other than licenses granted in the ordinary course of business; or

(k) enter into any agreement for the in-license of any material technology or intellectual property.

5.5 Board Matters; Committees. Unless otherwise determined by the vote of a majority of the directors then in office, the Board shall meet at least six (6) times per year in accordance with an agreed-upon schedule. The Company shall reimburse the nonemployee directors for all reasonable out-of-pocket travel expenses incurred (consistent with the Company’s travel policy, if any) in connection with attending meetings of the Board. The Board may elect a chairman of the Board of Directors, which individual shall initially be Noubar Afeyan. The Company shall cause to be established, as soon as practicable after such request, and will maintain, an audit and compensation committee, each of which shall consist solely of non-management directors and shall include at least two (2) Investor Directors; provided, that an Investor Director shall not be required to serve on any such committee to the extent such director is not willing or able to so serve. Further, the Board may establish such other committees of the Board, in its sole discretion, as it shall deem necessary or convenient from time to time. Except as provided in the first sentence of this Section 5.5, each committee of the Board may be composed of any of its Directors; provided that each such committee shall include one (1) Investor Director; provided further that an Investor Director shall not be required to serve on any such committee to the extent such Director is not willing or able to so serve. The Board may delegate to any committee of the Board some or all of its powers, to the extent permitted by this Agreement. The approval of a committee of the Board with respect to any matter delegated by the Board to such committee shall constitute the approval of the Board for purposes of this Agreement.

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5.6 **Successor Indemnification.** If the Company or any of its successors or assignees consolidates with or merges into any other Person and is not the continuing or surviving corporation or entity of such consolidation or merger, then to the extent necessary, proper provision shall be made so that the successors and assignees of the Company assume the obligations of the Company with respect to indemnification of members of the Board as in effect immediately before such transaction, whether such obligations are contained in the Company’s Bylaws, its Certificate of Incorporation, or elsewhere, as the case may be.

5.7 **Assignment of Right of First Refusal.** In the event the Company elects not to exercise any right of first refusal or right of first offer the Company may have on a proposed transfer of any of the Company’s outstanding capital stock, by contract or otherwise, the Company shall, to the extent it may do so, assign such right of first refusal or right of first offer to each Major Investor. In the event of such assignment, each Major Investor shall have the right, but not the obligation, to purchase up to its pro rata portion of the capital stock proposed to be transferred. For purposes of this Section 5.7, each Major Investor’s pro rata portion shall be determined based on the proportion that the Common Stock issued and held, or issuable (directly or indirectly) upon conversion and/or exercise, as applicable, of the Preferred Stock and any other Derivative Securities then held, bears to the total Common Stock of the Company issued and held, or issuable (directly or indirectly) upon conversion and/or exercise, as applicable, of the Preferred Stock and any other Derivative Securities then held, by all Major Investors.

5.8 **USRPHC.** The Company shall promptly notify the Investors if it becomes aware, after due inquiry, that the Company is or is reasonably likely to become a United States real property holding corporation within the meaning of Section 897(c) of the Code.

5.9 **Termination of Covenants.** The covenants set forth in this Section 5, except for Section 5.6, shall terminate and be of no further force or effect (i) immediately before the consummation of the IPO, (ii) upon a Deemed Liquidation Event, as such term is defined in the Company’s Certificate of Incorporation, or (iii) the closing of any merger or other transaction in which all outstanding shares of capital stock of the Company are exchanged for securities registered under the Exchange Act whichever event described in clauses (i), (ii) and (iii) occurs first.

6. **Miscellaneous.**

6.1 **Successors and Assigns.** The rights under this Agreement may be assigned (but only with all related obligations) by a Holder to a transferee of Registrable Securities that (i) is an Affiliate of a Holder; (ii) is a Holder’s Immediate Family Member or trust for the benefit of an individual Holder or one or more of such Holder’s Immediate Family Members; or (iii) after such transfer, holds at least 1,500,000 shares of Registrable Securities (subject to appropriate adjustment for stock splits, stock dividends, combinations, and other recapitalizations); provided, however, that (x) the Company is, within a reasonable time after such transfer, furnished with written notice of the name and address of such transferee and the Registrable Securities with respect to which such rights are being transferred; and (y) such transferee agrees in a written instrument delivered to the Company to be bound by and subject to the terms and conditions of this Agreement, including the provisions of Section 2.11. For the purposes of determining the number of shares of Registrable Securities held by a transferee, the
holdings of a transferee (1) that is an Affiliate or stockholder of a Holder; (2) who is a Holder’s Immediate Family Member; or (3) that is a trust for the benefit of an individual Holder or such Holder’s Immediate Family Member shall be aggregated together and with those of the transferring Holder, provided further that all transferees who would not qualify individually for assignment of rights shall have a single attorney-in-fact for the purpose of exercising any rights, receiving notices, or taking any action under this Agreement. The terms and conditions of this Agreement inure to the benefit of and are binding upon the respective successors and permitted assignees of the parties. Nothing in this Agreement, express or implied, is intended to confer upon any party other than the parties hereto or their respective successors and permitted assignees any rights, remedies, obligations or liabilities under or by reason of this Agreement, except as expressly provided herein.

6.2 Governing Law. This Agreement and any controversy arising out of or relating to this Agreement shall be governed by and construed in accordance with the General Corporation Law of the State of Delaware as to matters within the scope thereof, and as to all other matters shall be governed by and construed in accordance with the internal laws of the Commonwealth of Massachusetts, without regard to conflict of law principles that would result in the application of any law other than the law of the Commonwealth of Massachusetts.

6.3 Counterparts; Facsimile. This Agreement may be executed and delivered by facsimile transmission or electronic mail (including in .pdf format) and in two or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument. Counterparts may be delivered via facsimile, electronic mail (including pdf or any electronic signature complying with the U.S. federal E-SIGN Act of 2000, e.g., www.docusign.com) or other transmission method and any counterpart so delivered shall be deemed to have been duly and validly delivered and be valid and effective for all purposes.

6.4 Titles and Subtitles. The titles and subtitles used in this Agreement are for convenience only and are not to be considered in construing or interpreting this Agreement.

6.5 Notices. All notices and other communications given or made pursuant to this Agreement shall be in writing and shall be deemed effectively given upon the earlier of actual receipt or: (i) personal delivery to the party to be notified; (ii) when sent, if sent by electronic mail or facsimile during the recipient’s normal business hours, and if not sent during normal business hours, then on the recipient’s next business day; (iii) five (5) days after having been sent by registered or certified mail, return receipt requested, postage prepaid; or (iv) one (1) business day after the business day of deposit with a nationally recognized overnight courier, freight prepaid, specifying next-day delivery, with written verification of receipt. All communications shall be sent only to the respective parties at their addresses as set forth on Schedule A hereto, or to the principal office of the Company and to the attention of the President, Chief Executive Officer, or General Counsel in the case of the Company, or to such email address, facsimile number, or address as subsequently modified by written notice given in accordance with this Section 6.5. If notice is given to the Company, a copy shall also be sent to Goodwin Procter LLP, 100 Northern Avenue, Boston, MA 02110, Attn: Kingsley Taft and John Mutkoski, Fax: (617) 523-1231.
Amendments and Waivers. Any term of this Agreement may be amended and the observance of any term of this Agreement may be waived (either generally or in a particular instance, and either retroactively or prospectively) only with the written consent of the Company and the Requisite Vote; provided that the Company may in its sole discretion waive compliance with Section 2.12(c) (and the Company’s failure to object promptly in writing after notification of a proposed assignment allegedly in violation of Section 2.12(c) shall be deemed to be a waiver); and provided further that any provision hereof may be waived by any waiving party on such party’s own behalf, without the consent of any other party. Notwithstanding the foregoing, this Agreement may not be amended or terminated and the observance of any term hereof may not be waived with respect to any Investor without the written consent of such Investor, unless such amendment, termination, or waiver applies to all Investors in the same fashion (it being agreed that a waiver of the provisions of Section 4 with respect to a particular transaction shall be deemed to apply to all Investors in the same fashion if such waiver does so by its terms, notwithstanding the fact that certain Investors may nonetheless, by agreement with the Company, purchase securities in such transaction). The Company shall give prompt notice of any amendment or termination hereof or waiver hereunder to any party hereto that did not consent in writing to such amendment, termination, or waiver. Any amendment, termination, or waiver effected in accordance with this Section 6.6 shall be binding on all parties hereto, regardless of whether any such party has consented thereto. No waivers of or exceptions to any term, condition, or provision of this Agreement, in any one or more instances, shall be deemed to be or construed as a further or continuing waiver of any such term, condition, or provision. Notwithstanding the foregoing:

(a) Section 2.11 of this Agreement shall not be amended or waived to apply to any transactions involving any Affiliates of any Fidelity Investor who do not own any Common Stock without the written consent of such Fidelity Investor so long as such Fidelity Investor continues to hold any Registrable Securities;

(b) Clause (c) (and the proviso immediately following clause (c)) of the definition of “Major Investor” in Section 1.20 shall not be amended or waived with respect to Fidelity without the written consent of Fidelity so long as Fidelity continues to hold any Registrable Securities;

(c) Clause (b) of the definition of “Major Investor” in Section 1.20 and the second sentence of the definition of “Major Investor” in Section 1.20 shall not be amended or waived with respect to AZ without the written consent of AZ so long as AZ continues to hold at least 5,000,000 shares (subject to appropriate adjustment for stock splits, stock dividends, combinations, and other recapitalizations) of Registrable Securities;

(d) Schedule A hereto may be amended by the Company from time to time to include additional Investors who become party hereto without the consent of the other parties hereto.

(e) Following an IPO, for purposes of this Section 6.6 only, the Requisite Vote shall mean the holders of at least 50% of the Registrable Securities.
6.7 **Severability.** In case any one or more of the provisions contained in this Agreement is for any reason held to be invalid, illegal or unenforceable in any respect, such invalidity, illegality, or unenforceability shall not affect any other provision of this Agreement, and such invalid, illegal, or unenforceable provision shall be reformed and construed so that it will be valid, legal, and enforceable to the maximum extent permitted by law.

6.8 **Aggregation of Stock.** All shares of Registrable Securities held or acquired by Affiliates shall be aggregated together for the purpose of determining the availability of any rights under this Agreement and such Affiliated persons may apportion such rights as among themselves in any manner they deem appropriate.

6.9 **Additional Investors.** Notwithstanding anything to the contrary contained herein, if the Company issues additional shares of Series H Preferred Stock after the date hereof, any purchaser of such shares of Series H Preferred Stock may become a party to this Agreement by executing and delivering an additional counterpart signature page to this Agreement, and thereafter shall be deemed an “Investor” for all purposes hereunder. No action or consent by the Investors shall be required for such joinder to this Agreement by such additional Investor, so long as such additional Investor has agreed in writing to be bound by all of the obligations as an “Investor” hereunder.

6.10 **Prior Agreement Superseded.** Pursuant to Section 6.6 of the Prior Agreement, the undersigned parties who are parties to such Prior Agreement hereby amend and restate the Prior Agreement to read in its entirety as set forth in this Agreement, all with the intent and effect that the Prior Agreement shall hereby be terminated and entirely replaced and superseded by this Agreement.

6.11 **Entire Agreement.** This Agreement (including any Schedules and Exhibits hereto) constitutes the full and entire understanding and agreement among the parties with respect to the subject matter hereof, and any other written or oral agreement relating to the subject matter hereof existing between the parties is expressly canceled.

6.12 **Dispute Resolution.** The parties (a) hereby irrevocably and unconditionally submit to the jurisdiction of the federal and state courts located within the geographical boundaries of the United States District Court for the District of Massachusetts for the purpose of any suit, action or other proceeding arising out of or based upon this Agreement, (b) agree not to commence any suit, action or other proceeding arising out of or based upon this Agreement except in the federal and state courts located within the geographical boundaries of the United States District Court for the District of Massachusetts, and (c) hereby waive, and agree not to assert, by way of motion, as a defense, or otherwise, in any such suit, action or proceeding, any claim that it is not subject personally to the jurisdiction of the above-named courts, that its property is exempt or immune from attachment or execution, that the suit, action or proceeding is brought in an inconvenient forum, that the venue of the suit, action or proceeding is improper or that this Agreement or the subject matter hereof may not be enforced in or by such court. Each party will bear its own costs in respect of any disputes arising under this Agreement. Each of the parties to this Agreement consents to personal jurisdiction for any equitable action sought in the U.S. District Court for the District of Massachusetts or any court of the Commonwealth of Massachusetts having subject matter jurisdiction.
6.13 **Delays or Omissions.** No delay or omission to exercise any right, power, or remedy accruing to any party under this Agreement, upon any breach or default of any other party under this Agreement, shall impair any such right, power, or remedy of such nonbreaching or nondefaulting party, nor shall it be construed to be a waiver of or acquiescence to any such breach or default, or to any similar breach or default thereafter occurring, nor shall any waiver of any single breach or default be deemed a waiver of any other breach or default theretofore or thereafter occurring. All remedies, whether under this Agreement or by law or otherwise afforded to any party, shall be cumulative and not alternative.

6.14 **Acknowledgment.**

(a) The Company acknowledges that some of the Investors are in the business of venture capital investing and therefore review the business plans and related proprietary information of many enterprises, including enterprises which may have products or services which compete directly or indirectly with those of the Company. Nothing in this Agreement shall preclude or in any way restrict such Investors from investing or participating in any particular enterprise whether or not such enterprise has products or services which compete with those of the Company.

(b) The Company acknowledges that each Advisory Investor’s Investment Advisor and its investment advisory clients currently may be invested in, may invest in or may consider investments in public and private companies, including, without limitation, companies that may compete either directly or indirectly with the Company, and that the execution of this Agreement, the terms hereof and the access to the Company’s confidential information hereunder shall in no way be construed to prohibit or restrict such Investment Advisor or its investment advisory clients from maintaining, making or considering such investments or from otherwise operating in the ordinary course of business. For purposes of clarity, the term “investment advisory clients” includes, without limitation, the Advisory Investors.

[Remainder of Page Intentionally Left Blank]
IN WITNESS WHEREOF, the parties have executed this Second Amended and Restated Investors’ Rights Agreement as of the date first written above.

COMPANY: MODERNA THERAPEUTICS, INC.

By: /s/ Stéphane Bancel
Name: Stéphane Bancel
Title: CEO

Address:
200 Technology Square
Cambridge, MA 02139

[SIGNATURE PAGE TO SECOND AMENDED AND RESTATED INVESTORS’ RIGHTS AGREEMENT]
SECTION 1. GENERAL PURPOSE OF THE PLAN; DEFINITIONS

The name of the plan is the Moderna Therapeutics, Inc. 2016 Stock Option and Grant Plan (the “Plan”). The purpose of the Plan is to encourage and enable the officers, employees, directors, Consultants and other key persons of Moderna Therapeutics, Inc., a Delaware corporation (including any successor entity, the “Company”) and its Subsidiaries, upon whose judgment, initiative and efforts the Company largely depends for the successful conduct of its business, to acquire a proprietary interest in the Company.

The following terms shall be defined as set forth below:

“Affiliate” of any Person means a Person that directly or indirectly, through one or more intermediaries, controls, is controlled by or is under common control with the first mentioned Person. A Person shall be deemed to control another Person if such first Person possesses directly or indirectly the power to direct, or cause the direction of, the management and policies of the second Person, whether through the ownership of voting securities, by contract or otherwise.

“Award” or “Awards,” except where referring to a particular category of grant under the Plan, shall include Incentive Stock Options, Non-Qualified Stock Options, Restricted Stock Awards, Unrestricted Stock Awards, Restricted Stock Units or any combination of the foregoing.

“Award Agreement” means a written or electronic agreement setting forth the terms and provisions applicable to an Award granted under the Plan. Each Award Agreement may contain terms and conditions in addition to those set forth in the Plan; provided, however, in the event of any conflict in the terms of the Plan and the Award Agreement, the terms of the Plan shall govern.

“Board” means the Board of Directors of the Company.

“Cause” shall have the meaning as set forth in the Award Agreement(s). In the case that any Award Agreement does not contain a definition of “Cause,” it shall mean (i) the grantee’s dishonest statements or acts with respect to the Company or any Affiliate of the Company, or any current or prospective customers, suppliers vendors or other third parties with which such entity does business; (ii) the grantee’s commission of (A) a felony or (B) any misdemeanor involving moral turpitude, deceit, dishonesty or fraud; (iii) the grantee’s failure to perform his assigned duties and responsibilities to the reasonable satisfaction of the Company which failure continues, in the reasonable judgment of the Company, after written notice given to the grantee by the Company; (iv) the grantee’s gross negligence, willful misconduct or insubordination with respect to the Company or any Affiliate of the Company; or (v) the grantee’s material violation of any provision of any agreement(s) between the grantee and the Company relating to noncompetition, nonsolicitation, nondisclosure and/or assignment of inventions.
“Chief Executive Officer” means the Chief Executive Officer of the Company or, if there is no Chief Executive Officer, then the President of the Company.


“Committee” means the Committee of the Board referred to in Section 2.

“Consultant” means any natural person that provides bona fide services to the Company (including a Subsidiary), and such services are not in connection with the offer or sale of securities in a capital-raising transaction and do not directly or indirectly promote or maintain a market for the Company’s securities.

“Disability” means “disability” as defined in Section 422(c) of the Code.

“Effective Date” means the date on which the Plan is adopted as set forth on the final page of the Plan.


“Fair Market Value” of the Stock on any given date means the fair market value of the Stock determined in good faith by the Committee based on the reasonable application of a reasonable valuation method not inconsistent with Section 409A of the Code. If the Stock is admitted to trade on a national securities exchange, the determination shall be made by reference to the closing price reported on such exchange. If there is no closing price for such date, the determination shall be made by reference to the last date preceding such date for which there is a closing price. If the date for which Fair Market Value is determined is the first day when trading prices for the Stock are reported on a national securities exchange, the Fair Market Value shall be the “Price to the Public” (or equivalent) set forth on the cover page for the final prospectus relating to the Company’s Initial Public Offering.

“Good Reason” shall have the meaning as set forth in the Award Agreement(s). In the case that any Award Agreement does not contain a definition of “Good Reason,” it shall mean (i) a material diminution in the grantee’s base salary except for across-the-board salary reductions similarly affecting all or substantially all similarly situated employees of the Company or (ii) a change of more than 50 miles in the geographic location at which the grantee provides services to the Company, so long as the grantee provides at least 90 days notice to the Company following the initial occurrence of any such event and the Company fails to cure such event within 30 days thereafter.

“Grant Date” means the date that the Committee designates in its approval of an Award in accordance with applicable law as the date on which the Award is granted, which date may not precede the date of such Committee approval.

“Holder” means, with respect to an Award or any Shares, the Person holding such Award or Shares, including the initial recipient of the Award or any Permitted Transferee.
“Incentive Stock Option” means any Stock Option designated and qualified as an “incentive stock option” as defined in Section 422 of the Code.

“Initial Public Offering” means the consummation of the first firm commitment underwritten public offering pursuant to an effective registration statement under the Securities Act covering the offer and sale by the Company of its equity securities, as a result of or following which the Stock shall be publicly held.

“Non-Qualified Stock Option” means any Stock Option that is not an Incentive Stock Option.

“Option” or “Stock Option” means any option to purchase shares of Stock granted pursuant to Section 5.

“Permitted Transferees” shall mean any of the following to whom a Holder may transfer Shares hereunder (as set forth in Section 9(a)(ii)(A)): the Holder’s child, stepchild, grandchild, parent, stepparent, grandparent, spouse, former spouse, sibling, niece, nephew, mother-in-law, father-in-law, son-in-law, daughter-in-law, brother-in-law, or sister-in-law, including adoptive relationships, any person sharing the Holder’s household (other than a tenant or employee), a trust in which these persons have more than fifty percent of the beneficial interest, a foundation in which these persons control the management of assets, and any other entity in which these persons own more than fifty percent of the voting interests; provided, however, that any such trust does not require or permit distribution of any Shares during the term of the Award Agreement unless subject to its terms. Upon the death of the Holder, the term Permitted Transferees shall also include such deceased Holder’s estate, executors, administrators, personal representatives, heirs, legatees and distributees, as the case may be.

“Person” shall mean any individual, corporation, partnership (limited or general), limited liability company, limited liability partnership, association, trust, joint venture, unincorporated organization or any similar entity.

“Repurchase Event” shall mean (i) a Termination Event in which an Award recipient’s Service Relationship with the Company or its Subsidiaries is terminated for Cause, or (ii) an Award recipient’s failure to sign any of the Company’s standard form agreement(s) relating to noncompetition, nondisclosure and/or assignment of inventions upon request from the Company, or the Award recipient’s violation of any provision of any such agreements.

“Restricted Stock Award” means Awards granted pursuant to Section 6 and “Restricted Stock” means Shares issued pursuant to such Awards.

“Restricted Stock Unit” means an Award of phantom stock units to a grantee, which may be settled in cash or Shares as determined by the Committee, pursuant to Section 8.

“Sale Event” means the consummation of (i) the dissolution or liquidation of the Company, (ii) the sale of all or substantially all of the assets of the Company on a consolidated basis to an unrelated person or entity, (iii) a merger, reorganization or consolidation pursuant to which the holders of the Company’s outstanding voting power immediately prior to such transaction do not own a majority of the outstanding voting power of the surviving or resulting
entity (or its ultimate parent, if applicable), (iv) the acquisition of all or a majority of the outstanding voting stock of the Company in a single transaction or a series of related transactions by a Person or group of Persons, or (v) any other acquisition of the business of the Company, as determined by the Board; provided, however, that the Company’s Initial Public Offering, any subsequent public offering or another capital raising event, or a merger effected solely to change the Company’s domicile shall not constitute a “Sale Event.”

“Section 409A” means Section 409A of the Code and the regulations and other guidance promulgated thereunder.

“Securities Act” means the Securities Act of 1933, as amended, and the rules and regulations thereunder.

“Service Relationship” means any relationship as a full-time employee, part-time employee, director or other key person (including Consultants) of the Company or any Subsidiary or any successor entity (e.g., a Service Relationship shall be deemed to continue without interruption in the event an individual’s status changes from full-time employee to part-time employee or Consultant).

“Shares” means shares of Stock.

“Stock” means the Common Stock, par value $0.0001 per share, of the Company.

“Subsidiary” means any corporation or other entity (other than the Company) in which the Company has more than a 50 percent interest, either directly or indirectly.

“Ten Percent Owner” means an employee who owns or is deemed to own (by reason of the attribution rules of Section 424(d) of the Code) more than 10 percent of the combined voting power of all classes of stock of the Company or any parent of the Company or any Subsidiary.

“Termination Event” means the termination of the Award recipient’s Service Relationship with the Company and its Subsidiaries for any reason whatsoever, regardless of the circumstances thereof, and including, without limitation, upon death, disability, retirement, discharge or resignation for any reason, whether voluntarily or involuntarily. The following shall not constitute a Termination Event: (i) a transfer to the service of the Company from a Subsidiary or from the Company to a Subsidiary, or from one Subsidiary to another Subsidiary or (ii) an approved leave of absence for military service or sickness, or for any other purpose approved by the Committee, if the individual’s right to re-employment is guaranteed either by a statute or by contract or under the policy pursuant to which the leave of absence was granted or if the Committee otherwise so provides in writing.

“Unrestricted Stock Award” means any Award granted pursuant to Section 7 and “Unrestricted Stock” means Shares issued pursuant to such Awards.
SECTION 2. ADMINISTRATION OF PLAN; COMMITTEE AUTHORITY TO SELECT GRANTEES AND DETERMINE AWARDS

(a) Administration of Plan. The Plan shall be administered by the Board, or at the discretion of the Board, by a committee of the Board, comprised of not less than two directors. All references herein to the “Committee” shall be deemed to refer to the group then responsible for administration of the Plan at the relevant time (i.e., either the Board of Directors or a committee or committees of the Board, as applicable).

(b) Powers of Committee. The Committee shall have the power and authority to grant Awards consistent with the terms of the Plan, including the power and authority:

(i) to select the individuals to whom Awards may from time to time be granted;

(ii) to determine the time or times of grant, and the amount, if any, of Incentive Stock Options, Non-Qualified Stock Options, Restricted Stock Awards, Unrestricted Stock Awards, Restricted Stock Units, or any combination of the foregoing, granted to any one or more grantees;

(iii) to determine the number of Shares to be covered by any Award and, subject to the provisions of the Plan, the price, exercise price, conversion ratio or other price relating thereto;

(iv) to determine and, subject to Section 12, to modify from time to time the terms and conditions, including restrictions, not inconsistent with the terms of the Plan, of any Award, which terms and conditions may differ among individual Awards and grantees, and to approve the form of Award Agreements;

(v) to accelerate at any time the exercisability or vesting of all or any portion of any Award;

(vi) to impose any limitations on Awards, including limitations on transfers, repurchase provisions and the like, and to exercise repurchase rights or obligations;

(vii) subject to Section 5(a)(ii) and any restrictions imposed by Section 409A, to extend at any time the period in which Stock Options may be exercised; and

(viii) at any time to adopt, alter and repeal such rules, guidelines and practices for administration of the Plan and for its own acts and proceedings as it shall deem advisable; to interpret the terms and provisions of the Plan and any Award (including Award Agreements); to make all determinations it deems advisable for the administration of the Plan; to decide all disputes arising in connection with the Plan; and to otherwise supervise the administration of the Plan.

All decisions and interpretations of the Committee shall be binding on all persons, including the Company and all Holders.
(c) **Award Agreement.** Awards under the Plan shall be evidenced by Award Agreements that set forth the terms, conditions and limitations for each Award.

(d) **Indemnification.** Neither the Board nor the Committee, nor any member of either or any delegate thereof, shall be liable for any act, omission, interpretation, construction or determination made in good faith in connection with the Plan, and the members of the Board and the Committee (and any delegate thereof) shall be entitled in all cases to indemnification and reimbursement by the Company in respect of any claim, loss, damage or expense (including, without limitation, reasonable attorneys’ fees) arising or resulting therefrom to the fullest extent permitted by law and/or under the Company’s governing documents, including its certificate of incorporation or bylaws, or any directors’ and officers’ liability insurance coverage which may be in effect from time to time and/or any indemnification agreement between such individual and the Company.

(e) **Foreign Award Recipients.** Notwithstanding any provision of the Plan to the contrary, in order to comply with the laws in other countries in which the Company and any Subsidiary operate or have employees or other individuals eligible for Awards, the Committee, in its sole discretion, shall have the power and authority to: (i) determine which Subsidiaries, if any, shall be covered by the Plan; (ii) determine which individuals, if any, outside the United States are eligible to participate in the Plan; (iii) modify the terms and conditions of any Award granted to individuals outside the United States to comply with applicable foreign laws; (iv) establish subplans and modify exercise procedures and other terms and procedures, to the extent the Committee determines such actions to be necessary or advisable (and such subplans and/or modifications shall be attached to the Plan as appendices); provided, however, that no such subplans and/or modifications shall increase the share limitation contained in Section 3(a) hereof; and (v) take any action, before or after an Award is made, that the Committee determines to be necessary or advisable to obtain approval or comply with any local governmental regulatory exemptions or approvals.

SECTION 3. **STOCK ISSUABLE UNDER THE PLAN; MERGERS AND OTHER TRANSACTIONS; SUBSTITUTION**

(a) **Stock Issuable.** The maximum number of Shares reserved and available for issuance under the Plan shall be 81,271,240 Shares (the “Share Limit”), subject to adjustment as provided in Section 3(b). For purposes of this limitation, the Shares underlying any Awards that are forfeited, canceled, reacquired by the Company prior to vesting, satisfied without the issuance of Stock or otherwise terminated (other than by exercise) and Shares that are withheld upon exercise of an Option or settlement of an Award to cover the exercise price or tax withholding shall be added back to the Shares available for issuance under the Plan. Subject to such overall limitations, Shares may be issued up to such maximum number pursuant to any type or types of Award, and no more than the Share Limit may be issued pursuant to Incentive Stock Options. The Shares available for issuance under the Plan may be authorized but unissued Shares or Shares reacquired by the Company. Beginning on the date that the Company becomes subject to Section 162(m) of the Code, Options with respect to no more than 110,000 Shares shall be granted to any one individual in any calendar year period. For the avoidance of doubt, Shares issued by the Company as a result of equity awards granted pursuant to any equity incentive plan sponsored by any predecessor to the Company shall be treated as Shares granted under the Plan for purposes of determining the number of Shares available for issuance under the Plan.

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(b) **Changes in Stock.** Subject to Section 3(c) hereof, if, as a result of any reorganization, recapitalization, reclassification, stock dividend, stock split, reverse stock split or other similar change in the Company’s capital stock, the outstanding Shares are increased or decreased or are exchanged for a different number or kind of shares or other securities of the Company (or a parent or subsidiary thereof), or additional Shares or new or different shares or other securities of the Company or other non-cash assets are distributed with respect to such Shares or other securities, in each case, without the receipt of consideration by the Company, or, if, as a result of any merger or consolidation, or sale of all or substantially all of the assets of the Company, the outstanding Shares are converted into or exchanged for other securities of the Company or any successor entity (or a parent or subsidiary thereof), the Committee shall make an appropriate and proportionate adjustment in (i) the maximum number of Shares reserved for issuance under the Plan, (ii) the number and kind of Shares or other securities subject to any then outstanding Awards under the Plan, (iii) the repurchase price, if any, per Share subject to each outstanding Award, and (iv) the exercise price for each Share subject to any then outstanding Stock Options under the Plan, without changing the aggregate exercise price (i.e., the exercise price multiplied by the number of Stock Options) as to which such Stock Options remain exercisable. The Committee shall in any event make such adjustments as may be required by Section 25102(o) of the California Corporation Code and the rules and regulations promulgated thereunder. The adjustment by the Committee shall be final, binding and conclusive. No fractional Shares shall be issued under the Plan resulting from any such adjustment, but the Committee in its discretion may make a cash payment in lieu of fractional shares.

(c) **Sale Events.**

   (i) **Options.**

      (A) In the case of and subject to the consummation of a Sale Event, the Plan and all outstanding Options issued hereunder shall terminate upon the effective time of any such Sale Event unless assumed or continued by the successor entity, or new stock options or other awards of the successor entity or parent thereof are substituted therefor, with an equitable or proportionate adjustment as to the number and kind of shares and, if appropriate, the per share exercise prices, as such parties shall agree (after taking into account any acceleration hereunder and/or pursuant to the terms of any Award Agreement).

      (B) In the event of the termination of the Plan and all outstanding Options issued hereunder pursuant to Section 3(c), each Holder of Options shall be permitted, within a period of time prior to the consummation of the Sale Event as specified by the Committee, to exercise all such Options which are then exercisable or will become exercisable as of the effective time of the Sale Event; provided, however, that the exercise of Options not exercisable prior to the Sale Event shall be subject to the consummation of the Sale Event.
(C) Notwithstanding anything to the contrary in Section 3(c)(i)(A), in the event of a Sale Event, the Company shall have the right, but not the obligation, to make or provide for a cash payment to the Holders of Options, without any consent of the Holders, in exchange for the cancellation thereof, in an amount equal to the difference between (A) the value as determined by the Committee of the consideration payable per share of Stock pursuant to the Sale Event (the “Sale Price”) times the number of Shares subject to outstanding Options being cancelled (to the extent then vested and exercisable, including by reason of acceleration in connection with such Sale Event, at prices not in excess of the Sale Price) and (B) the aggregate exercise price of all such outstanding vested and exercisable Options.

(ii) Restricted Stock and Restricted Stock Unit Awards.

(A) In the case of and subject to the consummation of a Sale Event, all unvested Restricted Stock and unvested Restricted Stock Unit Awards (other than those becoming vested as a result of the Sale Event) issued hereunder shall be forfeited immediately prior to the effective time of any such Sale Event unless assumed or continued by the successor entity, or awards of the successor entity or parent thereof are substituted therefor, with an equitable or proportionate adjustment as to the number and kind of shares subject to such awards as such parties shall agree (after taking into account any acceleration hereunder and/or pursuant to the terms of any Award Agreement).

(B) In the event of the forfeiture of Restricted Stock pursuant to Section 3(c)(ii)(A), such Restricted Stock shall be repurchased from the Holder thereof at a price per share equal to the original per share purchase price paid by the Holder (subject to adjustment as provided in Section 3(b)) for such Shares.

(C) Notwithstanding anything to the contrary in Section 3(c)(ii)(A), in the event of a Sale Event, the Company shall have the right, but not the obligation, to make or provide for a cash payment to the Holders of Restricted Stock or Restricted Stock Unit Awards, without consent of the Holders, in exchange for the cancellation thereof, in an amount equal to the Sale Price times the number of Shares subject to such Awards, to be paid at the time of such Sale Event or upon the later vesting of such Awards.

SECTION 4. ELIGIBILITY

Grantees under the Plan will be such full or part-time officers and other employees, directors, Consultants and key persons of the Company and any Subsidiary who are selected from time to time by the Committee in its sole discretion; provided, however, that Awards shall be granted only to those individuals described in Rule 701(c) of the Securities Act.

SECTION 5. STOCK OPTIONS

Upon the grant of a Stock Option, the Company and the grantee shall enter into an Award Agreement. The terms and conditions of each such Award Agreement shall be determined by the Committee, and such terms and conditions may differ among individual Awards and grantees.
Stock Options granted under the Plan may be either Incentive Stock Options or Non-Qualified Stock Options. Incentive Stock Options may be granted only to employees of the Company or any Subsidiary that is a "subsidiary corporation" within the meaning of Section 424(f) of the Code. To the extent that any Option does not qualify as an Incentive Stock Option, it shall be deemed a Non-Qualified Stock Option.

(a) **Terms of Stock Options.** The Committee in its discretion may grant Stock Options to those individuals who meet the eligibility requirements of Section 4. Stock Options shall be subject to the following terms and conditions and shall contain such additional terms and conditions, not inconsistent with the terms of the Plan, as the Committee shall deem desirable.

(i) **Exercise Price.** The exercise price per share for the Shares covered by a Stock Option shall be determined by the Committee at the time of grant but shall not be less than 100 percent of the Fair Market Value on the Grant Date. In the case of an Incentive Stock Option that is granted to a Ten Percent Owner, the exercise price per share for the Shares covered by such Incentive Stock Option shall not be less than 110 percent of the Fair Market Value on the Grant Date.

(ii) **Option Term.** The term of each Stock Option shall be fixed by the Committee, but no Stock Option shall be exercisable more than ten years from the Grant Date. In the case of an Incentive Stock Option that is granted to a Ten Percent Owner, the term of such Stock Option shall be no more than five years from the Grant Date.

(iii) **Exercisability; Rights of a Stockholder.** Stock Options shall become exercisable and/or vested at such time or times, whether or not in installments, as shall be determined by the Committee at or after the Grant Date. The Award Agreement may permit a grantee to exercise all or a portion of a Stock Option immediately at grant; provided that the Shares issued upon such exercise shall be subject to restrictions and a vesting schedule identical to the vesting schedule of the related Stock Option, such Shares shall be deemed to be Restricted Stock for purposes of the Plan, and the optionee may be required to enter into an additional or new Award Agreement as a condition to exercise of such Stock Option. An optionee shall have the rights of a stockholder only as to Shares acquired upon the exercise of a Stock Option and not as to unexercised Stock Options. An optionee shall not be deemed to have acquired any Shares unless and until a Stock Option shall have been exercised pursuant to the terms of the Award Agreement and this Plan and the optionee’s name has been entered on the books of the Company as a stockholder.

(iv) **Method of Exercise.** Stock Options may be exercised by an optionee in whole or in part, by the optionee giving written or electronic notice of exercise to the Company, specifying the number of Shares to be purchased. Payment of the purchase price may be made by one or more of the following methods (or any combination thereof) to the extent provided in the Award Agreement:

(A) In cash, by certified or bank check, by wire transfer of immediately available funds, or other instrument acceptable to the Committee;
(B) If permitted by the Committee and the Initial Public Offering has occurred (or the Stock otherwise becomes publicly-traded), through the delivery (or attestation to the ownership) of Shares that have been purchased by the optionee on the open market or that are beneficially owned by the optionee and are not then subject to restrictions under any Company plan. To the extent required to avoid variable accounting treatment under ASC 718 or other applicable accounting rules, such surrendered Shares if originally purchased from the Company shall have been owned by the optionee for at least six months. Such surrendered Shares shall be valued at Fair Market Value on the exercise date;

(C) If permitted by the Committee and the Initial Public Offering has occurred (or the Stock otherwise becomes publicly-traded), by the optionee delivering to the Company a properly executed exercise notice together with irrevocable instructions to a broker to promptly deliver to the Company cash or a check payable and acceptable to the Company for the purchase price; provided that in the event the optionee chooses to pay the purchase price as so provided, the optionee and the broker shall comply with such procedures and enter into such agreements of indemnity and other agreements as the Committee shall prescribe as a condition of such payment procedure; or

(D) If permitted by the Committee, and only with respect to Stock Options that are not Incentive Stock Options, by a “net exercise” arrangement pursuant to which the Company will reduce the number of Shares issuable upon exercise by the largest whole number of Shares with a Fair Market Value that does not exceed the aggregate exercise price.

Payment instruments will be received subject to collection. No certificates for Shares so purchased will be issued to the optionee or, with respect to uncertificated Stock, no transfer to the optionee on the records of the Company will take place, until the Company has completed all steps it has deemed necessary to satisfy legal requirements relating to the issuance and sale of the Shares, which steps may include, without limitation, (i) receipt of a representation from the optionee at the time of exercise of the Option that the optionee is purchasing the Shares for the optionee’s own account and not with a view to any sale or distribution of the Shares or other representations relating to compliance with applicable law governing the issuance of securities, (ii) the legending of the certificate (or notation on any book entry) representing the Shares to evidence the foregoing restrictions, and (iii) obtaining from optionee payment or provision for all withholding taxes due as a result of the exercise of the Option. The delivery of certificates representing the shares of Stock (or the transfer to the optionee on the records of the Company with respect to uncertificated Stock) to be purchased pursuant to the exercise of a Stock Option will be contingent upon (A) receipt from the optionee (or a purchaser acting in his or her stead in accordance with the provisions of the Stock Option) by the Company of the full purchase price for such Shares and the fulfillment of any other requirements contained in the Award Agreement or applicable provisions of laws and (B) if required by the Company, the optionee shall have entered into any stockholders agreements or other agreements with the Company and/or certain other of the Company’s stockholders relating to the Stock. In the event an optionee chooses to pay the purchase price by previously-owned Shares through the attestation method, the number of Shares transferred to the optionee upon the exercise of the Stock Option shall be net of the number of Shares attested to.
(b) **Annual Limit on Incentive Stock Options.** To the extent required for “incentive stock option” treatment under Section 422 of the Code, the aggregate Fair Market Value (determined as of the Grant Date) of the Shares with respect to which Incentive Stock Options granted under the Plan and any other plan of the Company or its parent and any Subsidiary that become exercisable for the first time by an optionee during any calendar year shall not exceed $100,000 or such other limit as may be in effect from time to time under Section 422 of the Code. To the extent that any Stock Option exceeds this limit, it shall constitute a Non-Qualified Stock Option.

(c) **Termination.** Any portion of a Stock Option that is not vested and exercisable on the date of termination of an optionee’s Service Relationship shall immediately expire and be null and void. Once any portion of the Stock Option becomes vested and exercisable, the optionee’s right to exercise such portion of the Stock Option (or the optionee’s representatives and legatees as applicable) in the event of a termination of the optionee’s Service Relationship shall continue until the earliest of: (i) the date which is: (A) 12 months following the date on which the optionee’s Service Relationship terminates due to death or Disability (or such longer period of time as determined by the Committee and set forth in the applicable Award Agreement), or (B) three months following the date on which the optionee’s Service Relationship terminates if the termination is due to any reason other than death or Disability (or such longer period of time as determined by the Committee and set forth in the applicable Award Agreement), or (ii) the Expiration Date set forth in the Award Agreement; provided that notwithstanding the foregoing, an Award Agreement may provide that if the optionee’s Service Relationship is terminated for Cause, the Stock Option shall terminate immediately and be null and void upon the date of the optionee’s termination and shall not thereafter be exercisable.

**SECTION 6. RESTRICTED STOCK AWARDS**

(a) **Nature of Restricted Stock Awards.** The Committee may, in its sole discretion, grant (or sell at par value or such other purchase price determined by the Committee) to an eligible individual under Section 4 hereof a Restricted Stock Award under the Plan. The Committee shall determine the restrictions and conditions applicable to each Restricted Stock Award at the time of grant. Conditions may be based on continuing employment (or other Service Relationship), achievement of pre-established performance goals and objectives and/or such other criteria as the Committee may determine. Upon the grant of a Restricted Stock Award, the Company and the grantee shall enter into an Award Agreement. The terms and conditions of each such Award Agreement shall be determined by the Committee, and such terms and conditions may differ among individual Awards and grantees.

(b) **Rights as a Stockholder.** Upon the grant of the Restricted Stock Award and payment of any applicable purchase price, and satisfaction of any other conditions required by the Committee, a grantee of Restricted Stock shall be considered the record owner of and shall be entitled to vote the Restricted Stock if, and to the extent, such Shares are entitled to voting rights, subject to such conditions contained in the Award Agreement. The grantee shall be entitled to receive all dividends and any other distributions declared on the Shares; provided, however, that the Company is under no duty to declare any such dividends or to make any such distribution. Unless the Committee shall otherwise determine, certificates evidencing the Restricted Stock shall remain in the possession of the Company until such Restricted Stock is vested as provided in subsection (d) below of this Section, and the grantee shall be required, as a condition of the grant, to deliver to the Company a stock power endorsed in blank and such other instruments of transfer as the Committee may prescribe.
(c) **Restrictions.** Restricted Stock may not be sold, assigned, transferred, pledged or otherwise encumbered or disposed of except as specifically provided herein or in the Award Agreement. Except as may otherwise be provided by the Committee either in the Award Agreement or, subject to Section 12 below, in writing after the Award Agreement is issued, if a grantee’s Service Relationship with the Company and any Subsidiary terminates, the Company or its assigns shall have the right, as may be specified in the relevant instrument, to repurchase some or all of the Shares subject to the Award at such purchase price as is set forth in the Award Agreement.

(d) **Vesting of Restricted Stock.** The Committee at the time of grant shall specify in the Award Agreement the date or dates and/or the attainment of pre-established performance goals, objectives and other conditions on which the substantial risk of forfeiture imposed shall lapse and the Restricted Stock shall become vested, subject to such further rights of the Company or its assigns as may be specified in the Award Agreement.

**SECTION 7. UNRESTRICTED STOCK AWARDS**

The Committee may, in its sole discretion, grant (or sell at par value or such other purchase price determined by the Committee) to an eligible person under Section 4 hereof an Unrestricted Stock Award under the Plan. Unrestricted Stock Awards may be granted in respect of past services or other valid consideration, or in lieu of cash compensation due to such grantee.

**SECTION 8. RESTRICTED STOCK UNITS**

(a) **Nature of Restricted Stock Units.** The Committee may, in its sole discretion, grant to an eligible person under Section 4 hereof Restricted Stock Units under the Plan. The Committee shall determine the restrictions and conditions applicable to each Restricted Stock Unit at the time of grant. Vesting conditions may be based on continuing employment (or other Service Relationship), achievement of pre-established performance goals and objectives and/or other such criteria as the Committee may determine. Upon the grant of Restricted Stock Units, the grantee and the Company shall enter into an Award Agreement. The terms and conditions of each such Award Agreement shall be determined by the Committee and may differ among individual Awards and grantees. On or promptly following the vesting date or dates applicable to any Restricted Stock Unit, but in no event later than March 15 of the year following the year in which such vesting occurs, such Restricted Stock Unit(s) shall be settled in the form of cash or shares of Stock, as specified in the Award Agreement. Restricted Stock Units may not be sold, assigned, transferred, pledged, or otherwise encumbered or disposed of.

(b) **Rights as a Stockholder.** A grantee shall have the rights of a stockholder only as to Shares, if any, acquired upon settlement of Restricted Stock Units. A grantee shall not be deemed to have acquired any such Shares unless and until the Restricted Stock Units shall have been settled in Shares pursuant to the terms of the Plan and the Award Agreement, the Company shall have issued and delivered a certificate representing the Shares to the grantee (or transferred on the records of the Company with respect to uncertificated stock), and the grantee’s name has been entered in the books of the Company as a stockholder.
(c) **Termination.** Except as may otherwise be provided by the Committee either in the Award Agreement or in writing after the Award Agreement is issued, a grantee’s right in all Restricted Stock Units that have not vested shall automatically terminate upon the grantee’s cessation of Service Relationship with the Company and any Subsidiary for any reason.

**SECTION 9. TRANSFER RESTRICTIONS; COMPANY RIGHT OF FIRST REFUSAL; COMPANY REPURCHASE RIGHTS**

(a) **Restrictions on Transfer.**

(i) **Non-Transferability of Stock Options.** Stock Options and, prior to exercise, the Shares issuable upon exercise of such Stock Option, shall not be transferable by the optionee otherwise than by will, or by the laws of descent and distribution, and all Stock Options shall be exercisable, during the optionee’s lifetime, only by the optionee, or by the optionee’s legal representative or guardian in the event of the optionee’s incapacity. Notwithstanding the foregoing, the Committee, in its sole discretion, may provide in the Award Agreement regarding a given Stock Option that the optionee may transfer by gift, without consideration for the transfer, his or her Non-Qualified Stock Options to his or her family members (as defined in Rule 701 of the Securities Act), to trusts for the benefit of such family members, or to partnerships in which such family members are the only partners (to the extent such trusts or partnerships are considered “family members” for purposes of Rule 701 of the Securities Act), provided that the transferee agrees in writing with the Company to be bound by all of the terms and conditions of this Plan and the applicable Award Agreement, including the execution of a stock power upon the issuance of Shares. Stock Options, and the Shares issuable upon exercise of such Stock Options, shall be restricted as to any pledge, hypothecation, or other transfer, including any short position, any “put equivalent position” (as defined in the Exchange Act) or any “call equivalent position” (as defined in the Exchange Act) prior to exercise.

(ii) **Shares.** No Shares shall be sold, assigned, transferred, pledged, hypothecated, given away or in any other manner disposed of or encumbered, whether voluntarily or by operation of law, unless (i) the transfer is in compliance with the terms of the applicable Award Agreement, all applicable securities laws (including, without limitation, the Securities Act), and with the terms and conditions of this Section 9, (ii) the transfer does not cause the Company to become subject to the reporting requirements of the Exchange Act, and (iii) the transferee consents in writing to be bound by the provisions of the Plan and the Award Agreement, including this Section 9. In connection with any proposed transfer, the Committee may require the transferor to provide at the transferor’s own expense an opinion of counsel to the transferor, satisfactory to the Committee, that such transfer is in compliance with all foreign, federal and state securities laws (including, without limitation, the Securities Act). Any attempted transfer of Shares not in accordance with the terms and conditions of this Section 9 shall be null and void, and the Company shall not reflect on its records any change in record ownership of any Shares as a result of any such transfer, shall otherwise refuse to recognize any such transfer and shall not in any way give effect to any such transfer of Shares. The Company shall be entitled to seek protective orders, injunctive relief and other remedies available at law or
in equity including, without limitation, seeking specific performance or the rescission of any transfer not made in strict compliance with the provisions of this Section 9. Subject to the foregoing general provisions, and unless otherwise provided in the applicable Award Agreement, Shares may be transferred pursuant to the following specific terms and conditions (provided that with respect to any transfer of Restricted Stock, all vesting and forfeiture provisions shall continue to apply with respect to the original recipient):

(A) Transfers to Permitted Transferees. The Holder may transfer any or all of the Shares to one or more Permitted Transferees; provided, however, that following such transfer, such Shares shall continue to be subject to the terms of this Plan (including this Section 9) and such Permitted Transferee(s) shall, as a condition to any such transfer, deliver a written acknowledgment to that effect to the Company and shall deliver a stock power to the Company with respect to the Shares. Notwithstanding the foregoing, the Holder may not transfer any of the Shares to a Person whom the Company reasonably determines is a direct competitor or a potential competitor of the Company or any of its Subsidiaries.

(B) Transfers Upon Death. Upon the death of the Holder, any Shares then held by the Holder at the time of such death and any Shares acquired after the Holder’s death by the Holder’s legal representative shall be subject to the provisions of this Plan, and the Holder’s estate, executors, administrators, personal representatives, heirs, legatees and distributees shall be obligated to convey such Shares to the Company or its assigns under the terms contemplated by the Plan and the Award Agreement.

(b) Right of First Refusal. In the event that a Holder desires at any time to sell or otherwise transfer all or any part of his or her Shares (other than shares of Restricted Stock which by their terms are not transferrable), the Holder first shall give written notice to the Company of the Holder’s intention to make such transfer. Such notice shall state the number of Shares that the Holder proposes to sell (the “Offered Shares”), the price and the terms at which the proposed sale is to be made and the name and address of the proposed transferee. At any time within 60 days after the receipt of such notice by the Company, the Company or its assigns may elect to purchase all or any portion of the Offered Shares at the price and on the terms offered by the proposed transferee and specified in the notice. The Company or its assigns shall exercise this right by mailing or delivering written notice to the Holder within the foregoing 60-day period. If the Company or its assigns elect to exercise its purchase rights under this Section 9(b), the closing for such purchase shall, in any event, take place within 90 days after the receipt by the Company of the initial notice from the Holder. In the event that the Company or its assigns do not elect to exercise such purchase right, or in the event that the Company or its assigns do not pay the full purchase price within such 90-day period, the Holder may, within 60 days thereafter, sell the Offered Shares to the proposed transferee and at the same price and on the same terms as specified in the Holder’s notice. Any Shares not sold to the proposed transferee shall remain subject to the Plan. If the Holder is a party to any stockholders agreements or other agreements with the Company and/or certain other of the Company’s stockholders relating to the Shares, (i) the transferring Holder shall comply with the requirements of such stockholders agreements or other agreements relating to any proposed transfer of the Offered Shares, and (ii) any proposed transferee that purchases Offered Shares shall enter into such stockholders agreements or other agreements with the Company and/or certain of the
Company’s stockholders relating to the Offered Shares on the same terms and in the same capacity as the transferring Holder. The consideration for such Offered Shares shall be paid to the Holder in the form of either a certified or bank cashier’s check, a wire transfer of immediately available U.S. funds to an account or accounts designated by the Holder, a promissory note (which shall be payable upon the earlier of a Sale Event or the maturity date of such promissory note as determined by the Company in its sole discretion), or by another form of payment approved by the Company.

(c) Company’s Right of Repurchase.

(i) Right of Repurchase for Unvested Shares Issued Upon the Exercise of an Option. Upon a Repurchase Event with respect to any Holder of Shares, the Company or its assigns shall have the right and option to repurchase from such Holder all Shares acquired upon exercise of a Stock Option. Such repurchase rights may be exercised by the Company within the later of (A) 12 months following the date of such Repurchase Event or (B) seven months after the acquisition of Shares upon exercise of a Stock Option. The repurchase price shall be equal to the lower of the original per share price paid by the Holder, subject to adjustment as provided in Section 3(b) of the Plan, or the current Fair Market Value of such Shares as of the date the Company elects to exercise its repurchase rights in connection with a Repurchase Event.

(ii) Right of Repurchase With Respect to Restricted Stock. Upon a Repurchase Event with respect to any Holder of Shares, the Company or its assigns shall have the right and option to repurchase from such Holder any Shares received pursuant to a Restricted Stock Award. Such repurchase right may be exercised by the Company within 12 months following the date of such Repurchase Event. The repurchase price shall be the lower of the original per share purchase price paid by the Holder, subject to adjustment as provided in Section 3(b) of the Plan, or the current Fair Market Value of such Shares as of the date the Company elects to exercise its repurchase rights.

(iii) Procedure. Any repurchase right of the Company shall be exercised by the Company or its assigns by giving the Holder written notice on or before the last day of the repurchase period of its intention to exercise such repurchase right. Upon such notification, the Holder shall promptly surrender to the Company, free and clear of any liens or encumbrances, any certificates representing the Shares being purchased, together with a duly executed stock power for the transfer of such Shares to the Company or the Company’s assignee or assignees. Upon the Company’s or its assignee’s receipt of the certificates from the Holder, the Company or its assignee or assignees shall deliver to him, her or them a check for the applicable repurchase price; provided, however, that the Company may pay the repurchase price by offsetting and canceling any indebtedness then owed by the Holder to the Company. Such consideration shall be paid to the Holder in the form of either a certified or bank cashier’s check, a wire transfer of immediately available U.S.

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(d) **Drag Along Right.** In the event the holders of a majority of the Company’s equity securities then outstanding (the “Majority Stockholders”) determine to enter into a Sale Event in a bona fide negotiated transaction (a “Sale”), with a Person, or group of Persons, (in each case, the “Buyer”), a Holder of Shares, including any Permitted Transferee, shall be obligated to and shall upon the written request of the Majority Stockholders: (a) sell, transfer and deliver, or cause to be sold, transferred and delivered, to the Buyer, his or her Shares (including for this purpose all of such Holder’s Shares that presently or as a result of any such transaction may be acquired upon the exercise of an Option (following the payment of the exercise price therefor)) on substantially the same terms applicable to the Majority Stockholders (with appropriate adjustments to reflect the conversion of convertible securities, the redemption of redeemable securities and the exercise of exercisable securities as well as the relative preferences and priorities of preferred stock); (b) execute and deliver such instruments of conveyance and transfer and take such other action, including voting such Shares in favor of any Sale proposed by the Majority Stockholders and executing any purchase agreements, merger agreements, indemnity agreements, escrow agreements or related documents as the Majority Stockholders or the Buyer may reasonably require in order to carry out the terms and provisions of this Section 9(d) and (c) refrain from exercising any dissenters’ rights or rights of appraisal under applicable law at any time with respect to such Sale.

(e) **Escrow Arrangement.**

(i) **Escrow.** In order to carry out the provisions of this Section 9 of this Plan more effectively, the Company shall hold any Shares issued pursuant to Awards granted under the Plan in escrow together with separate stock powers executed by the Holder in blank for transfer. The Company shall not dispose of the Shares except as otherwise provided in this Plan. In the event of any repurchase by the Company (or any of its assigns), the Company is hereby authorized by the Holder, as the Holder’s attorney-in-fact, to date and complete the stock powers necessary for the transfer of the Shares being purchased and to transfer such Shares in accordance with the terms hereof. At such time as any Shares are no longer subject to the Company’s repurchase and first refusal rights, the Company shall, at the written request of the Holder, deliver to the Holder a certificate representing such Shares with the balance of the Shares to be held in escrow pursuant to this Section.

(ii) **Remedy.** Without limitation of any other provision of this Plan or other rights, in the event that a Holder or any other Person is required to sell a Holder’s Shares pursuant to the provisions of Sections 9(b) or (c) hereof and in the further event that he or she refuses or for any reason fails to deliver to the Company or its designated purchaser of such Shares the certificate or certificates evidencing such Shares together with a related stock power, the Company or such designated purchaser may deposit the applicable purchase price for such Shares with a bank designated by the Company, or with the Company’s independent public accounting firm, as agent or trustee, or in escrow, for such Holder or other Person, to be held by such bank or accounting firm for the benefit of and for delivery to him, her, them or it, and/or, in its discretion, pay such purchase price by offsetting any indebtedness then owed by such Holder as provided above. Upon any such deposit and/or offset by the Company or its designated purchaser of such amount and upon notice to the Person who was required to sell the Shares to be sold pursuant to the provisions of Sections 9(b) or (c), such Shares shall at such time be deemed to have been sold, assigned, transferred and conveyed to such purchaser, such Holder shall have no further rights thereto (other than the right to withdraw the payment thereof held in escrow, if applicable), and the Company shall record such transfer in its stock transfer book or in any appropriate manner.

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(f) **Lockup Provision.** If requested by the Company, a Holder shall not sell or otherwise transfer or dispose of any Shares (including, without limitation, pursuant to Rule 144 under the Securities Act) held by him or her for such period following the effective date of a public offering by the Company of Shares as the Company shall specify reasonably and in good faith. If requested by the underwriter engaged by the Company, each Holder shall execute a separate letter confirming his or her agreement to comply with this Section.

(g) **Adjustments for Changes in Capital Structure.** If, as a result of any reorganization, recapitalization, reclassification, stock dividend, stock split, reverse stock split or other similar change in the Common Stock, the outstanding Shares are increased or decreased or are exchanged for a different number or kind of securities of the Company, the restrictions contained in this Section 9 shall apply with equal force to additional and/or substitute securities, if any, received by Holder in exchange for, or by virtue of his or her ownership of, Shares.

(h) **Termination.** The terms and provisions of Sections 9(b) and (d) hereof shall terminate upon the closing of the Company’s Initial Public Offering or upon consummation of any Sale Event, in either case as a result of which Shares are registered under Section 12 of the Exchange Act and publicly-traded on any national security exchange.

SECTION 10. **TAX WITHHOLDING**

(a) **Payment by Grantee.** Each grantee shall, no later than the date as of which the value of an Award or of any Shares or other amounts received thereunder first becomes includable in the gross income of the grantee for income tax purposes, pay to the Company, or make arrangements satisfactory to the Committee regarding payment of, any Federal, state, or local taxes of any kind required by law to be withheld by the Company with respect to such income. The Company and any Subsidiary shall, to the extent permitted by law, have the right to deduct any such taxes from any payment of any kind otherwise due to the grantee. The Company’s obligation to deliver stock certificates (or evidence of book entry) to any grantee is subject to and conditioned on any such tax withholding obligations being satisfied by the grantee.

(b) **Payment in Stock.** The tax withholding obligation described in Section 10(a) may, in the Company’s sole discretion, be satisfied, in whole or in part, by the Company withholding from Shares to be issued pursuant to an Award; provided that the number of Shares so withheld shall have an aggregate Fair Market Value (as of the date the withholding is effected) no greater than the amount that would satisfy the withholding amount due based on the maximum statutory withholding rates in the grantee’s applicable jurisdiction.

SECTION 11. **SECTION 409A AWARDS.**

To the extent that any Award is determined to constitute “nonqualified deferred compensation” within the meaning of Section 409A (a “409A Award”), the Award shall be subject to such additional rules and requirements as may be specified by the Committee from time to time. In this regard, if any amount under a 409A Award is payable upon a “separation
from service” (within the meaning of Section 409A) to a grantee who is considered a “specified employee” (within the meaning of Section 409A), then no such payment shall be made prior to the date that is the earlier of (i) six months and one day after the grantee’s separation from service, or (ii) the grantee’s death, but only to the extent such delay is necessary to prevent such payment from being subject to interest, penalties and/or additional tax imposed pursuant to Section 409A. The Company makes no representation or warranty and shall have no liability to any grantee under the Plan or any other Person with respect to any penalties or taxes under Section 409A that are, or may be, imposed with respect to any Award.

SECTION 12. AMENDMENTS AND TERMINATION

The Board may, at any time, amend or discontinue the Plan and the Committee may, at any time, amend or cancel any outstanding Award for the purpose of satisfying changes in law or for any other lawful purpose, but no such action shall adversely affect rights under any outstanding Award without the consent of the holder of the Award. The Committee may exercise its discretion to reduce the exercise price of outstanding Stock Options or effect repricing through cancellation of outstanding Stock Options and by granting such holders new Awards in replacement of the cancelled Stock Options. To the extent determined by the Committee to be required either by the Code to ensure that Incentive Stock Options granted under the Plan are qualified under Section 422 of the Code or otherwise, Plan amendments shall be subject to approval by the Company stockholders entitled to vote at a meeting of stockholders. Nothing in this Section 12 shall limit the Board’s or Committee’s authority to take any action permitted pursuant to Section 3(c). The Board reserves the right to amend the Plan and/or the terms of any outstanding Stock Options to the extent reasonably necessary to comply with the requirements of the exemption pursuant to paragraph (i)(4) of Rule 12h-1 of the Exchange Act.

SECTION 13. STATUS OF PLAN

With respect to the portion of any Award that has not been exercised and any payments in cash, Stock or other consideration not received by a grantee, a grantee shall have no rights greater than those of a general creditor of the Company unless the Committee shall otherwise expressly so determine in connection with any Award.

SECTION 14. GENERAL PROVISIONS

(a) No Distribution; Compliance with Legal Requirements. The Committee may require each person acquiring Shares pursuant to an Award to represent to and agree with the Company in writing that such person is acquiring the Shares without a view to distribution thereof. No Shares shall be issued pursuant to an Award until all applicable securities law and other legal and stock exchange or similar requirements have been satisfied. The Committee may require the placing of such stop-orders and restrictive legends on certificates for Stock and Awards as it deems appropriate.

(b) Delivery of Stock Certificates. Stock certificates to grantees under the Plan shall be deemed delivered for all purposes when the Company or a stock transfer agent of the Company shall have mailed such certificates in the United States mail, addressed to the grantee, at the grantee’s last known address on file with the Company; provided that stock certificates to
be held in escrow pursuant to Section 9 of the Plan shall be deemed delivered when the Company shall have recorded the issuance in its records. Uncertificated Stock shall be deemed delivered for all purposes when the Company or a stock transfer agent of the Company shall have given to the grantee by electronic mail (with proof of receipt) or by United States mail, addressed to the grantee, at the grantee’s last known address on file with the Company, notice of issuance and recorded the issuance in its records (which may include electronic “book entry” records).

(c) **No Employment Rights.** The adoption of the Plan and the grant of Awards do not confer upon any Person any right to continued employment or Service Relationship with the Company or any Subsidiary.

(d) **Trading Policy Restrictions.** Option exercises and other Awards under the Plan shall be subject to the Company’s insider trading policy-related restrictions, terms and conditions as may be established by the Committee, or in accordance with policies set by the Committee, from time to time.

(e) **Designation of Beneficiary.** Each grantee to whom an Award has been made under the Plan may designate a beneficiary or beneficiaries to exercise any Award on or after the grantee’s death or receive any payment under any Award payable on or after the grantee’s death. Any such designation shall be on a form provided for that purpose by the Committee and shall not be effective until received by the Committee. If no beneficiary has been designated by a deceased grantee, or if the designated beneficiaries have predeceased the grantee, the beneficiary shall be the grantee’s estate.

(f) **Legend.** Any certificate(s) representing the Shares shall carry substantially the following legend (and with respect to uncertificated Stock, the book entries evidencing such shares shall contain the following notation):

   "The transferability of this certificate and the shares of stock represented hereby are subject to the restrictions, terms and conditions (including repurchase and restrictions against transfers) contained in the Moderna Therapeutics, Inc. 2016 Stock Option and Grant Plan and any agreements entered into thereunder by and between the company and the holder of this certificate (a copy of which is available at the offices of the company for examination)."

(g) **Information to Holders of Options.** In the event the Company is relying on the exemption from the registration requirements of Section 12(g) of the Exchange Act contained in paragraph (9)(1) of Rule 12b-1 of the Exchange Act, the Company shall provide the information described in Rule 701(c)(2), (3), (4) and (5) of the Securities Act to all holders of Options in accordance with the requirements thereunder. The foregoing notwithstanding, the Company shall not be required to provide such information unless the optionholder has agreed in writing, on a form prescribed by the Company, to keep such information confidential.
SECTION 15. EFFECTIVE DATE OF PLAN

The Plan shall become effective upon adoption by the Board and shall be approved by stockholders in accordance with applicable state law and the Company’s articles of incorporation and bylaws within 12 months thereafter. If the stockholders fail to approve the Plan within 12 months after its adoption by the Board of Directors, then any Awards granted or sold under the Plan shall be rescinded and no additional grants or sales shall thereafter be made under the Plan. Subject to such approval by stockholders and to the requirement that no Shares may be issued hereunder prior to such approval, Stock Options and other Awards may be granted hereunder on and after adoption of the Plan by the Board. No grants of Stock Options and other Awards may be made hereunder after the tenth anniversary of the date the Plan is adopted by the Board or the date the Plan is approved by the Company’s stockholders, whichever is earlier.

SECTION 16. GOVERNING LAW

This Plan, all Awards and any controversy arising out of or relating to this Plan and all Awards shall be governed by and construed in accordance with the General Corporation Law of the State of Delaware as to matters within the scope thereof, and as to all other matters shall be governed by and construed in accordance with the internal laws of the Commonwealth of Massachusetts, without regard to conflict of law principles that would result in the application of any law other than the law of the Commonwealth of Massachusetts.

DATE ADOPTED BY THE BOARD OF DIRECTORS: August 10, 2016

DATE APPROVED BY THE STOCKHOLDERS: August 10, 2016
In accordance with the provisions of the Moderna Therapeutics, Inc. 2016 Stock Option and Grant Plan (the “Plan”), the Plan is hereby amended as follows:

1. Section 3(a) is hereby amended and restated as follows:

   “(a) **Stock Issuable.** The maximum number of Shares reserved and available for issuance under the Plan shall be 105,271,248 Shares (the “Share Limit”), subject to adjustment as provided in Section 3(b). For purposes of this limitation, the Shares underlying any Awards that are forfeited, canceled, reacquired by the Company prior to vesting, satisfied without the issuance of Stock or otherwise terminated (other than by exercise) and Shares that are withheld upon exercise of an Option or settlement of an Award to cover the exercise price or tax withholding shall be added back to the Shares available for issuance under the Plan. Subject to such overall limitations, Shares may be issued up to such maximum number pursuant to any type or types of Award, and no more than the Share Limit may be issued pursuant to Incentive Stock Options. The Shares available for issuance under the Plan may be authorized but unissued Shares or Shares reacquired by the Company. Beginning on the date that the Company becomes subject to Section 162(m) of the Code, Options with respect to no more than 110,000 Shares shall be granted to any one individual in any calendar year period. For the avoidance of doubt, Shares issued by the Company as a result of equity awards granted pursuant to any equity incentive plan sponsored by any predecessor to the Company shall be treated as Shares granted under the Plan for purposes of determining the number of Shares available for issuance under the Plan.

2. Except as modified herein, the Plan is not modified in any respect and remains in full force and effect.

Approved by the Board of Directors: February 23, 2017

Approved by the Stockholders: March 3, 2017
In accordance with the provisions of the Moderna Therapeutics, Inc. 2016 Stock Option and Grant Plan (the “Plan”), the Plan is hereby amended as follows:

1. Section 3(a) is hereby amended and restated as follows:

“(a) Stock Issuable. The maximum number of Shares reserved and available for issuance under the Plan shall be **130,271,240** Shares (the “Share Limit”), subject to adjustment as provided in Section 3(b). For purposes of this limitation, the Shares underlying any Awards that are forfeited, canceled, reacquired by the Company prior to vesting, satisfied without the issuance of Stock or otherwise terminated (other than by exercise) and Shares that are withheld upon exercise of an Option or settlement of an Award to cover the exercise price or tax withholding shall be added back to the Shares available for issuance under the Plan. Subject to such overall limitations, Shares may be issued up to such maximum number pursuant to any type or types of Award, and no more than the Share Limit may be issued pursuant to Incentive Stock Options. The Shares available for issuance under the Plan may be authorized but unissued Shares or Shares reacquired by the Company.

2. Except as modified herein, the Plan is not modified in any respect and remains in full force and effect.

Approved by the Board of Directors: February 28, 2018

Approved by the Stockholders: March 7, 2018
In accordance with the provisions of the Moderna Therapeutics, Inc. 2016 Stock Option and Grant Plan (as amended from time to time, the “Plan”), the Plan is hereby amended as follows:

1. Section 5(a)(iv)(C) is hereby deleted in its entirety and replaced with the following:

“If the Initial Public Offering has occurred (or the Stock otherwise becomes publicly-traded), by the optionee delivering to the Company a properly executed exercise notice together with irrevocable instructions to a broker to promptly deliver to the Company cash or a check payable and acceptable to the Company for the purchase price; provided that in the event the optionee chooses to pay the purchase price as so provided, the optionee and the broker shall comply with such procedures and enter into such agreements of indemnity and other agreements as the Committee shall prescribe as a condition of such payment procedure. For the avoidance of doubt, this provision shall apply to any and all Stock Options which have been granted under the Plan, including prior to any amendments thereto; or”

2. The first sentence in Section 9(a)(i) is hereby deleted in its entirety and replaced with the following:

“Non-Transferability of Stock Options. Stock Options and, prior to exercise, the Shares issuable upon exercise of such Stock Option, shall not be transferable by the optionee otherwise than by will, or by the laws of descent and distribution or pursuant to a domestic relations order, and all Stock Options shall be exercisable, during the optionee’s lifetime, only by the optionee, or by the optionee’s legal representative or guardian in the event of the optionee’s incapacity.”

3. Section 9(h) is hereby deleted in its entirety and replaced with the following:

“Termination. The terms and provisions of Sections 9(b), (c) (except for the Company’s right and option to repurchase Shares still subject to a risk of forfeiture upon a Repurchase Event) and (d) hereof shall terminate upon the closing of the Company’s Initial Public Offering or upon consummation of any Sale Event, in either case as a result of which Shares are registered under Section 12 of the Exchange Act and publicly-traded on any national security exchange.”

4. The following sentence is hereby added to the end of Section 3(c)(i)(A):

“In the event the Plan and all outstanding Options terminate in connection with a Sale Event, and the Initial Public Offering has occurred (or the Stock otherwise becomes publicly-traded), except as the Committee may otherwise specify with respect to particular Options in the relevant Award Agreement, all Options that are not vested and exercisable immediately prior to the effective time of the Sale Event shall become fully vested and exercisable as of the consummation of the Sale Event.”
5. The following sentence is hereby added to the end of Section 3(c)(ii)(A):

“In the event all outstanding and unvested Restricted Stock and Restricted Stock Unit Awards shall be forfeited in connection with a Sale Event, and the Initial Public Offering has occurred (or the Stock otherwise becomes publicly-traded), except as the Committee may otherwise specify with respect to particular Restricted Stock or Restricted Stock Unit Awards in the relevant Award Agreement, all Restricted Stock or Restricted Stock Units shall become fully vested and nonforfeitable as of such consummation.”

6. Except as modified herein, the Plan is not modified in any respect and remains in full force and effect.

Approved by the Board of Directors: November 4, 2018
Pursuant to the Moderna Therapeutics, Inc. 2016 Stock Option and Grant Plan (the “Plan”), Moderna Therapeutics, Inc., a Delaware corporation (together with any successor, the “Company”), has granted to the individual named below, an option (the “Stock Option”) to purchase on or prior to the Expiration Date, or such earlier date as is specified herein, all or any part of the number of shares of Common Stock, par value $0.0001 per share (“Common Stock”), of the Company indicated below (the “Shares”), at the Option Exercise Price per share, subject to the terms and conditions set forth in this Incentive Stock Option Grant Notice (the “Grant Notice”), the attached Incentive Stock Option Agreement (the “Agreement”) and the Plan. This Stock Option is intended to qualify as an “incentive stock option” as defined in Section 422(b) of the Internal Revenue Code of 1986, as amended from time to time (the “Code”). To the extent that any portion of the Stock Option does not so qualify, it shall be deemed a non-qualified stock option.

Name of Optionee: ____________________ (the “Optionee”)
No. of Shares: __________ Shares of Common Stock
Grant Date: _______________ (the “Grant Date”)
Vesting Commencement Date: _______________ (the “Vesting Commencement Date”)
Expiration Date: _______________ (the “Expiration Date”)
Option Exercise Price/Share: $_____________ (the “Option Exercise Price”)
Vesting Schedule: 25 percent of the Shares shall vest and become exercisable on the first anniversary of the Vesting Commencement Date; provided that the Optionee continues to have a Service Relationship with the Company at such time. Thereafter, the remaining 75 percent of the Shares shall vest and become exercisable in 12 equal installments at the end of each calendar quarter following the first anniversary of the Vesting Commencement Date, provided the Optionee continues to have a Service Relationship with the Company at such time. Any fractional Shares, if applicable, shall be aggregated and vest with the last of the 12 installments. Notwithstanding anything in the Agreement to the contrary, in the case of a Sale Event, this Stock Option and the Shares shall be treated as provided in Section 3(c) of the Plan. For the avoidance of doubt, any Shares with a vesting date occurring on or prior to the Grant Date will be vested and exercisable as of the Grant Date.

Attachments: Incentive Stock Option Agreement, 2016 Stock Option and Grant Plan
INCENTIVE STOCK OPTION AGREEMENT
UNDER THE MODERNA THERAPEUTICS, INC.
2016 STOCK OPTION AND GRANT PLAN

All capitalized terms used herein and not otherwise defined shall have the respective meanings set forth in the Grant Notice and the Plan.

1. Vesting, Exercisability and Termination.

(a) No portion of this Stock Option may be exercised until such portion shall have vested and become exercisable.

(b) Except as set forth below, and subject to the determination of the Committee in its sole discretion to accelerate the vesting schedule hereunder, this Stock Option shall be vested and exercisable on the respective dates indicated below:

(i) This Stock Option shall initially be unvested and unexercisable (except as may otherwise be set forth in the Grant Notice).

(ii) This Stock Option shall vest and become exercisable in accordance with the Vesting Schedule set forth in the Grant Notice.

(c) Termination. Except as may otherwise be provided by the Committee, if the Optionee’s Service Relationship is terminated, the period within which to exercise this Stock Option will be subject to earlier termination as set forth below (and if not exercised within such period, shall thereafter terminate subject, in each case, to Section 3(c) of the Plan):

(i) Termination Due to Death or Disability. If the Optionee’s Service Relationship terminates by reason of such Optionee’s death or Disability, this Stock Option may be exercised, to the extent exercisable on the date of such termination, by the Optionee, the Optionee’s legal representative or legatee for a period of 12 months from the date of death or Disability or until the Expiration Date, if earlier.

(ii) Other Termination. If the Optionee’s Service Relationship terminates for any reason other than death or Disability, and unless otherwise determined by the Committee, this Stock Option may be exercised, to the extent exercisable on the date of termination, for a period of 90 days from the date of termination or until the Expiration Date, if earlier; provided however, if the Optionee’s Service Relationship is terminated for Cause, this Stock Option shall terminate immediately upon the date of such termination.

For purposes hereof, the Committee’s determination of the reason for termination of the Optionee’s Service Relationship shall be conclusive and binding on the Optionee and his or her representatives or legatees. Any portion of this Stock Option that is not vested and exercisable on the date of termination of the Service Relationship shall terminate immediately and be null and void.

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(d) It is understood and intended that this Stock Option is intended to qualify as an “incentive stock option” as defined in Section 422 of the Code to the extent permitted under applicable law. Accordingly, the Optionee understands that in order to obtain the benefits of an incentive stock option under Section 422 of the Code, no sale or other disposition may be made of Shares for which incentive stock option treatment is desired within the one-year period beginning on the day after the day of the transfer of such Shares to him or her, nor within the two-year period beginning on the day after Grant Date of this Stock Option and further that this Stock Option must be exercised within three months after termination of employment as an employee (or 12 months in the case of death or disability) to qualify as an incentive stock option. If the Optionee disposes (whether by sale, gift, transfer or otherwise) of any such Shares within either of these periods, he or she will notify the Company within 30 days after such disposition. The Optionee also agrees to provide the Company with any information concerning any such dispositions required by the Company for tax purposes. Further, to the extent this Stock Option and any other incentive stock options of the Optionee having an aggregate Fair Market Value in excess of $100,000 (determined as of the Grant Date) first become exercisable in any year, such options will not qualify as incentive stock options.

2. Exercise of Stock Option.

(a) The Optionee may exercise this Stock Option only in the following manner: Prior to the Expiration Date, the Optionee may deliver a Stock Option exercise notice (an “Exercise Notice”) in the form of Appendix A hereto indicating his or her election to purchase some or all of the Shares with respect to which this Stock Option is then exercisable. Such notice shall specify the number of Shares to be purchased. Payment of the purchase price may be made by one or more of the methods described in Section 5 of the Plan, subject to the limitations contained in such Section of the Plan, including the requirement that the Committee specifically approve in advance certain payment methods.

(b) Notwithstanding any other provision hereof or of the Plan, no portion of this Stock Option shall be exercisable after the Expiration Date.

3. Incorporation of Plan. Notwithstanding anything herein to the contrary, this Stock Option shall be subject to and governed by all the terms and conditions of the Plan.

4. Transferability of Stock Option. This Stock Option is personal to the Optionee and is not transferable by the Optionee in any manner other than by will or by the laws of descent and distribution. The Stock Option may be exercised during the Optionee’s lifetime only by the Optionee (or by the Optionee’s guardian or personal representative in the event of the Optionee’s incapacity). The Optionee may elect to designate a beneficiary by providing written notice of the name of such beneficiary to the Company, and may revoke or change such designation at any time by filing written notice of revocation or change with the Company; such beneficiary may exercise the Optionee’s Stock Option in the event of the Optionee’s death to the extent provided herein. If the Optionee does not designate a beneficiary, or if the designated beneficiary predeceases the Optionee, the legal representative of the Optionee may exercise this Stock Option to the extent provided herein in the event of the Optionee’s death.
5. **Restrictions on Transfer of Shares.** The Shares acquired upon exercise of the Stock Option shall be subject to certain transfer restrictions and other limitations including, without limitation, the provisions contained in Section 9 of the Plan.

6. **Miscellaneous Provisions.**

   (a) **Equitable Relief.** The parties hereto agree and declare that legal remedies may be inadequate to enforce the provisions of this Agreement and that equitable relief, including specific performance and injunctive relief, may be used to enforce the provisions of this Agreement.

   (b) **Adjustments for Changes in Capital Structure.** If, as a result of any reorganization, recapitalization, reincorporation, reclassification, stock dividend, stock split, reverse stock split or other similar change in the Common Stock, the outstanding shares of Common Stock are increased or decreased or are exchanged for a different number or kind of securities of the Company (or parent or subsidiary thereof), the restrictions contained in this Agreement shall apply with equal force to additional and/or substitute securities, if any, received by the Optionee in exchange for, or by virtue of his or her ownership of, this Stock Option or Shares acquired pursuant hereto.

   (c) **Change and Modifications.** This Agreement may not be orally changed, modified or terminated, nor shall any oral waiver of any of its terms be effective. This Agreement may be changed, modified or terminated only by an agreement in writing signed by the Company and the Optionee.

   (d) **Governing Law.** This Agreement shall be governed by and construed in accordance with the General Corporation Law of the State of Delaware as to matters within the scope thereof, and as to all other matters shall be governed by and construed in accordance with the internal laws of the Commonwealth of Massachusetts, without regard to conflict of law principles that would result in the application of any law other than the law of the Commonwealth of Massachusetts.

   (e) **Headings.** The headings are intended only for convenience in finding the subject matter and do not constitute part of the text of this Agreement and shall not be considered in the interpretation of this Agreement.

   (f) **Saving Clause.** If any provision(s) of this Agreement shall be determined to be illegal or unenforceable, such determination shall in no manner affect the legality or enforceability of any other provision hereof.

   (g) **Notices.** All notices, requests, consents and other communications shall be in writing and be deemed given when delivered personally, by telex or facsimile transmission or when received if mailed by first class registered or certified mail, postage prepaid. Notices to the Company or the Optionee shall be addressed as set forth underneath their signatures below, or to such other address or addresses as may have been furnished by such party in writing to the other.
This Agreement shall be binding upon and shall inure to the benefit of the parties hereto, their respective successors, assigns, and legal representatives. The Company has the right to assign this Agreement, and such assignee shall become entitled to all the rights of the Company hereunder to the extent of such assignment.

For the convenience of the parties and to facilitate execution, this Agreement may be executed in two or more counterparts, each of which shall be deemed an original, but all of which shall constitute one and the same document.

This Agreement constitutes the entire agreement between the parties with respect to this Stock Option and supersedes all prior agreements and discussions between the parties concerning such subject matter.

Without limiting the generality of Section 6(j), the Optionee acknowledges that this Agreement has been executed and the Stock Option granted hereunder has been issued pursuant to, and in full satisfaction of, any obligations of the Company, Moderna LLC or any affiliate thereof under any and all offer letters, employee agreements, consulting agreements and similar documents between the Company and the Optionee.

Except as provided below, any dispute arising out of or relating to the Plan or this Stock Option, this Agreement, or the breach, termination or validity of the Plan, this Stock Option or this Agreement, shall be finally settled by binding arbitration conducted expeditiously in accordance with the J.A.M.S./Endispute Comprehensive Arbitration Rules and Procedures (the “J.A.M.S. Rules”). The arbitration shall be governed by the United States Arbitration Act, 9 U.S.C. Sections 1-16, and judgment upon the award rendered by the arbitrators may be entered by any court having jurisdiction thereof. The place of arbitration shall be Boston, Massachusetts.

The arbitration shall commence within 60 days of the date on which a written demand for arbitration is filed by any party hereto. In connection with the arbitration proceeding, the arbitrator shall have the power to order the production of documents by each party and any third-party witnesses. In addition, each party may take up to three depositions as of right, and the arbitrator may in his or her discretion allow additional depositions upon good cause shown by the moving party. However, the arbitrator shall not have the power to order the answering of interrogatories or the response to requests for admission. In connection with any arbitration, each party to the arbitration shall provide to the other, no later than seven business days before the date of the arbitration, the identity of all persons that may testify at the arbitration and a copy of all documents that may be introduced at the arbitration or considered or used by a party’s witness or expert. The arbitrator’s decision and award shall be made and delivered within six months of the selection of the arbitrator. The arbitrator’s decision shall set forth a reasoned basis for any award of damages or finding of liability. The arbitrator shall not have power to award damages in excess of actual compensatory damages and shall not multiply actual damages or award punitive damages, and each party hereby irrevocably waives any claim to such damages.
(c) The Company, the Optionee, each party to the Agreement and any other holder of Shares issued pursuant to this Agreement (each, a “Party”) covenants and agrees that such party will participate in the arbitration in good faith. This Section 7 applies equally to requests for temporary, preliminary or permanent injunctive relief, except that in the case of temporary or preliminary injunctive relief any party may proceed in court without prior arbitration for the limited purpose of avoiding immediate and irreparable harm.

(d) Each Party (i) hereby irrevocably submits to the jurisdiction of any United States District Court of competent jurisdiction for the purpose of enforcing the award or decision in any such proceeding, (ii) hereby waives, and agrees not to assert, by way of motion, as a defense, or otherwise, in any such suit, action or proceeding, any claim that it is not subject personally to the jurisdiction of the above named courts, that its property is exempt or immune from attachment or execution (except as protected by applicable law), that the suit, action or proceeding is brought in an inconvenient forum, that the venue of the suit, action or proceeding is improper or that this Agreement or the subject matter hereof may not be enforced in or by such court, and (iii) hereby waives and agrees not to seek any review by any court of any other jurisdiction which may be called upon to grant an enforcement of the judgment of any such court. Each Party hereby consents to service of process by registered mail at the address to which notices are to be given. Each Party agrees that its, his or her submission to jurisdiction and its, his or her consent to service of process by mail is made for the express benefit of each other Party. Final judgment against any Party in any such action, suit or proceeding may be enforced in other jurisdictions by suit, action or proceeding on the judgment, or in any other manner provided by or pursuant to the laws of such other jurisdiction.

8. Waiver of Statutory Information Rights. The Optionee understands and agrees that, but for the waiver made herein, upon exercise the Optionee would be entitled, upon written demand under oath stating the purpose thereof, to inspect for any proper purpose, and to make copies and extracts from, the Company’s stock ledger, a list of its stockholders, and its other books and records, and the books and records of subsidiaries of the Company, if any, under the circumstances and in the manner provided in Section 220 of the General Corporation Law of Delaware (any and all such rights, and any and all such other rights of the Optionee as may be provided for in Section 220, the “Inspection Rights”). In light of the foregoing, until the first sale of Stock of the Company to the general public pursuant to a registration statement filed with and declared effective by the Securities and Exchange Commission under the Securities Act, the Optionee hereby unconditionally and irrevocably waives the Inspection Rights, whether such Inspection Rights would be exercised or pursued directly or indirectly pursuant to Section 220 or otherwise, and covenants and agrees never to directly or indirectly commence, voluntarily aid in any way, prosecute, assign, transfer, or cause to be commenced any claim, action, cause of action, or other proceeding to pursue or exercise the Inspection Rights. The foregoing waiver shall not affect any rights of a director, in his or her capacity as such, under Section 220. The foregoing waiver shall not apply to any contractual inspection rights of the Optionee under any other written agreement between the Optionee and the Company.

[SIGNATURE PAGE FOLLOWS]
The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned as of the date first above written.

MODERNA THERAPEUTICS, INC.

By: _____________________________
   Name: __________________________
   Title: ___________________________
   Address: _________________________

The undersigned hereby acknowledges receiving and reviewing a copy of the Plan, including, without limitation, Section 9 thereof, and understands that this Stock Option is subject to the terms of the Plan and of this Agreement. This Agreement is hereby accepted, and the terms and conditions of the Plan, the Grant Notice and this Agreement, SPECIFICALLY INCLUDING THE ARBITRATION PROVISIONS SET FORTH IN SECTION 7 AND THE WAIVER OF STATUTORY INFORMATION RIGHTS SET FORTH IN SECTION 8 OF THIS AGREEMENT, are hereby agreed to, by the undersigned as of the date first above written.

OPTIONEE:

Name: ___________________________
Address: _________________________
Appendix A

STOCK OPTION EXERCISE NOTICE

Moderna Therapeutics, Inc.
Attention: 

Pursuant to the terms of the grant notice and stock option agreement between the undersigned and Moderna Therapeutics, Inc. (the “Company”) dated (the “Agreement”) under the Moderna Therapeutics, Inc. 2016 Stock Option and Grant Plan, I, [Insert Name], hereby [Circle One] partially/fully exercise such option by including herein payment in the amount of $ representing the purchase price for [Fill in number of Shares] Shares. I have chosen the following form(s) of payment:

[ ] 1. Cash
[ ] 2. Certified or bank check payable to Moderna Therapeutics, Inc.
[ ] 3. Other (as referenced in the Agreement and described in the Plan (please describe))

In connection with my exercise of the option as set forth above, I hereby represent and warrant to the Company as follows:

(i) I am purchasing the Shares for my own account for investment only, and not for resale or with a view to the distribution thereof.

(ii) I have had such an opportunity as I have deemed adequate to obtain from the Company such information as is necessary to permit me to evaluate the merits and risks of my investment in the Company and have consulted with my own advisers, including my tax adviser, with respect to my investment in the Company.

(iii) I have sufficient experience in business, financial and investment matters to be able to evaluate the risks involved in the purchase of the Shares and to make an informed investment decision with respect to such purchase.

(iv) I can afford a complete loss of the value of the Shares and am able to bear the economic risk of holding such Shares for an indefinite period of time.

(v) I understand that the Shares may not be registered under the Securities Act of 1933 (it being understood that the Shares are being issued and sold in reliance on the exemption provided in Rule 701 thereunder) or any applicable state securities or “blue sky” laws and may not be sold or otherwise transferred or disposed of in the absence of an effective registration statement under the Securities Act of 1933 and under any applicable state securities or “blue sky” laws (or exemptions from the registration requirement thereof). I further acknowledge that certificates representing Shares will bear restrictive legends reflecting the foregoing and/or that book entries for uncertificated Shares will include similar restrictive notations.
(vi) I have read and understand the Plan and acknowledge and agree that the Shares are subject to all of the relevant terms of the Plan, including without limitation, the transfer restrictions set forth in Section 9 of the Plan.

(vii) I understand and agree that the Company has a right of first refusal with respect to the Shares pursuant to Section 9(b) of the Plan.

(viii) I understand and agree that the Company has certain repurchase rights with respect to the Shares pursuant to Section 9(c) of the Plan.

(ix) I understand and agree that I may not sell or otherwise transfer or dispose of the Shares for a period of time following the effective date of a public offering by the Company as described in Section 9(f) of the Plan.

(x) I understand the tax implications of exercising the option described above, I have or will consult with my personal tax advisors regarding such tax implications and I am aware of my payment obligations under Section 10(a) of the Plan.

(xi) I understand and agree to the waiver of statutory information rights as set forth in Section 8 of the Agreement.

Sincerely yours,

__________________________________________
Name:

__________________________________________
Address:

__________________________________________
__________________________________________
Date: ________________________________

10
Pursuant to the Moderna Therapeutics, Inc. 2016 Stock Option and Grant Plan (the “Plan”), Moderna Therapeutics, Inc., a Delaware corporation (together with any successor, the “Company”), has granted to the individual named below, an option (the “Stock Option”) to purchase on or prior to the Expiration Date, or such earlier date as is specified herein, all or any part of the number of shares of Common Stock, par value $0.0001 per share (“Common Stock”), of the Company indicated below (the “Shares”), at the Option Exercise Price per share, subject to the terms and conditions set forth in this Non-Qualified Stock Option Grant Notice (the “Grant Notice”), the attached Non-Qualified Stock Option Agreement (the “Agreement”) and the Plan. This Stock Option is not intended to qualify as an “incentive stock option” as defined in Section 422(b) of the Internal Revenue Code of 1986, as amended from time to time (the “Code”).

Name of Optionee: ____________________ (the “Optionee”)

No. of Shares: __________________ Shares of Common Stock

Grant Date: __________________ (the “Grant Date”)

Vesting Commencement Date: ____________ (the “Vesting Commencement Date”)

Expiration Date: __________________ (the “Expiration Date”)

Option Exercise Price/Share: $ ____________ (the “Option Exercise Price”)

Vesting Schedule: [25 percent of the Shares shall vest and become exercisable on the first anniversary of the Vesting Commencement Date; provided that the Optionee continues to have a Service Relationship with the Company at such time. Thereafter, the remaining 75 percent of the Shares shall vest and become exercisable in 12 equal installments at the end of each calendar quarter following the first anniversary of the Vesting Commencement Date, provided the Optionee continues to have a Service Relationship with the Company at such time. Any fractional Shares, if applicable, shall be aggregated and vest with the last of the 12 installments. Notwithstanding anything in the Agreement to the contrary, in the case of a Sale Event, this Stock Option and the Shares shall be treated as provided in Section 3(c) of the Plan. For the avoidance of doubt, any Shares with a vesting date occurring on or prior to the Grant Date will be vested and exercisable as of the Grant Date.] 1

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1 For employees.
of the Shares shall vest and become exercisable on the first anniversary of the Vesting Commencement Date; provided that the Optionee continues to have a Service Relationship with the Company at such time. Notwithstanding anything in the Agreement to the contrary, in the case of a Sale Event, this Stock Option and the Shares shall be treated as provided in Section 3(c) of the Plan. For the avoidance of doubt, any Shares with a vesting date occurring on or prior to the Grant Date will be vested and exercisable as of the Grant Date.²

**Attachments**: Non-Qualified Stock Option Agreement, 2016 Stock Option and Grant Plan

² For directors.
1. Vesting, Exercisability and Termination.

(a) No portion of this Stock Option may be exercised until such portion shall have vested and become exercisable.

(b) Except as set forth below, and subject to the determination of the Committee in its sole discretion to accelerate the vesting schedule hereunder, this Stock Option shall be vested and exercisable on the respective dates indicated below:

(i) This Stock Option shall initially be unvested and unexercisable (except as may otherwise be set forth in the Grant Notice).

(ii) This Stock Option shall vest and become exercisable in accordance with the Vesting Schedule set forth in the Grant Notice.

(c) Termination. Except as may otherwise be provided by the Committee, if the Optionee’s Service Relationship is terminated, the period within which to exercise this Stock Option will be subject to earlier termination as set forth below (and if not exercised within such period, shall thereafter terminate subject, in each case, to Section 3(c) of the Plan):

(i) Termination Due to Death or Disability. If the Optionee’s Service Relationship terminates by reason of such Optionee’s death or Disability, this Stock Option may be exercised, to the extent exercisable on the date of such termination, by the Optionee, the Optionee’s legal representative or legatee for a period of 12 months from the date of death or Disability or until the Expiration Date, if earlier.

(ii) Other Termination. If the Optionee’s Service Relationship terminates for any reason other than death or Disability, and unless otherwise determined by the Committee, this Stock Option may be exercised, to the extent exercisable on the date of termination, for a period of 90 days from the date of termination or until the Expiration Date, if earlier; provided however, if the Optionee’s Service Relationship is terminated for Cause, this Stock Option shall terminate immediately upon the date of such termination.

For purposes hereof, the Committee’s determination of the reason for termination of the Optionee’s Service Relationship shall be conclusive and binding on the Optionee and his or her representatives or legatees and any Permitted Transferee. Any portion of this Stock Option that is not vested and exercisable on the date of termination of the Service Relationship shall terminate immediately and be null and void.
2. **Exercise of Stock Option.**

   (a) The Optionee may exercise this Stock Option only in the following manner: Prior to the Expiration Date, the Optionee may deliver a Stock Option exercise notice (an “Exercise Notice”) in the form of Appendix A hereto indicating his or her election to purchase some or all of the Shares with respect to which this Stock Option is then exercisable. Such notice shall specify the number of Shares to be purchased. Payment of the purchase price may be made by one or more of the methods described in Section 5 of the Plan, subject to the limitations contained in such Section of the Plan, including the requirement that the Committee specifically approve in advance certain payment methods.

   (b) Notwithstanding any other provision hereof or of the Plan, no portion of this Stock Option shall be exercisable after the Expiration Date.

3. **Incorporation of Plan.** Notwithstanding anything herein to the contrary, this Stock Option shall be subject to and governed by all the terms and conditions of the Plan.

4. **Transferability of Stock Option.** This Stock Option is personal to the Optionee and is not transferable by the Optionee in any manner other than by will or by the laws of descent and distribution. The Stock Option may be exercised during the Optionee’s lifetime only by the Optionee (or by the Optionee’s guardian or personal representative in the event of the Optionee’s incapacity). The Optionee may elect to designate a beneficiary by providing written notice of the name of such beneficiary to the Company, and may revoke or change such designation at any time by filing written notice of revocation or change with the Company; such beneficiary may exercise the Optionee’s Stock Option in the event of the Optionee’s death to the extent provided herein. If the Optionee does not designate a beneficiary, or if the designated beneficiary predeceases the Optionee, the legal representative of the Optionee may exercise this Stock Option to the extent provided herein in the event of the Optionee’s death.

5. **Restrictions on Transfer of Shares.** The Shares acquired upon exercise of the Stock Option shall be subject to certain transfer restrictions and other limitations including, without limitation, the provisions contained in Section 9 of the Plan.

6. **Miscellaneous Provisions.**

   (a) **Equitable Relief.** The parties hereto agree and declare that legal remedies may be inadequate to enforce the provisions of this Agreement and that equitable relief, including specific performance and injunctive relief, may be used to enforce the provisions of this Agreement.

   (b) **Adjustments for Changes in Capital Structure.** If, as a result of any reorganization, recapitalization, reincorporation, reclassification, stock dividend, stock split, reverse stock split or other similar change in the Common Stock, the outstanding shares of Common Stock are increased or decreased or are exchanged for a different number or kind of securities of the Company (or parent or subsidiary thereof), the restrictions contained in this Agreement shall apply with equal force to additional and/or substitute securities, if any, received by the Optionee in exchange for, or by virtue of his or her ownership of, this Stock Option or Shares acquired pursuant thereto.
(c) **Change and Modifications.** This Agreement may not be orally changed, modified or terminated, nor shall any oral waiver of any of its terms be effective. This Agreement may be changed, modified or terminated only by an agreement in writing signed by the Company and the Optionee.

(d) **Governing Law.** This Agreement shall be governed by and construed in accordance with the General Corporation Law of the State of Delaware as to matters within the scope thereof, and as to all other matters shall be governed by and construed in accordance with the internal laws of the Commonwealth of Massachusetts, without regard to conflict of law principles that would result in the application of any law other than the law of the Commonwealth of Massachusetts.

(e) **Headings.** The headings are intended only for convenience in finding the subject matter and do not constitute part of the text of this Agreement and shall not be considered in the interpretation of this Agreement.

(f) **Saving Clause.** If any provision(s) of this Agreement shall be determined to be illegal or unenforceable, such determination shall in no manner affect the legality or enforceability of any other provision hereof.

(g) **Notices.** All notices, requests, consents and other communications shall be in writing and be deemed given when delivered personally, by telex or facsimile transmission or when received if mailed by first class registered or certified mail, postage prepaid. Notices to the Company or the Optionee shall be addressed as set forth underneath their signatures below, or to such other address or addresses as may have been furnished by such party in writing to the other.

(h) **Benefit and Binding Effect.** This Agreement shall be binding upon and shall inure to the benefit of the parties hereto, their respective successors, assigns, and legal representatives. The Company has the right to assign this Agreement, and such assignee shall become entitled to all the rights of the Company hereunder to the extent of such assignment.

(i) **Counterparts.** For the convenience of the parties and to facilitate execution, this Agreement may be executed in two or more counterparts, each of which shall be deemed an original, but all of which shall constitute one and the same document.

(j) **Integration.** This Agreement constitutes the entire agreement between the parties with respect to this Stock Option and supersedes all prior agreements and discussions between the parties concerning such subject matter.

(k) **Satisfaction of Obligations.** Without limiting the generality of Section 6(j), the Optionee acknowledges that this Agreement has been executed and the Stock Option granted hereunder has been issued pursuant to, and in full satisfaction of, any obligations of the Company, Moderna LLC or any affiliate thereof under any and all offer letters, employee agreements, consulting agreements and similar documents between the Company and the Optionee.
7. Dispute Resolution.

(a) Except as provided below, any dispute arising out of or relating to the Plan or this Stock Option, this Agreement, or the breach, termination or validity of the Plan, this Stock Option or this Agreement, shall be finally settled by binding arbitration conducted expeditiously in accordance with the J.A.M.S./Endispute Comprehensive Arbitration Rules and Procedures (the “J.A.M.S. Rules”). The arbitration shall be governed by the United States Arbitration Act, 9 U.S.C. Sections 1-16, and judgment upon the award rendered by the arbitrators may be entered by any court having jurisdiction thereof. The place of arbitration shall be Boston, Massachusetts.

(b) The arbitration shall commence within 60 days of the date on which a written demand for arbitration is filed by any party hereto. In connection with the arbitration proceeding, the arbitrator shall have the power to order the production of documents by each party and any third-party witnesses. In addition, each party may take up to three depositions as of right, and the arbitrator may in his or her discretion allow additional depositions upon good cause shown by the moving party. However, the arbitrator shall not have the power to order the answering of interrogatories or the response to requests for admission. In connection with any arbitration, each party to the arbitration shall provide to the other, no later than seven business days before the date of the arbitration, the identity of all persons that may testify at the arbitration and a copy of all documents that may be introduced at the arbitration or considered or used by a party’s witness or expert. The arbitrator’s decision and award shall be made and delivered within six months of the selection of the arbitrator. The arbitrator’s decision shall set forth a reasoned basis for any award of damages or finding of liability. The arbitrator shall not have power to award damages in excess of actual compensatory damages and shall not multiply actual damages or award punitive damages, and each party hereby irrevocably waives any claim to such damages.

(c) The Company, the Optionee, each party to the Agreement and any other holder of Shares issued pursuant to this Agreement (each, a “Party”) covenants and agrees that such party will participate in the arbitration in good faith. This Section 7 applies equally to requests for temporary, preliminary or permanent injunctive relief, except that in the case of temporary or preliminary injunctive relief any party may proceed in court without prior arbitration for the limited purpose of avoiding immediate and irreparable harm.

(d) Each Party (i) hereby irrevocably submits to the jurisdiction of any United States District Court of competent jurisdiction for the purpose of enforcing the award or decision in any such proceeding, (ii) hereby waives, and agrees not to assert, by way of motion, as a defense, or otherwise, in any such suit, action or proceeding, any claim that it is not subject personally to the jurisdiction of the above named courts, that its property is exempt or immune from attachment or execution (except as protected by applicable law), that the suit, action or proceeding is brought in an inconvenient forum, that the venue of the suit, action or proceeding is improper or that this Agreement or the subject matter hereof may not be enforced in or by such court, and (iii) hereby waives and agrees not to seek any review by any court of any other jurisdiction which may be called upon to grant an enforcement of the judgment of any such court. Each Party hereby consents to service of process by registered mail at the address to which notices are to be given. Each Party agrees that its, his or her submission to jurisdiction and its, his or her consent to service of process by mail is made for the express benefit of each other Party. Final judgment against any Party in any such action, suit or proceeding may be enforced in other jurisdictions by suit, action or proceeding on the judgment, or in any other manner provided by or pursuant to the laws of such other jurisdiction.
8. Waiver of Statutory Information Rights. The Optionee understands and agrees that, but for the waiver made herein, upon exercise the Optionee would be entitled, upon written demand under oath stating the purpose thereof, to inspect for any proper purpose, and to make copies and extracts from, the Company’s stock ledger, a list of its stockholders, and its other books and records, and the books and records of subsidiaries of the Company, if any, under the circumstances and in the manner provided in Section 220 of the General Corporation Law of Delaware (any and all such rights, and any and all such other rights of the Optionee as may be provided for in Section 220, the “Inspection Rights”). In light of the foregoing, until the first sale of Stock of the Company to the general public pursuant to a registration statement filed with and declared effective by the Securities and Exchange Commission under the Securities Act, the Optionee hereby unconditionally and irrevocably waives the Inspection Rights, whether such Inspection Rights would be exercised or pursued directly or indirectly pursuant to Section 220 or otherwise, and covenants and agrees never to directly or indirectly commence, voluntarily aid in any way, prosecute, assign, transfer, or cause to be commenced any claim, action, cause of action, or other proceeding to pursue or exercise the Inspection Rights. The foregoing waiver shall not affect any rights of a director, in his or her capacity as such, under Section 220. The foregoing waiver shall not apply to any contractual inspection rights of the Optionee under any other written agreement between the Optionee and the Company.
The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned as of the date first above written.

MODERNA THERAPEUTICS, INC.

By:  

Name:  
Title:  
Address:  

The undersigned hereby acknowledges receiving and reviewing a copy of the Plan, including, without limitation, Section 9 thereof, and understands that this Stock Option is subject to the terms of the Plan and of this Agreement. This Agreement is hereby accepted, and the terms and conditions of the Plan, the Grant Notice and this Agreement, SPECIFICALLY INCLUDING THE ARBITRATION PROVISIONS SET FORTH IN SECTION 7 AND THE WAIVER OF STATUTORY INFORMATION RIGHTS SET FORTH IN SECTION 8 OF THIS AGREEMENT, are hereby agreed to, by the undersigned as of the date first above written.

OPTIONEE:

Name:  
Address:  


8
DESIGNATED BENEFICIARY:

Beneficiary’s Address:

______________________________

______________________________

______________________________
Appendix A

STOCK OPTION EXERCISE NOTICE

Moderna Therapeutics, Inc.
Attention: ______________________

Pursuant to the terms of the grant notice and stock option agreement between the undersigned and Moderna Therapeutics, Inc. (the “Company”) dated ________ (the “Agreement”) under the Moderna Therapeutics, Inc. 2016 Stock Option and Grant Plan, I, [Insert Name] , hereby [Circle One] partially/fully exercise such option by including herein payment in the amount of $ ______ representing the purchase price for [Fill in number of Shares] ______ Shares. I have chosen the following form(s) of payment:

☐ 1. Cash
☐ 2. Certified or bank check payable to Moderna Therapeutics, Inc.
☐ 3. Other (as referenced in the Agreement and described in the Plan (please describe))

In connection with my exercise of the option as set forth above, I hereby represent and warrant to the Company as follows:

(i) I am purchasing the Shares for my own account for investment only, and not for resale or with a view to the distribution thereof.

(ii) I have had such an opportunity as I have deemed adequate to obtain from the Company such information as is necessary to permit me to evaluate the merits and risks of my investment in the Company and have consulted with my own advisers, including my tax adviser, with respect to my investment in the Company.

(iii) I have sufficient experience in business, financial and investment matters to be able to evaluate the risks involved in the purchase of the Shares and to make an informed investment decision with respect to such purchase.

(iv) I can afford a complete loss of the value of the Shares and am able to bear the economic risk of holding such Shares for an indefinite period of time.

(v) I understand that the Shares may not be registered under the Securities Act of 1933 (it being understood that the Shares are being issued and sold in reliance on the exemption provided in Rule 701 thereunder) or any applicable state securities or “blue sky” laws and may not be sold or otherwise transferred or disposed of in the absence of an effective registration statement under the Securities Act of 1933 and under any applicable state securities or “blue sky” laws (or exemptions from the registration requirement thereof). I further acknowledge that certificates representing Shares will bear restrictive legends reflecting the foregoing and/or that book entries for uncertificated Shares will include similar restrictive notations.
(vi) I have read and understand the Plan and acknowledge and agree that the Shares are subject to all of the relevant terms of the Plan, including without limitation, the transfer restrictions set forth in Section 9 of the Plan.

(vii) I understand and agree that the Company has a right of first refusal with respect to the Shares pursuant to Section 9(b) of the Plan.

(viii) I understand and agree that the Company has certain repurchase rights with respect to the Shares pursuant to Section 9(c) of the Plan.

(ix) I understand and agree that I may not sell or otherwise transfer or dispose of the Shares for a period of time following the effective date of a public offering by the Company as described in Section 9(f) of the Plan.

(x) I understand the tax implications of exercising the option described above, I have or will consult with my personal tax advisors regarding such tax implications and I am aware of my payment obligations under Section 10(a) of the Plan.

(xi) I understand and agree to the waiver of statutory information rights as set forth in Section 8 of the Agreement.

Sincerely yours,

Name:

Address:

Date: ___________________________

11
Pursuant to the Moderna Therapeutics, Inc. 2016 Stock Option and Grant Plan (the “Plan”), Moderna Therapeutics, Inc., a Delaware corporation (together with any successor, the “Company”), hereby grants, sells and issues to the individual named below, the Shares at the Per Share Purchase Price, subject to the terms and conditions set forth in this Restricted Stock Award Notice (the “Award Notice”), the attached Restricted Stock Agreement (the “Agreement”) and the Plan. The Grantee agrees to the provisions set forth herein and acknowledges that each such provision is a material condition of the Company’s agreement to issue and sell the Shares to him or her. The Company hereby acknowledges receipt of $ in full payment for the Shares. All references to share prices and amounts herein shall be equitably adjusted to reflect stock splits, stock dividends, recapitalizations, mergers, reorganizations and similar changes affecting the capital stock of the Company, and any shares of capital stock of the Company received on or in respect of Shares in connection with any such event (including any shares of capital stock or any right, option or warrant to receive the same or any security convertible into or exchangeable for any such shares or received upon conversion of any such shares) shall be subject to this Agreement on the same basis and extent at the relevant time as the Shares in respect of which they were issued, and shall be deemed Shares as if and to the same extent they were issued at the date hereof.

Name of Grantee: ____________________ (the “Grantee”)
No. of Shares: ___________ Shares of Common Stock (the “Shares”)
Grant Date: ____________ (the “Grant Date”)
Date of Purchase of Shares: ____________ (the “Vesting Commencement Date”)
Per Share Purchase Price: $__________ (the “Per Share Purchase Price”)

Vesting Schedule: 25 percent of the Shares shall vest on the first anniversary of the Vesting Commencement Date; provided that the Grantee continues to have a Service Relationship with the Company at such time. Thereafter, the remaining 75 percent of the Shares shall vest in 12 equal installments at the end of each calendar quarter following the first anniversary of the Vesting Commencement Date, provided the Grantee continues to have a Service Relationship with the Company at such time. Any fractional Shares, if applicable, shall be aggregated and vest with the last of the 12 installments. Notwithstanding anything in the Agreement to the contrary in the case of a Sale Event, the Shares of Restricted Stock shall be treated as provided in Section 3(c) of the Plan. For the avoidance of doubt, any Shares with a vesting date occurring on or prior to the Grant Date will be vested as of the Grant Date.

Attachments: Restricted Stock Agreement, 2016 Stock Option and Grant Plan
RESTRICTED STOCK AGREEMENT
UNDER THE MODERNA THERAPEUTICS, INC.
2016 STOCK OPTION AND GRANT PLAN

All capitalized terms used herein and not otherwise defined shall have the respective meanings set forth in the Award Notice and the Plan.

1. Purchase and Sale of Shares; Vesting; Investment Representations.

(a) Purchase and Sale. The Company hereby sells to the Grantee, and the Grantee hereby purchases from the Company, the number of Shares set forth in the Award Notice for the Per Share Purchase Price.

(b) Vesting. Initially, all of the Shares are non-transferable and subject to a substantial risk of forfeiture and are Shares of Restricted Stock (except as may otherwise be set forth in the Award Notice). The risk of forfeiture shall lapse with respect to the Shares on the respective dates indicated on the Vesting Schedule set forth in the Award Notice.

(c) Investment Representations. In connection with the purchase and sale of the Shares contemplated by Section 1(a) above, the Grantee hereby represents and warrants to the Company as follows:

(i) The Grantee is purchasing the Shares for the Grantee’s own account for investment only, and not for resale or with a view to the distribution thereof.

(ii) The Grantee has had such an opportunity as he or she has deemed adequate to obtain from the Company such information as is necessary to permit him or her to evaluate the merits and risks of the Grantee’s investment in the Company and has consulted with the Grantee’s own advisers with respect to the Grantee’s investment in the Company.

(iii) The Grantee has sufficient experience in business, financial and investment matters to be able to evaluate the risks involved in the purchase of the Shares and to make an informed investment decision with respect to such purchase.

(iv) The Grantee can afford a complete loss of the value of the Shares and is able to bear the economic risk of holding such Shares for an indefinite period.

(v) The Grantee understands that the Shares are not registered under the Act (it being understood that the Shares are being issued and sold in reliance on the exemption provided in Rule 701 thereunder) or any applicable state securities or “blue sky” laws and may not be sold or otherwise transferred or disposed of in the absence of an effective registration statement under the Act and under any applicable state securities or “blue sky” laws (or exemptions from the registration requirements thereof). The Grantee further acknowledges that certificates representing the Shares will bear restrictive legends reflecting the foregoing and/or that book entries for uncertificated Shares will include similar restrictive notations.
(vi) The Grantee has read and understands the Plan and acknowledges and agrees that the Shares are subject to all of the relevant terms of the Plan, including without limitation, the transfer restrictions set forth in Section 9 of the Plan.

(vii) The Grantee understands and agrees that the Company has a right of first refusal with respect to the Shares pursuant to Section 9(b) of the Plan.

(viii) The Grantee understands and agrees that the Company has certain repurchase rights with respect to the Shares pursuant to Section 9(c) of the Plan.

(ix) The Grantee understands and agrees that the Grantee may not sell or otherwise transfer or dispose of the Shares for a period of time following the effective date of a public offering by the Company as described in Section 9(f) of the Plan.

(x) The Grantee understands the tax implications of purchasing the Shares, the Grantee has or will consult with his or her personal tax advisors regarding such tax implications and the Grantee is aware of his or her payment obligations under Section 10(a) of the Plan.

(xi) The Grantee understands and agrees to the waiver of statutory information rights as set forth in Section 7 of this Agreement.

2. **Repurchase Right.** Upon a Repurchase Event, the Company shall have the right to repurchase any Shares of Restricted Stock upon a Repurchase Event as set forth in Section 9(c) of the Plan.

3. **Restrictions on Transfer of Shares.** The Shares (whether or not vested) shall be subject to certain transfer restrictions and other limitations including, without limitation, the provisions contained in Section 9 of the Plan.

4. **Incorporation of Plan.** Notwithstanding anything herein to the contrary, this Restricted Stock Award shall be subject to and governed by all the terms and conditions of the Plan.

5. **Miscellaneous Provisions.**

   (a) **Record Owner; Dividends.** The Grantee and any Permitted Transferees, during the duration of this Agreement, shall be considered the record owners of and shall be entitled to vote the Shares if and to the extent the Shares are entitled to voting rights. The Grantee and any Permitted Transferees shall be entitled to receive all dividends and any other distributions declared on the Shares; provided, however, that the Company is under no duty to declare any such dividends or to make any such distribution.
(b) **Section 83(b) Election.** The Grantee shall consult with the Grantee’s tax advisor to determine whether it would be appropriate for the Grantee to make an election under Section 83(b) of the Code with respect to this Award. Any such election must be filed with the Internal Revenue Service within 30 days of the date of this Award. If the Grantee makes an election under Section 83(b) of the Code, the Grantee shall give prompt notice to the Company (and provide a copy of such election to the Company).

(c) **Equitable Relief.** The parties hereto agree and declare that legal remedies may be inadequate to enforce the provisions of this Agreement and that equitable relief, including specific performance and injunctive relief, may be used to enforce the provisions of this Agreement.

(d) **Change and Modifications.** This Agreement may not be orally changed, modified or terminated, nor shall any oral waiver of any of its terms be effective. This Agreement may be changed, modified or terminated only by an agreement in writing signed by the Company and the Grantee.

(e) **Governing Law.** This Agreement shall be governed by and construed in accordance with the General Corporation Law of the State of Delaware as to matters within the scope thereof, and as to all other matters shall be governed by and construed in accordance with the internal laws of the Commonwealth of Massachusetts, without regard to conflict of law principles that would result in the application of any law other than the law of the Commonwealth of Massachusetts.

(f) **Headings.** The headings are intended only for convenience in finding the subject matter and do not constitute part of the text of this Agreement and shall not be considered in the interpretation of this Agreement.

(g) **Saving Clause.** If any provision(s) of this Agreement shall be determined to be illegal or unenforceable, such determination shall in no manner affect the legality or enforceability of any other provision hereof.

(h) **Notices.** All notices, requests, consents and other communications shall be in writing and be deemed given when delivered personally, by telex or facsimile transmission or when received if mailed by first class registered or certified mail, postage prepaid. Notices to the Company or the Grantee shall be addressed as set forth underneath their signatures below, or to such other address or addresses as may have been furnished by such party in writing to the other.

(i) **Benefit and Binding Effect.** This Agreement shall be binding upon and shall inure to the benefit of the parties hereto, their respective successors, assigns, and legal representatives. The Company has the right to assign this Agreement, and such assignee shall become entitled to all the rights of the Company hereunder to the extent of such assignment.

(j) **Counterparts.** For the convenience of the parties and to facilitate execution, this Agreement may be executed in two or more counterparts, each of which shall be deemed an original, but all of which shall constitute one and the same document.
Integration. This Agreement constitutes the entire agreement between the parties with respect to this Award and supersedes all prior agreements and discussions between the parties concerning such subject matter.

Satisfaction of Obligations. Without limiting the generality of Section 5(k), the Grantee acknowledges that this Agreement has been executed and the Shares granted hereunder have been issued pursuant to, and in full satisfaction of, any obligations of the Company, Moderna LLC or any affiliate thereof under any and all offer letters, employee agreements, consulting agreements and similar documents between the Company and the Grantee.

6. Dispute Resolution.

(a) Except as provided below, any dispute arising out of or relating to the Plan or the Shares, this Agreement, or the breach, termination or validity of the Plan, the Shares or this Agreement, shall be finally settled by binding arbitration conducted expeditiously in accordance with the J.A.M.S./Endispute Comprehensive Arbitration Rules and Procedures (the “J.A.M.S. Rules”). The arbitration shall be governed by the United States Arbitration Act, 9 U.S.C. Sections 1 - 16, and judgment upon the award rendered by the arbitrators may be entered by any court having jurisdiction thereof. The place of arbitration shall be Boston, Massachusetts.

(b) The arbitration shall commence within 60 days of the date on which a written demand for arbitration is filed by any party hereto. In connection with the arbitration proceeding, the arbitrator shall have the power to order the production of documents by each party and any third-party witnesses. In addition, each party may take up to three depositions as of right, and the arbitrator may in his or her discretion allow additional depositions upon good cause shown by the moving party. However, the arbitrator shall not have the power to order the answering of interrogatories or the response to requests for admission. In connection with any arbitration, each party to the arbitration shall provide to the other, no later than seven business days before the date of the arbitration, the identity of all persons that may testify at the arbitration and a copy of all documents that may be introduced at the arbitration or considered or used by a party’s witness or expert. The arbitrator’s decision and award shall be made and delivered within six months of the selection of the arbitrator. The arbitrator’s decision shall set forth a reasoned basis for any award of damages or finding of liability. The arbitrator shall not have power to award damages in excess of actual compensatory damages and shall not multiply actual damages or award punitive damages, and each party hereby irrevocably waives any claim to such damages.

(c) The Company, the Grantee, each party to the Agreement and any other holder of Shares issued pursuant to this Agreement (each, a “Party”) covenants and agrees that such party will participate in the arbitration in good faith. This Section 6 applies equally to requests for temporary, preliminary or permanent injunctive relief, except that in the case of temporary or preliminary injunctive relief any party may proceed in court without prior arbitration for the limited purpose of avoiding immediate and irreparable harm.
(d) Each Party (i) hereby irrevocably submits to the jurisdiction of any United States District Court of competent jurisdiction for the purpose of enforcing the award or decision in any such proceeding, (ii) hereby waives, and agrees not to assert, by way of motion, as a defense, or otherwise, in any such suit, action or proceeding, any claim that it is not subject personally to the jurisdiction of the above named courts, that its property is exempt or immune from attachment or execution (except as protected by applicable law), that the suit, action or proceeding is brought in an inconvenient forum, that the venue of the suit, action or proceeding is improper or that this Agreement or the subject matter hereof may not be enforced in or by such court, and (iii) hereby waives and agrees not to seek any review by any court of any other jurisdiction which may be called upon to grant an enforcement of the judgment of any such court. Each Party hereby consents to service of process by registered mail at the address to which notices are to be given. Each Party agrees that its, his or her submission to jurisdiction and its, his or her consent to service of process by mail is made for the express benefit of each other Party. Final judgment against any Party in any such action, suit or proceeding may be enforced in other jurisdictions by suit, action or proceeding on the judgment, or in any other manner provided by or pursuant to the laws of such other jurisdiction.

7. Waiver of Statutory Information Rights. The Grantee understands and agrees that, but for the waiver made herein, the Grantee would be entitled, upon written demand under oath stating the purpose thereof, to inspect for any proper purpose, and to make copies and extracts from, the Company’s stock ledger, a list of its stockholders, and its other books and records, and the books and records of subsidiaries of the Company, if any, under the circumstances and in the manner provided in Section 220 of the General Corporation Law of Delaware (any and all such rights, and any and all such other rights of the Grantee as may be provided for in Section 220, the “Inspection Rights”). In light of the foregoing, until the first sale of Stock of the Company to the general public pursuant to a registration statement filed with and declared effective by the Securities and Exchange Commission under the Securities Act, the Grantee hereby unconditionally and irrevocably waives the Inspection Rights, whether such Inspection Rights would be exercised or pursued directly or indirectly pursuant to Section 220 or otherwise, and covenants and agrees never to directly or indirectly commence, voluntarily aid in any way, prosecute, assign, transfer, or cause to be commenced any claim, action, cause of action, or other proceeding to pursue or exercise the Inspection Rights. The foregoing waiver shall not affect any rights of a director, in his or her capacity as such, under Section 220. The foregoing waiver shall not apply to any contractual inspection rights of the Grantee under any other written agreement between the Grantee and the Company.

[SIGNATURE PAGE FOLLOWS]
The foregoing Restricted Stock Agreement is hereby accepted and the terms and conditions thereof are hereby agreed to by the undersigned as of the date of purchase of Shares above written.

MODERNA THERAPEUTICS, INC.

By: _____________________________________________

Name:__________________________________________
Title:___________________________________________

Address:________________________________________

__________________________________________________________________________

The undersigned hereby acknowledges receiving and reviewing a copy of the Plan, including, without limitation, Section 9 thereof and understands that the Shares granted hereby are subject to the terms of the Plan and of this Agreement. This Agreement is hereby accepted, and the terms and conditions of the Plan, the Award Notice and this Agreement, SPECIFICALLY INCLUDING THE ARBITRATION PROVISIONS SET FORTH IN SECTION 6 AND THE WAIVER OF STATUTORY INFORMATION RIGHTS SET FORTH IN SECTION 7 OF THIS AGREEMENT, are hereby agreed to, by the undersigned as of the date first above written.

GRANTEE:

Name:__________________________________________

Address:________________________________________

__________________________________________________________________________

8
RESTRICTED STOCK UNIT AWARD AGREEMENT
FOR COMPANY EMPLOYEES
UNDER THE MODERNA THERAPEUTICS, INC.
2016 STOCK OPTION AND GRANT PLAN

Name of Grantee: ____________________________
No. of Restricted Stock Units: ________________
Grant Date: ________________________________
Expiration Date: ____________________________
Vesting Commencement Date: ________________

Pursuant to the Moderna Therapeutics, Inc. 2016 Stock Option and Grant Plan (as amended and in effect from time to time, the "Plan"), Moderna Therapeutics, Inc., a Delaware corporation (together with any successor, the "Company"), hereby grants an award of the number of Restricted Stock Units listed above (an "Award") to the Grantee named above. Each Restricted Stock Unit shall relate to one share of Common Stock, par value $0.0001 per share (the "Stock") of the Company.

1. Restrictions on Transfer of Award. This Award may not be sold, transferred, pledged, assigned or otherwise encumbered or disposed of by the Grantee, and any shares of Stock issuable with respect to the Award may not be sold, transferred, pledged, assigned or otherwise encumbered or disposed of until (i) the Restricted Stock Units have vested as provided in Section 2 of this Agreement and (ii) shares of Stock have been issued to the Grantee in accordance with the terms of the Plan and this Agreement. In addition, any Shares issued in settlement of this Award pursuant to Section 4 below shall be subject to certain transfer restrictions and other limitations including, without limitation, the provisions contained in Section 9 of the Plan (and, notwithstanding anything in the Plan or this Agreement to the contrary, Sections 9(c)(ii) and 9(c)(iii) of the Plan shall be deemed to apply to any repurchase of Shares issued in settlement of this Award upon a Repurchase Event).

2. Vesting of Restricted Stock Units. Except as otherwise provided in the Plan and this Agreement, the restrictions and conditions of Section 1 of this Agreement shall lapse on the Vesting Date or Dates as specified below.

(a) [_____] Restricted Stock Units (the “Service RSUs”) shall vest upon the satisfaction of the Service RSU Time Vesting Criteria, as hereinafter defined. The “Service RSU
Time Vesting Criteria shall be incrementally satisfied with respect to the Service RSUs as follows: (i) [__]% of the Service RSUs will vest on the [__] anniversary of the Vesting Commencement Date (the "Anniversary Date") provided that the Grantee remains employed by the Company, a Subsidiary or an Affiliate on such date; and (ii) the remaining [__]% of the Service RSUs will vest in [__] equal quarterly installments over the [__]-year period commencing on the Anniversary Date provided that the Grantee remains employed by the Company, a Subsidiary or an Affiliate on each such date. For the avoidance of doubt, the Service RSU Time Vesting Criteria must be satisfied for the Service RSUs to be deemed vested (each such date, a "Service RSU Vesting Date") and such vesting criteria may be satisfied with respect to portions of the Service RSUs at different times.

The Administrator may at any time accelerate the vesting schedule specified in this Section 2.

3. Termination of Employment. If the Grantee’s employment with the Company, a Subsidiary or an Affiliate terminates for any reason (including death or disability) prior to the satisfaction of the vesting conditions set forth in Section 2 above, any Restricted Stock Units that have not vested as of such date shall automatically and without notice terminate and be forfeited, and neither the Grantee nor any of his or her successors, heirs, assigns, or personal representatives will thereafter have any further rights or interests in such unvested Restricted Stock Units.

4. Issuance of Shares of Stock. Upon settlement, the Company shall issue (or cause to be issued) to the Grantee the number of shares of Stock equal to the aggregate number of Restricted Stock Units that have vested pursuant to Section 2 of this Agreement on each such Service RSU Vesting Date, and the Grantee shall thereafter have all the rights of a stockholder of the Company with respect to such shares. Alternatively, the Company may, in its sole discretion, issue to the Grantee cash in an amount equal to the aggregate Fair Market Value of a number of shares of Stock equal to the aggregate number of Restricted Stock Units which are being settled. The Service RSUs shall be settled as soon as practicable following each respective Service RSU Vesting Date (but in no event later than two and one-half months after the end of the year in which any such Service RSU Vesting Date occurs).

5. Incorporation of Plan. Notwithstanding anything herein to the contrary, this Agreement shall be subject to and governed by all the terms and conditions of the Plan, including the powers of the Administrator set forth in Section 2(b) of the Plan. Capitalized terms in this Agreement shall have the meaning specified in the Plan, unless a different meaning is specified herein.

6. Tax Withholding. The Grantee shall, not later than the date as of which the receipt of this Award becomes a taxable event for Federal income tax purposes, pay to the Company or make arrangements satisfactory to the Administrator for payment of any Federal,
state, and local taxes required by law to be withheld on account of such taxable event. The Company shall have the authority to cause the required minimum tax withholding obligation to be satisfied, in whole or in part, by withholding from shares of Stock to be issued to the Grantee a number of shares of Stock with an aggregate Fair Market Value that would satisfy the withholding amount due.

7. **Section 409A of the Code.** This Award is intended to constitute a “short term deferral” for purposes of Section 409A of the Code to the greatest extent possible, and otherwise is intended to comply with Section 409A, and the Award will be administered and interpreted in accordance with that intent. To the extent that any provision of this Agreement is ambiguous as to its exemption from, or compliance with, Section 409A, the provision shall be read in such a manner so that all payments hereunder are either exempt from, or comply with, Section 409A. Solely for purposes of Section 409A, each issuance of shares of Stock on or after each Vesting Date shall be considered a separate payment. The Company makes no representation or warranty and shall have no liability to the Grantee or any other person if any provisions of this Award are determined to constitute deferred compensation subject to Section 409A but do not satisfy an exemption from, or the conditions of, such Section.

8. **No Obligation to Continue Employment.** Neither the Company nor any Subsidiary or Affiliate is obligated by or as a result of the Plan or this Agreement to continue the Grantee in employment and neither the Plan nor this Agreement shall interfere in any way with the right of the Company or any Subsidiary or Affiliate to terminate the employment of the Grantee at any time.

9. **Integration.** This Agreement constitutes the entire agreement between the parties with respect to this Award and supersedes all prior agreements and discussions between the parties concerning such subject matter.

10. **Data Privacy Consent.** In order to administer the Plan and this Agreement and to implement or structure future equity grants, the Company, its subsidiaries and affiliates and certain agents thereof (together, the “Relevant Companies”) may process any and all personal or professional data, including but not limited to Social Security or other identification number, home address and telephone number, date of birth and other information that is necessary or desirable for the administration of the Plan and/or this Agreement (the “Relevant Information”). By entering into this Agreement, the Grantee (i) authorizes the Company to collect, process, register and transfer to the Relevant Companies all Relevant Information; (ii) waives any privacy rights the Grantee may have with respect to the Relevant Information; (iii) authorizes the Relevant Companies to store and transmit such information in electronic form; and (iv) authorizes the transfer of the Relevant Information to any jurisdiction in which the Relevant Companies consider appropriate. The Grantee shall have access to, and the right to change, the Relevant Information. Relevant Information will only be used in accordance with applicable law.

11. **Dispute Resolution.**

   (a) Except as provided below, any dispute arising out of or relating to the Plan or the Award, this Agreement, or the breach, termination or validity of the Plan, the Award or
this Agreement, shall be finally settled by binding arbitration conducted expeditiously in accordance with the J.A.M.S./Endispute Comprehensive Arbitration Rules and Procedures (the “J.A.M.S. Rules”). The arbitration shall be governed by the United States Arbitration Act, 9 U.S.C. Sections 1 – 16, and judgment upon the award rendered by the arbitrators may be entered by any court having jurisdiction thereof. The place of arbitration shall be Boston, Massachusetts.

(b) The arbitration shall commence within 60 days of the date on which a written demand for arbitration is filed by any party hereto. In connection with the arbitration proceeding, the arbitrator shall have the power to order the production of documents by each party and any third-party witnesses. In addition, each party may take up to three depositions as of right, and the arbitrator may in his or her discretion allow additional depositions upon good cause shown by the moving party. However, the arbitrator shall not have the power to order the answering of interrogatories or the response to requests for admission. In connection with any arbitration, each party to the arbitration shall provide to the other, no later than seven business days before the date of the arbitration, the identity of all persons that may testify at the arbitration and a copy of all documents that may be introduced at the arbitration or considered or used by a party’s witness or expert. The arbitrator’s decision and award shall be made and delivered within six months of the selection of the arbitrator. The arbitrator’s decision shall set forth a reasoned basis for any award of damages or finding of liability. The arbitrator shall not have power to award damages in excess of actual compensatory damages and shall not multiply actual damages or award punitive damages, and each party hereby irrevocably waives any claim to such damages.

(c) The Company, the Grantee, each party to the Agreement and any other holder of Restricted Stock Units or Shares issued pursuant to this Agreement (each, a “Party”) covenants and agrees that such party will participate in the arbitration in good faith. This Section 11 applies equally to requests for temporary, preliminary or permanent injunctive relief, except that in the case of temporary or preliminary injunctive relief any party may proceed in court without prior arbitration for the limited purpose of avoiding immediate and irreparable harm.

(d) Each Party (i) hereby irrevocably submits to the jurisdiction of any United States District Court of competent jurisdiction for the purpose of enforcing the award or decision in any such proceeding, (ii) hereby waives, and agrees not to assert, by way of motion, as a defense, or otherwise, in any such suit, action or proceeding, any claim that it is not subject personally to the jurisdiction of the above named courts, that its property is exempt or immune from attachment or execution (except as protected by applicable law), that the suit, action or proceeding is brought in an inconvenient forum, that the venue of the suit, action or proceeding is improper or that this Agreement or the subject matter hereof may not be enforced in or by such court, and (iii) hereby waives and agrees not to seek any review by any court of any other jurisdiction which may be called upon to grant an enforcement of the judgment of any such court. Each Party hereby consents to service of process by registered mail at the address to which notices are to be given. Each Party agrees that its, his or her submission to jurisdiction and its, his or her consent to service of process by mail is made for the express benefit of each other Party. Final judgment against any Party in any such action, suit or proceeding may be enforced in other jurisdictions by suit, action or proceeding on the judgment, or in any other manner provided by or pursuant to the laws of such other jurisdiction.
12. **Waiver of Statutory Information Rights.** The Grantee understands and agrees that, but for the waiver made herein, upon settlement of the Award in shares of Stock, the Grantee would be entitled, upon written demand under oath stating the purpose thereof, to inspect for any proper purpose, and to make copies and extracts from, the Company’s stock ledger, a list of its stockholders, and its other books and records, and the books and records of subsidiaries of the Company, if any, under the circumstances and in the manner provided in Section 220 of the General Corporation Law of Delaware (any and all such rights, and any and all such other rights of the Grantee as may be provided for in Section 220, the “Inspection Rights”). In light of the foregoing, until the first sale of Stock of the Company to the general public pursuant to a registration statement filed with and declared effective by the Securities and Exchange Commission under the Securities Act, the Grantee hereby unconditionally and irrevocably waives the Inspection Rights, whether such Inspection Rights would be exercised or pursued directly or indirectly pursuant to Section 220 or otherwise, and covenants and agrees never to directly or indirectly commence, voluntarily aid in any way, prosecute, assign, transfer, or cause to be commenced any claim, action, cause of action, or other proceeding to pursue or exercise the Inspection Rights. The foregoing waiver shall not affect any rights of a director, in his or her capacity as such, under Section 220. The foregoing waiver shall not apply to any contractual inspection rights of the Grantee under any other written agreement between the Grantee and the Company.

13. **Electronic Delivery of Documents.** The Grantee agrees that the Company may deliver by email all documents relating to the Company, the Plan or this Award and all other documents that the Company is required to deliver to its security holders (including, without limitation, disclosures that may be required by the Securities and Exchange Commission). The Grantee also agrees that the Company may deliver these documents by posting them on a website maintained by the Company or by a third party under contract with the Company. If the Company posts these documents on a website, it shall notify the Grantee by email.

14. **Notices.** Notices hereunder shall be mailed or delivered to the Company at its principal place of business and shall be mailed or delivered to the Grantee at the address on file with the Company or, in either case, at such other address as one party may subsequently furnish to the other party in writing.
The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned as of the date first above written.

MODERNA THERAPEUTICS, INC.

By: ______________________________
    Name: Stephane Bancel
    Title: Chief Executive Officer

The undersigned hereby acknowledges receiving and reviewing a copy of the Plan, including, without limitation, Section 9 thereof, and understands that this Award is subject to the terms of the Plan and of this Agreement. The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned. SPECIFICALLY INCLUDING THE ARBITRATION PROVISIONS SET FORTH IN SECTION 11 AND THE WAIVER OF STATUTORY INFORMATION RIGHTS SET FORTH IN SECTION 12 OF THIS AGREEMENT, are hereby agreed to by the undersigned. Electronic acceptance of this Agreement pursuant to the Company’s instructions to the Grantee (including through an online acceptance process) is acceptable.

Dated: ______________________________

Grantee’s Signature

Grantee’s name and address:
SECTION 1. GENERAL PURPOSE OF THE PLAN; DEFINITIONS

The name of the plan is the Moderna, Inc. 2018 Stock Option and Incentive Plan (the “Plan”). The purpose of the Plan is to encourage and enable the officers, employees, Non-Employee Directors and Consultants of Moderna, Inc. (the “Company”) and its Affiliates upon whose judgment, initiative and efforts the Company largely depends for the successful conduct of its business to acquire a proprietary interest in the Company. It is anticipated that providing such persons with a direct stake in the Company’s welfare will assure a closer identification of their interests with those of the Company and its stockholders, thereby stimulating their efforts on the Company’s behalf and strengthening their desire to remain with the Company.

The following terms shall be defined as set forth below:

“Act” means the Securities Act of 1933, as amended, and the rules and regulations thereunder.

“Administrator” means either the Board or the compensation committee of the Board or a similar committee performing the functions of the compensation committee and which is comprised of not less than two Non-Employee Directors who are independent.

“Affiliate” means, at the time of determination, any “parent” or “subsidiary” of the Company as such terms are defined in Rule 405 of the Act. The Board will have the authority to determine the time or times at which “parent” or “subsidiary” status is determined within the foregoing definition.

“Award” or “Awards,” except where referring to a particular category of grant under the Plan, shall include Incentive Stock Options, Non-Qualified Stock Options, Stock Appreciation Rights, Restricted Stock Awards, Restricted Stock Units, Unrestricted Stock Awards, Cash-Based Awards, and Dividend Equivalent Rights.

“Award Certificate” means a written or electronic document setting forth the terms and provisions applicable to an Award granted under the Plan. Each Award Certificate is subject to the terms and conditions of the Plan.

“Board” means the Board of Directors of the Company.

“Cash-Based Award” means an Award entitling the recipient to receive a cash-denominated payment.

“Consultant” means a consultant or adviser who provides bona fide services to the Company or an Affiliate as an independent contractor and who qualifies as a consultant or advisor under Instruction A.1.(a)(1) of Form S-8 under the Act.

“Dividend Equivalent Right” means an Award entitling the grantee to receive credits based on cash dividends that would have been paid on the shares of Stock specified in the Dividend Equivalent Right (or other award to which it relates) if such shares had been issued to and held by the grantee.

“Effective Date” means the date on which the Plan becomes effective as set forth in Section 19.


“Fair Market Value” of the Stock on any given date means the fair market value of the Stock determined in good faith by the Administrator; provided, however, that if the Stock is listed on the National Association of Securities Dealers Automated Quotation System (“NASDAQ”), NASDAQ Global Market, The New York Stock Exchange or another national securities exchange or traded on any established market, the determination shall be made by reference to the closing sales price. If there is no closing sales price for such date, the determination shall be made by reference to the last date preceding such date for which there is a closing sales price; provided further, however, that if the date for which Fair Market Value is determined is the Registration Date, the Fair Market Value shall be the “Price to the Public” (or equivalent) set forth on the cover page for the final prospectus relating to the Company’s initial public offering.

“Incentive Stock Option” means any Stock Option designated and qualified as an “incentive stock option” as defined in Section 422 of the Code.

“Non-Employee Director” means a member of the Board who is not also an employee of the Company or any Subsidiary.

“Non-Qualified Stock Option” means any Stock Option that is not an Incentive Stock Option.

“Option” or “Stock Option” means any option to purchase shares of Stock granted pursuant to Section 5.

“Registration Date” means the date upon which the registration statement on Form S-1 that is filed by the Company with respect to its initial public offering is declared effective by the Securities and Exchange Commission.

“Restricted Shares” means the shares of Stock underlying a Restricted Stock Award that remain subject to a risk of forfeiture or the Company’s right of repurchase.

“Restricted Stock Award” means an Award of Restricted Shares subject to such restrictions and conditions as the Administrator may determine at the time of grant.
“Restricted Stock Units” means an Award of stock units subject to such restrictions and conditions as the Administrator may determine at the time of grant.

“Sale Event” means (i) the sale of all or substantially all of the assets of the Company on a consolidated basis to an unrelated person or entity, (ii) a merger, reorganization or consolidation pursuant to which the holders of the Company’s outstanding voting power and outstanding stock immediately prior to such transaction do not own a majority of the outstanding voting power and outstanding stock or other equity interests of the resulting or successor entity (or its ultimate parent, if applicable) immediately upon completion of such transaction, (iii) the sale of all of the Stock of the Company to an unrelated person, entity or group thereof acting in concert, or (iv) any other transaction in which the owners of the Company’s outstanding voting power immediately prior to such transaction do not own at least a majority of the outstanding voting power of the Company or any successor entity immediately upon completion of the transaction other than as a result of the acquisition of securities directly from the Company.

“Sale Price” means the value as determined by the Administrator of the consideration payable, or otherwise to be received by stockholders, per share of Stock pursuant to a Sale Event.

“Section 409A” means Section 409A of the Code and the regulations and other guidance promulgated thereunder.

“Service Relationship” means any relationship as an employee, director or Consultant of the Company or any Affiliate (e.g., a Service Relationship shall be deemed to continue without interruption in the event an individual’s status changes from full-time employee to part-time employee or Consultant).

“Stock” means the Common Stock, par value $0.0001 per share, of the Company, subject to adjustments pursuant to Section 3.

“Stock Appreciation Right” means an Award entitling the recipient to receive shares of Stock (or cash, to the extent explicitly provided for in the applicable Award Certificate) having a value equal to the excess of the Fair Market Value of the Stock on the date of exercise over the exercise price of the Stock Appreciation Right multiplied by the number of shares of Stock with respect to which the Stock Appreciation Right shall have been exercised.

“Subsidiary” means any corporation or other entity (other than the Company) in which the Company has at least a 50 percent interest, either directly or indirectly.

“Ten Percent Owner” means an employee who owns or is deemed to own (by reason of the attribution rules of Section 424(d) of the Code) more than 10 percent of the combined voting power of all classes of stock of the Company or any parent or subsidiary corporation.

“Unrestricted Stock Award” means an Award of shares of Stock free of any restrictions.

SECTION 2. ADMINISTRATION OF PLAN; ADMINISTRATOR AUTHORITY TO SELECT GRANTEES AND DETERMINE AWARDS

(a) Administration of Plan. The Plan shall be administered by the Administrator.
(b) Powers of Administrator. The Administrator shall have the power and authority to grant Awards consistent with the terms of the Plan, including the power and authority:

(i) to select the individuals to whom Awards may from time to time be granted;

(ii) to determine the time or times of grant, and the extent, if any, of Incentive Stock Options, Non-Qualified Stock Options, Stock Appreciation Rights, Restricted Stock Awards, Restricted Stock Units, Unrestricted Stock Awards, Cash-Based Awards, and Dividend Equivalent Rights, or any combination of the foregoing, granted to any one or more grantees;

(iii) to determine the number of shares of Stock to be covered by any Award;

(iv) to determine and modify from time to time the terms and conditions, including restrictions, not inconsistent with the terms of the Plan, of any Award, which terms and conditions may differ among individual Awards and grantees, and to approve the forms of Award Certificates;

(v) to accelerate at any time the exercisability or vesting of all or any portion of any Award;

(vi) subject to the provisions of Section 5(c), to extend at any time the period in which Stock Options may be exercised; and

(vii) at any time to adopt, alter and repeal such rules, guidelines and practices for administration of the Plan and for its own acts and proceedings as it shall deem advisable; to interpret the terms and provisions of the Plan and any Award (including related written instruments); to make all determinations it deems advisable for the administration of the Plan; to decide all disputes arising in connection with the Plan; and to otherwise supervise the administration of the Plan.

All decisions and interpretations of the Administrator shall be binding on all persons, including the Company and Plan grantees.

(c) Delegation of Authority to Grant Awards. Subject to applicable law, the Administrator, in its discretion, may delegate to a committee consisting of one or more officers of the Company including the Chief Executive Officer of the Company all or part of the Administrator’s authority and duties with respect to the granting of Awards to individuals who are (i) not subject to the reporting and other provisions of Section 16 of the Exchange Act and (ii) not members of the delegated committee. Any such delegation by the Administrator shall include a limitation as to the amount of Stock underlying Awards that may be granted during the period of the delegation and shall contain guidelines as to the determination of the exercise price and the vesting criteria. The Administrator may revoke or amend the terms of a delegation at any time but such action shall not invalidate any prior actions of the Administrator’s delegate or delegates that were consistent with the terms of the Plan.

(d) Award Certificate. Awards under the Plan shall be evidenced by Award Certificates that set forth the terms, conditions and limitations for each Award which may include, without limitation, the term of an Award and the provisions applicable in the event employment or service terminates.
Indemnification. Neither the Board nor the Administrator, nor any member of either or any delegate thereof, shall be liable for any act, omission, interpretation, construction or determination made in good faith in connection with the Plan, and the members of the Board and the Administrator (and any delegate thereof) shall be entitled in all cases to indemnification and reimbursement by the Company in respect of any claim, loss, damage or expense (including, without limitation, reasonable attorneys’ fees) arising or resulting therefrom to the fullest extent permitted by law and/or under the Company’s articles or bylaws or any directors’ and officers’ liability insurance coverage which may be in effect from time to time and/or any indemnification agreement between such individual and the Company.

Foreign Award Recipients. Notwithstanding any provision of the Plan to the contrary, in order to comply with the laws in other countries in which the Company and its Subsidiaries operate or have employees or other individuals eligible for Awards, the Administrator, in its sole discretion, shall have the power and authority to: (i) determine which Subsidiaries shall be covered by the Plan; (ii) determine which individuals outside the United States are eligible to participate in the Plan; (iii) modify the terms and conditions of any Award granted to individuals outside the United States to comply with applicable foreign laws; (iv) establish subplans and modify exercise procedures and other terms and procedures, to the extent the Administrator determines such actions to be necessary or advisable (and such subplans and/or modifications shall be attached to this Plan as appendices); provided, however, that no such subplans and/or modifications shall increase the share limitations contained in Section 3(a) hereof; and (v) take any action, before or after an Award is made, that the Administrator determines to be necessary or advisable to obtain approval or comply with any local governmental regulatory exemptions or approvals. Notwithstanding the foregoing, the Administrator may not take any actions hereunder, and no Awards shall be granted, that would violate the Exchange Act or any other applicable United States securities law, the Code, or any other applicable United States governing statute or law.

SECTION 3. STOCK ISSUABLE UNDER THE PLAN; MERGERS; SUBSTITUTION

(a) Stock Issuable. The maximum number of shares of Stock reserved and available for issuance under the Plan shall be 13,000,000 (the “Initial Limit”), subject to adjustment as provided in Section 3(c), plus on January 1, 2019 and each January 1 thereafter, the number of shares of Stock reserved and available for issuance under the Plan shall be cumulatively increased by four (4) percent of the number of shares of Stock issued and outstanding on the immediately preceding December 31 or such lesser number of shares of Stock as determined by the Administrator (the “Annual Increase”). Subject to such overall limitation, the maximum aggregate number of shares of Stock that may be issued in the form of Incentive Stock Options shall not exceed the Initial Limit cumulatively increased on January 1, 2019 and on each January 1 thereafter by the lesser of the Annual Increase for such year or 13,000,000 shares of Stock, subject in all cases to adjustment as provided in Section 3(c). Shares of Stock underlying any Awards under the Plan and under the Company’s 2016 Stock Option and Grant Plan, as amended from time to time, that are forfeited, canceled, held back upon exercise of an Option or settlement of an Award to cover the exercise price or tax withholding, reacquired by the
Company prior to vesting, satisfied without the issuance of Stock or otherwise terminated (other than by exercise) shall be added back to the shares of Stock available for issuance under the Plan and, to the extent permitted under Section 422 of the Code and the regulations promulgated thereunder, the shares of Stock that may be issued as Incentive Stock Options. In the event the Company repurchases shares of Stock on the open market, such shares shall not be added to the shares of Stock available for issuance under the Plan. Subject to such overall limitations, shares of Stock may be issued up to such maximum number pursuant to any type or types of Award. The shares available for issuance under the Plan may be authorized but unissued shares of Stock or shares of Stock reacquired by the Company.

(b) Maximum Awards to Non-Employee Directors. Notwithstanding anything to the contrary in this Plan, the value of all Awards awarded under this Plan and all other cash compensation paid by the Company to any Non-Employee Director in any calendar year shall not exceed $1,500,000 for the first year of service as a Non-Employee Director and $1,000,000 for each year thereafter for service as a Non-Employee Director. For the purpose of this limitation, the value of any Award shall be its grant date fair value, as determined in accordance with ASC 718 or successor provision but excluding the impact of estimated forfeitures related to service-based vesting provisions.

(c) Changes in Stock. Subject to Section 3(d) hereof, if, as a result of any reorganization, recapitalization, reclassification, stock dividend, stock split, reverse stock split or other similar change in the Company’s capital stock, the outstanding shares of Stock are increased or decreased or are exchanged for a different number or kind of shares or other securities of the Company, or additional shares or new or different shares or other securities of the Company or other non-cash assets are distributed with respect to such shares of Stock or other securities, or, if, as a result of any merger or consolidation, sale of all or substantially all of the assets of the Company, the outstanding shares of Stock are converted into or exchanged for securities of the Company or any successor entity (or a parent or subsidiary thereof), the Administrator shall make an appropriate or proportionate adjustment in (i) the maximum number of shares reserved for issuance under the Plan, including the maximum number of shares that may be issued in the form of Incentive Stock Options, (ii) the number and kind of shares or other securities subject to any then outstanding Awards under the Plan, (iii) the repurchase price, if any, per share subject to each outstanding Restricted Stock Award, and (iv) the exercise price for each share subject to any then outstanding Stock Options and Stock Appreciation Rights under the Plan, without changing the aggregate exercise price (i.e., the exercise price multiplied by the number of shares subject to Stock Options and Stock Appreciation Rights) as to which such Stock Options and Stock Appreciation Rights remain exercisable. The Administrator shall also make equitable or proportionate adjustments in the number of shares subject to outstanding Awards and the exercise price and the terms of outstanding Awards to take into consideration cash dividends paid other than in the ordinary course or any other extraordinary corporate event. The adjustment by the Administrator shall be final, binding and conclusive. No fractional shares of Stock shall be issued under the Plan resulting from any such adjustment, but the Administrator in its discretion may make a cash payment in lieu of fractional shares.
(d) **Mergers and Other Transactions.** In the case of and subject to the consummation of a Sale Event, the parties thereto may cause the assumption or continuation of Awards theretofore granted by the successor entity, or the substitution of such Awards with new Awards of the successor entity or parent thereof, with appropriate adjustment as to the number and kind of shares and, if appropriate, the per share exercise prices, as such parties shall agree. To the extent the parties to such Sale Event do not provide for the assumption, continuation or substitution of Awards, upon the effective time of the Sale Event, the Plan and all outstanding Awards granted hereunder shall terminate. In such case, except as may be otherwise provided in the relevant Award Certificate, all Options and Stock Appreciation Rights with time-based vesting, conditions or restrictions that are not vested and/or exercisable immediately prior to the effective time of the Sale Event shall become fully vested and exercisable as of the effective time of the Sale Event, all other Awards with time-based vesting, conditions or restrictions shall become fully vested and nonforfeitable as of the effective time of the Sale Event, and all Awards with conditions and restrictions relating to the attainment of performance goals may become vested and nonforfeitable in connection with a Sale Event in the Administrator’s discretion or to the extent specified in the relevant Award Certificate. In the event of such termination, (i) the Company shall have the option (in its sole discretion) to make or provide for a payment, in cash or in kind, to the grantees holding Options and Stock Appreciation Rights, in exchange for the cancellation thereof, in an amount equal to the difference between (A) the Sale Price multiplied by the number of shares of Stock subject to outstanding Options and Stock Appreciation Rights (to the extent then exercisable at prices not in excess of the Sale Price) and (B) the aggregate exercise price of all such outstanding Options and Stock Appreciation Rights (provided that, in the case of an Option or Stock Appreciation Right with an exercise price equal to or less than the Sale Price, such Option or Stock Appreciation Right shall be cancelled for no consideration); or (ii) each grantee shall be permitted, within a specified period of time prior to the consummation of the Sale Event as determined by the Administrator, to exercise all outstanding Options and Stock Appreciation Rights (to the extent then exercisable) held by such grantee. The Company shall also have the option (in its sole discretion) to make or provide for a payment, in cash or in kind, to the grantees holding other Awards in an amount equal to the Sale Price multiplied by the number of vested shares of Stock under such Awards.

**SECTION 4. ELIGIBILITY**

Grantees under the Plan will be such employees, Non-Employee Directors or Consultants of the Company and its Affiliates as are selected from time to time by the Administrator in its sole discretion; provided that Awards may not be granted to employees, Directors or Consultants who are providing services only to any “parent” of the Company, as such term is defined in Rule 405 of the Act, unless (i) the stock underlying the Awards is treated as “service recipient stock” under Section 409A or (ii) the Company has determined that such Awards are exempt from or otherwise comply with Section 409A.

**SECTION 5. STOCK OPTIONS**

(a) **Award of Stock Options.** The Administrator may grant Stock Options under the Plan. Any Stock Option granted under the Plan shall be in such form as the Administrator may from time to time approve.

Stock Options granted under the Plan may be either Incentive Stock Options or Non-Qualified Stock Options. Incentive Stock Options may be granted only to employees of the Company or any Subsidiary that is a “subsidiary corporation” within the meaning of Section 424(i) of the Code. To the extent that any Option does not qualify as an Incentive Stock Option, it shall be deemed a Non-Qualified Stock Option.
Stock Options granted pursuant to this Section 5 shall be subject to the following terms and conditions and shall contain such additional terms and conditions, not inconsistent with the terms of the Plan, as the Administrator shall deem desirable. If the Administrator so determines, Stock Options may be granted in lieu of cash compensation at the optionee’s election, subject to such terms and conditions as the Administrator may establish.

(b) Exercise Price. The exercise price per share for the Stock covered by a Stock Option granted pursuant to this Section 5 shall be determined by the Administrator at the time of grant but shall not be less than 100 percent of the Fair Market Value on the date of grant. In the case of an Incentive Stock Option that is granted to a Ten Percent Owner, the exercise price of such Incentive Stock Option shall be not less than 110 percent of the Fair Market Value on the grant date. Notwithstanding the foregoing, Stock Options may be granted with an exercise price per share that is less than 100 percent of the Fair Market Value on the date of grant pursuant to a transaction described in, and in a manner consistent with, Section 424(a) of the Code.

(c) Option Term. The term of each Stock Option shall be fixed by the Administrator, but no Stock Option shall be exercisable more than ten years after the date the Stock Option is granted. In the case of an Incentive Stock Option that is granted to a Ten Percent Owner, the term of such Stock Option shall be no more than five years from the date of grant.

(d) Exercisability; Rights of a Stockholder. Stock Options shall become exercisable at such time or times, whether or not in installments, as shall be determined by the Administrator at or after the grant date. The Administrator may at any time accelerate the exercisability of all or any portion of any Stock Option. An optionee shall have the rights of a stockholder only as to shares acquired upon the exercise of a Stock Option and not as to unexercised Stock Options.

(e) Method of Exercise. Stock Options may be exercised in whole or in part, by giving written or electronic notice of exercise to the Company, specifying the number of shares to be purchased. Payment of the purchase price may be made by one or more of the following methods except to the extent otherwise provided in the Option Award Certificate:

(i) In cash, by certified or bank check or other instrument acceptable to the Administrator;

(ii) If permitted by the Administrator, through the delivery (or attestation to the ownership following such procedures as the Company may prescribe) of shares of Stock that are not then subject to restrictions under any Company plan. Such surrendered shares shall be valued at Fair Market Value on the exercise date;

(iii) By the optionee delivering to the Company a properly executed exercise notice together with irrevocable instructions to a broker to promptly deliver to the Company cash or a check payable and acceptable to the Company for the purchase price; provided that in the event the optionee chooses to pay the purchase price as so provided, the optionee and the broker shall comply with such procedures and enter into such agreements of indemnity and other agreements as the Company shall prescribe as a condition of such payment procedure; or...
Payment instruments will be received subject to collection. The transfer to the optionee on the records of the Company or of the transfer agent of the shares of Stock to be purchased pursuant to the exercise of a Stock Option will be contingent upon receipt from the optionee (or a purchaser acting in his stead in accordance with the provisions of the Stock Option) by the Company of the full purchase price for such shares and the fulfillment of any other requirements contained in the Option Award Certificate or applicable provisions of laws (including the satisfaction of any withholding taxes that the Company is obligated to withhold with respect to the optionee). In the event an optionee chooses to pay the purchase price by previously-owned shares of Stock through the attestation method, the number of shares of Stock transferred to the optionee upon the exercise of the Stock Option shall be net of the number of attested shares. In the event that the Company establishes, for itself or using the services of a third party, an automated system for the exercise of Stock Options, such as a system using an internet website or interactive voice response, then the paperless exercise of Stock Options may be permitted through the use of such an automated system.

(f) **Annual Limit on Incentive Stock Options.** To the extent required for “incentive stock option” treatment under Section 422 of the Code, the aggregate Fair Market Value (determined as of the time of grant) of the shares of Stock with respect to which Incentive Stock Options granted under this Plan and any other plan of the Company or its parent and subsidiary corporations become exercisable for the first time by an optionee during any calendar year shall not exceed $100,000. To the extent that any Stock Option exceeds this limit, it shall constitute a Non-Qualified Stock Option.

**SECTION 6. STOCK APPRECIATION RIGHTS**

(a) **Award of Stock Appreciation Rights.** The Administrator may grant Stock Appreciation Rights under the Plan. A Stock Appreciation Right is an Award entitling the recipient to receive shares of Stock (or cash, to the extent explicitly provided for in the applicable Award Certificate) having a value equal to the excess of the Fair Market Value of a share of Stock on the date of exercise over the exercise price of the Stock Appreciation Right multiplied by the number of shares of Stock with respect to which the Stock Appreciation Right shall have been exercised.

(b) **Exercise Price of Stock Appreciation Rights.** The exercise price of a Stock Appreciation Right shall not be less than 100 percent of the Fair Market Value of the Stock on the date of grant.

(c) **Grant and Exercise of Stock Appreciation Rights.** Stock Appreciation Rights may be granted by the Administrator independently of any Stock Option granted pursuant to Section 5 of the Plan.
(d) Terms and Conditions of Stock Appreciation Rights. Stock Appreciation Rights shall be subject to such terms and conditions as shall be determined on the date of grant by the Administrator. The term of a Stock Appreciation Right may not exceed ten years. The terms and conditions of each such Award shall be determined by the Administrator, and such terms and conditions may differ among individual Awards and grantees.

SECTION 7. RESTRICTED STOCK AWARDS

(a) Nature of Restricted Stock Awards. The Administrator may grant Restricted Stock Awards under the Plan. A Restricted Stock Award is any Award of Restricted Shares subject to such restrictions and conditions as the Administrator may determine at the time of grant. Conditions may be based on continuing employment (or other Service Relationship) and/or achievement of pre-established performance goals and objectives.

(b) Rights as a Stockholder. Upon the grant of the Restricted Stock Award and payment of any applicable purchase price, a grantee shall have the rights of a stockholder with respect to the voting of the Restricted Shares and receipt of dividends; provided that any dividends paid by the Company shall accrue and shall not be paid to the grantee until and to the extent the applicable restrictions with respect to the Restricted Stock Award have lapsed. Unless the Administrator shall otherwise determine, (i) uncertificated Restricted Shares shall be accompanied by a notation on the records of the Company or the transfer agent to the effect that they are subject to forfeiture until such Restricted Shares are vested as provided in Section 7(d) below, and (ii) certificated Restricted Shares shall remain in the possession of the Company until such Restricted Shares are vested as provided in Section 7(d) below, and the grantee shall be required, as a condition of the grant, to deliver to the Company such instruments of transfer as the Administrator may prescribe.

(c) Restrictions. Restricted Shares may not be sold, assigned, transferred, pledged or otherwise encumbered or disposed of except as specifically provided herein or in the Restricted Stock Award Certificate. Except as may otherwise be provided by the Administrator either in the Award Certificate or, subject to Section 16 below, in writing after the Award is issued, if a grantee’s employment (or other Service Relationship) with the Company and its Subsidiaries terminates for any reason, any Restricted Shares that have not vested at the time of termination shall automatically and without any requirement of notice to such grantee from or other action by or on behalf of, the Company be deemed to have been reacquired by the Company at its original purchase price (if any) from such grantee or such grantee’s legal representative simultaneously with such termination of employment (or other Service Relationship), and thereafter shall cease to represent any ownership of the Company by the grantee or rights of the grantee as a stockholder. Following such deemed reacquisition of Restricted Shares that are represented by physical certificates, a grantee shall surrender such certificates to the Company upon request without consideration.

(d) Vesting of Restricted Shares. The Administrator at the time of grant shall specify the date or dates and/or the attainment of pre-established performance goals, objectives and other conditions on which the non-transferability of the Restricted Shares and the Company’s right of repurchase or forfeiture shall lapse. Subsequent to such date or dates and/or the attainment of such pre-established performance goals, objectives and other conditions, the shares on which all restrictions have lapsed shall no longer be Restricted Shares and shall be deemed “vested.”
SECTION 8. RESTRICTED STOCK UNITS

(a) Nature of Restricted Stock Units. The Administrator may grant Restricted Stock Units under the Plan. A Restricted Stock Unit is an Award of stock units that may be settled in shares of Stock (or cash, to the extent explicitly provided for in the Award Certificate) upon the satisfaction of such restrictions and conditions at the time of grant. Conditions may be based on continuing employment (or other Service Relationship) and/or achievement of pre-established performance goals and objectives. The terms and conditions of each such Award shall be determined by the Administrator, and such terms and conditions may differ among individual Awards and grantees. Except in the case of Restricted Stock Units with a deferred settlement date that complies with Section 409A, at the end of the vesting period, the Restricted Stock Units, to the extent vested, shall be settled in the form of shares of Stock. Restricted Stock Units with deferred settlement dates are subject to Section 409A and shall contain such additional terms and conditions as the Administrator shall determine in its sole discretion in order to comply with the requirements of Section 409A.

(b) Election to Receive Restricted Stock Units in Lieu of Compensation. The Administrator may, in its sole discretion, permit a grantee to elect to receive a portion of future cash compensation otherwise due to such grantee in the form of an award of Restricted Stock Units. Any such election shall be made in writing and shall be delivered to the Company no later than the date specified by the Administrator and in accordance with Section 409A and such other rules and procedures established by the Administrator. Any such future cash compensation that the grantee elects to defer shall be converted to a fixed number of Restricted Stock Units based on the Fair Market Value of Stock on the date the compensation would otherwise have been paid to the grantee if such payment had not been deferred as provided herein. The Administrator shall have the sole right to determine whether and under what circumstances to permit such elections and to impose such limitations and other terms and conditions thereon as the Administrator deems appropriate. Any Restricted Stock Units that are elected to be received in lieu of cash compensation shall be fully vested, unless otherwise provided in the Award Certificate.

(c) Rights as a Stockholder. A grantee shall have the rights as a stockholder only as to shares of Stock acquired by the grantee upon settlement of Restricted Stock Units; provided, however, that the grantee may be credited with Dividend Equivalent Rights with respect to the stock units underlying his Restricted Stock Units, subject to the provisions of Section 11 and such terms and conditions as the Administrator may determine.

(d) Termination. Except as may otherwise be provided by the Administrator either in the Award Certificate or, subject to Section 16 below, in writing after the Award is issued, a grantee’s right in all Restricted Stock Units that have not vested shall automatically terminate upon the grantee’s termination of employment (or cessation of Service Relationship) with the Company and its Subsidiaries for any reason.
SECTION 9. UNRESTRICTED STOCK AWARDS

Grant or Sale of Unrestricted Stock. The Administrator may grant (or sell at par value or such higher purchase price determined by the Administrator) an Unrestricted Stock Award under the Plan. An Unrestricted Stock Award is an Award pursuant to which the grantee may receive shares of Stock free of any restrictions under the Plan. Unrestricted Stock Awards may be granted in respect of past services or other valid consideration, or in lieu of cash compensation due to such grantee.

SECTION 10. CASH-BASED AWARDS

Grant of Cash-Based Awards. The Administrator may grant Cash-Based Awards under the Plan. A Cash-Based Award is an Award that entitles the grantee to a payment in cash upon the attainment of specified performance goals. The Administrator shall determine the maximum duration of the Cash-Based Award, the amount of cash to which the Cash-Based Award pertains, the conditions upon which the Cash-Based Award shall become vested or payable, and such other provisions as the Administrator shall determine. Each Cash-Based Award shall specify a cash-denominated payment amount, formula or payment ranges as determined by the Administrator. Payment, if any, with respect to a Cash-Based Award shall be made in accordance with the terms of the Award and may be made in cash.

SECTION 11. DIVIDEND EQUIVALENT RIGHTS

(a) Dividend Equivalent Rights. The Administrator may grant Dividend Equivalent Rights under the Plan. A Dividend Equivalent Right is an Award entitling the grantee to receive credits based on cash dividends that would have been paid on the shares of Stock specified in the Dividend Equivalent Right (or other Award to which it relates) if such shares had been issued to the grantee. A Dividend Equivalent Right may be granted hereunder to any grantee as a component of an award of Restricted Stock Units or as a freestanding award. The terms and conditions of Dividend Equivalent Rights shall be specified in the Award Certificate. Dividend equivalents credited to the holder of a Dividend Equivalent Right may be paid currently or may be deemed to be reinvested in additional shares of Stock, which may thereafter accrue additional equivalents. Any such reinvestment shall be at Fair Market Value on the date of reinvestment or such other price as may then apply under a dividend reinvestment plan sponsored by the Company, if any. Dividend Equivalent Rights may be settled in cash or shares of Stock or a combination thereof, in a single installment or installments. A Dividend Equivalent Right granted as a component of an Award of Restricted Stock Units shall provide that such Dividend Equivalent Right shall be settled only upon settlement or payment of, or lapse of restrictions on, such other Award, and that such Dividend Equivalent Right shall expire or be forfeited or annulled under the same conditions as such other Award.

(b) Termination. Except as may otherwise be provided by the Administrator either in the Award Certificate or, subject to Section 16 below, in writing after the Award is issued, a grantee’s rights in all Dividend Equivalent Rights shall automatically terminate upon the grantee’s termination of employment (or cessation of Service Relationship) with the Company and its Subsidiaries for any reason.
SECTION 12. TRANSFERABILITY OF AWARDS

(a) **Transferability.** Except as provided in Section 12(b) below, during a grantee’s lifetime, his or her Awards shall be exercisable only by the grantee, or by the grantee’s legal representative or guardian in the event of the grantee’s incapacity. No Awards shall be sold, assigned, transferred or otherwise encumbered or disposed of by a grantee other than by will or by the laws of descent and distribution or pursuant to a domestic relations order. No Awards shall be subject, in whole or in part, to attachment, execution, or levy of any kind, and any purported transfer in violation hereof shall be null and void.

(b) **Administrator Action.** Notwithstanding Section 12(a), the Administrator, in its discretion, may provide either in the Award Certificate regarding a given Award or by subsequent written approval that the grantee (who is an employee or director) may transfer his or her Non-Qualified Stock Options to his or her immediate family members, to trusts for the benefit of such family members, or to partnerships in which such family members are the only partners, provided that the transferee agrees in writing with the Company to be bound by all of the terms and conditions of this Plan and the applicable Award. In no event may an Award be transferred by a grantee for value.

(c) **Family Member.** For purposes of Section 12(b), “family member” shall mean a grantee’s child, stepchild, grandchild, parent, stepparent, grandparent, spouse, former spouse, sibling, niece, nephew, mother-in-law, father-in-law, son-in-law, daughter-in-law, brother-in-law, or sister-in-law, including adoptive relationships, any person sharing the grantee’s household (other than a tenant of the grantee), a trust in which these persons (or the grantee) have more than 50 percent of the beneficial interest, a foundation in which these persons (or the grantee) control the management of assets, and any other entity in which these persons (or the grantee) own more than 50 percent of the voting interests.

(d) **Designation of Beneficiary.** To the extent permitted by the Company, each grantee to whom an Award has been made under the Plan may designate a beneficiary or beneficiaries to exercise any Award or receive any payment under any Award payable on or after the grantee’s death. Any such designation shall be on a form provided for that purpose by the Administrator and shall not be effective until received by the Administrator. If no beneficiary has been designated by a deceased grantee, or if the designated beneficiaries have predeceased the grantee, the beneficiary shall be the grantee’s estate.

SECTION 13. TAX WITHHOLDING

(a) **Payment by Grantee.** Each grantee shall, no later than the date as of which the value of an Award or of any Stock or other amounts received thereunder first becomes includable in the gross income of the grantee for income tax purposes, pay to the Company, or make arrangements satisfactory to the Administrator regarding payment of, any Federal, state, or local taxes of any kind required by law to be withheld by the Company with respect to such income. The Company and its Subsidiaries shall, to the extent permitted by law, have the right to deduct any such taxes from any payment of any kind otherwise due to the grantee. The Company’s obligation to deliver evidence of book entry (or stock certificates) to any grantee is subject to and conditioned on tax withholding obligations being satisfied by the grantee.
(b) Payment in Stock. The Administrator may require the Company’s tax withholding obligation to be satisfied, in whole or in part, by the Company withholding from shares of Stock to be issued pursuant to any Award a number of shares with an aggregate Fair Market Value (as of the date the withholding is effected) that would satisfy the withholding amount due; provided, however, that the amount withheld does not exceed the maximum statutory tax rate or such lesser amount as is necessary to avoid liability accounting treatment. For purposes of share withholding, the Fair Market Value of withheld shares shall be determined in the same manner as the value of Stock includible in income of the grantee. The Administrator may also require the Company’s tax withholding obligation to be satisfied, in whole or in part, by an arrangement whereby a certain number of shares of Stock issued pursuant to any Award are immediately sold and proceeds from such sale are remitted to the Company in an amount that would satisfy the withholding amount due.

SECTION 14. SECTION 409A AWARDS

Awards are intended to be exempt from Section 409A to the greatest extent possible and to otherwise comply with Section 409A. The Plan and all Awards shall be interpreted in accordance with such intent. To the extent that any Award is determined to constitute “nonqualified deferred compensation” within the meaning of Section 409A (a “409A Award”), the Award shall be subject to such additional rules and requirements as specified by the Administrator from time to time in order to comply with Section 409A. In this regard, if any amount under a 409A Award is payable upon a “separation from service” (within the meaning of Section 409A) to a grantee who is then considered a “specified employee” (within the meaning of Section 409A), then no such payment shall be made prior to the date that is the earlier of (i) six months and one day after the grantee’s separation from service, or (ii) the grantee’s death, but only to the extent such delay is necessary to prevent such payment from being subject to interest, penalties and/or additional tax imposed pursuant to Section 409A. Further, the settlement of any 409A Award may not be accelerated except to the extent permitted by Section 409A.

SECTION 15. TERMINATION OF SERVICE RELATIONSHIP, TRANSFER, LEAVE OF ABSENCE, ETC.

(a) Termination of Service Relationship. If the grantee’s Service Relationship is with an Affiliate and such Affiliate ceases to be an Affiliate, the grantee shall be deemed to have terminated his or her Service Relationship for purposes of the Plan.

(b) For purposes of the Plan, the following events shall not be deemed a termination of a Service Relationship:

(i) a transfer to the employment of the Company from an Affiliate or from the Company to an Affiliate, or from one Affiliate to another; or

(ii) an approved leave of absence for military service or sickness, or for any other purpose approved by the Company, if the employee’s right to re-employment is guaranteed either by a statute or by contract or under the policy pursuant to which the leave of absence was granted or if the Administrator otherwise so provides in writing.
SECTION 16. AMENDMENTS AND TERMINATION

The Board may, at any time, amend or discontinue the Plan and the Administrator may, at any time, amend or cancel any outstanding Award for the purpose of satisfying changes in law or for any other lawful purpose, but no such action shall adversely affect rights under any outstanding Award without the holder’s consent. Except as provided in Section 3(c) or 3(d), without prior stockholder approval, in no event may the Administrator exercise its discretion to reduce the exercise price of outstanding Stock Options or Stock Appreciation Rights or effect the repricing of such Awards through cancellation and re-grants or cancellation of Stock Options or Stock Appreciation Rights in exchange for cash or other Awards. To the extent required under the rules of any securities exchange or market system on which the Stock is listed or to the extent determined by the Administrator to be required by the Code to ensure that Incentive Stock Options granted under the Plan are qualified under Section 422 of the Code, Plan amendments shall be subject to approval by Company stockholders. Nothing in this Section 16 shall limit the Administrator’s authority to take any action permitted pursuant to Section 3(c) or 3(d).

SECTION 17. STATUS OF PLAN

With respect to the portion of any Award that has not been exercised and any payments in cash, Stock or other consideration not received by a grantee, a grantee shall have no rights greater than those of a general creditor of the Company unless the Administrator shall otherwise expressly determine in connection with any Award or Awards. In its sole discretion, the Administrator may authorize the creation of trusts or other arrangements to meet the Company’s obligations to deliver Stock or make payments with respect to Awards hereunder, provided that the existence of such trusts or other arrangements is consistent with the foregoing sentence.

SECTION 18. GENERAL PROVISIONS

(a) No Distribution. The Administrator may require each person acquiring Stock pursuant to an Award to represent to and agree with the Company in writing that such person is acquiring the shares without a view to distribution thereof.

(b) Issuance of Stock. To the extent certificated, stock certificates to grantees under this Plan shall be deemed delivered for all purposes when the Company or a stock transfer agent of the Company shall have mailed such certificates in the United States mail, addressed to the grantee, at the grantee’s last known address on file with the Company. Uncertificated Stock shall be deemed delivered for all purposes when the Company or a Stock transfer agent of the Company shall have given to the grantee by electronic mail (with proof of receipt) or by United States mail, addressed to the grantee, at the grantee’s last known address on file with the Company, notice of issuance and recorded the issuance in its records (which may include electronic “book entry” records). Notwithstanding anything herein to the contrary, the Company shall not be required to issue or deliver any evidence of book entry or certificates evidencing shares of Stock pursuant to the exercise or settlement of any Award, unless and until the Administrator has determined, with advice of counsel (to the extent the Administrator deems such advice necessary or advisable), that the issuance and delivery is in compliance with all applicable laws, regulations of governmental authorities and, if applicable, the requirements of any exchange on which the shares of Stock are listed, quoted or traded. Any Stock issued
pursuant to the Plan shall be subject to any stop-transfer orders and other restrictions as the Administrator deems necessary or advisable to comply with federal, state or foreign jurisdiction, securities or other laws, rules and quotation system on which the Stock is listed, quoted or traded. The Administrator may place legends on any Stock certificate or notations on any book entry to reference restrictions applicable to the Stock. In addition to the terms and conditions provided herein, the Administrator may require that an individual make such reasonable covenants, agreements, and representations as the Administrator, in its discretion, deems necessary or advisable in order to comply with any such laws, regulations, or requirements. The Administrator shall have the right to require any individual to comply with any timing or other restrictions with respect to the settlement or exercise of any Award, including a window-period limitation, as may be imposed in the discretion of the Administrator.

(c) Stockholder Rights. Until Stock is deemed delivered in accordance with Section 18(b), no right to vote or receive dividends or any other rights of a stockholder will exist with respect to shares of Stock to be issued in connection with an Award, notwithstanding the exercise of a Stock Option or any other action by the grantee with respect to an Award.

(d) Other Compensation Arrangements; No Employment Rights. Nothing contained in this Plan shall prevent the Board from adopting other or additional compensation arrangements, including trusts, and such arrangements may be either generally applicable or applicable only in specific cases. The adoption of this Plan and the grant of Awards do not confer upon any employee any right to continued employment with the Company or any Subsidiary.

(e) Trading Policy Restrictions. Option exercises and other Awards under the Plan shall be subject to the Company’s insider trading policies and procedures, as in effect from time to time.

(f) Clawback Policy. Awards under the Plan shall be subject to the Company’s clawback policy, as in effect from time to time.

SECTION 19. EFFECTIVE DATE OF PLAN

This Plan shall become effective upon the date immediately preceding the Registration Date subject to prior stockholder approval in accordance with applicable state law, the Company’s bylaws and articles of incorporation, and applicable stock exchange rules. No grants of Stock Options and other Awards may be made hereunder after the tenth anniversary of the Effective Date and no grants of Incentive Stock Options may be made hereunder after the tenth anniversary of the date the Plan is approved by the Board.
SECTION 20. GOVERNING LAW

This Plan and all Awards and actions taken thereunder shall be governed by, and construed in accordance with the General Corporation Law of the State of Delaware as to matters within the scope thereof, and as to all other matters shall be governed by and construed in accordance with the internal laws of the Commonwealth of Massachusetts, applied without regard to conflict of law principles.

DATE APPROVED BY BOARD OF DIRECTORS: November 4, 2018

DATE APPROVED BY STOCKHOLDERS:
Name of Optionee: ____________________________________________
No. of Option Shares: ________________________________
Option Exercise Price per Share: $________________________

[FMV on Grant Date (110% of FMV if a 10% owner)]

Grant Date: ________________________________
Expiration Date: ________________________________
[up to 10 years (5 if a 10% owner)]

Pursuant to the Moderna, Inc. 2018 Stock Option and Incentive Plan as amended through the date hereof (the “Plan”), Moderna, Inc. (the “Company”) hereby grants to the Optionee named above an option (the “Stock Option”) to purchase on or prior to the Expiration Date specified above all or part of the number of shares of Common Stock, par value $0.0001 per share (the “Stock”), of the Company specified above at the Option Exercise Price per Share specified above subject to the terms and conditions set forth herein and in the Plan.

1. Exercisability Schedule. No portion of this Stock Option may be exercised until such portion shall have become exercisable. Except as set forth below, and subject to the discretion of the Administrator (as defined in Section 2 of the Plan) to accelerate the exercisability schedule hereunder, this Stock Option shall be exercisable with respect to the following number of Option Shares on the dates indicated so long as the Optionee remains an employee of the Company or a Subsidiary on such dates:

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* Max. of $100,000 per yr.

Once exercisable, this Stock Option shall continue to be exercisable at any time or times prior to the close of business on the Expiration Date, subject to the provisions hereof and of the Plan.
2. **Manner of Exercise.**

   (a) The Optionee may exercise this Stock Option only in the following manner: from time to time on or prior to the Expiration Date of this Stock Option, the Optionee may give written notice to the Administrator of his or her election to purchase some or all of the Option Shares purchasable at the time of such notice. This notice shall specify the number of Option Shares to be purchased.

   Payment of the purchase price for the Option Shares may be made by one or more of the following methods: (i) in cash, by certified or bank check or other instrument acceptable to the Administrator; (ii) if permitted by the Administrator, through the delivery (or attestation to the ownership) of shares of Stock that have been purchased by the Optionee on the open market or that are beneficially owned by the Optionee and are not then subject to any restrictions under any Company plan and that otherwise satisfy any holding periods as may be required by the Administrator; or (iii) by the Optionee delivering to the Company a properly executed exercise notice together with irrevocable instructions to a broker to promptly deliver to the Company cash or a check payable and acceptable to the Company to pay the option purchase price, provided that in the event the Optionee chooses to pay the option purchase price as so provided, the Optionee and the broker shall comply with such procedures and enter into such agreements of indemnity and other agreements as the Administrator shall prescribe as a condition of such payment procedure; or (iv) a combination of (i), (ii) and (iii) above. Payment instruments will be received subject to collection.

   The transfer to the Optionee on the records of the Company or of the transfer agent of the Option Shares will be contingent upon (i) the Company’s receipt from the Optionee of the full purchase price for the Option Shares, as set forth above, (ii) the fulfillment of any other requirements contained herein or in the Plan or in any other agreement or provision of laws, and (iii) the receipt by the Company of any agreement, statement or other evidence that the Company may require to satisfy itself that the issuance of Stock to be purchased pursuant to the exercise of Stock Options under the Plan and any subsequent resale of the shares of Stock will be in compliance with applicable laws and regulations. In the event the Optionee chooses to pay the purchase price by previously-owned shares of Stock through the attestation method, the number of shares of Stock transferred to the Optionee upon the exercise of the Stock Option shall be net of the Shares attested to.

   (b) The shares of Stock purchased upon exercise of this Stock Option shall be transferred to the Optionee on the records of the Company or of the transfer agent upon compliance to the satisfaction of the Administrator with all requirements under applicable laws or regulations in connection with such transfer and with the requirements hereof and of the Plan. The determination of the Administrator as to such compliance shall be final and binding on the Optionee. The Optionee shall not be deemed to be the holder of, or to have any of the rights of a holder with respect to, any shares of Stock subject to this Stock Option unless and until this Stock Option shall have been exercised pursuant to the terms hereof, the Company or the transfer agent shall have transferred the shares to the Optionee, and the Optionee’s name shall have been entered as the stockholder of record on the books of the Company. Thereupon, the Optionee shall have full voting, dividend and other ownership rights with respect to such shares of Stock.
3. **Termination of Employment.** If the Optionee’s employment by the Company or a Subsidiary (as defined in the Plan) is terminated, the period within which to exercise the Stock Option may be subject to earlier termination as set forth below.

   (a) **Termination Due to Death.** If the Optionee’s employment terminates by reason of the Optionee’s death, any portion of this Stock Option outstanding on such date, to the extent exercisable on the date of death, may thereafter be exercised by the Optionee’s legal representative or legatee for a period of 12 months from the date of death or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of death shall terminate immediately and be of no further force or effect.

   (b) **Termination Due to Disability.** If the Optionee’s employment terminates by reason of the Optionee’s disability (as determined by the Administrator), any portion of this Stock Option outstanding on such date, to the extent exercisable on the date of such termination of employment, may thereafter be exercised by the Optionee for a period of 12 months from the date of disability or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of disability shall terminate immediately and be of no further force or effect.

   (c) **Termination for Cause.** If the Optionee’s employment terminates for Cause, any portion of this Stock Option outstanding on such date shall terminate immediately and be of no further force and effect. For purposes hereof, “Cause” shall mean, unless otherwise provided in an employment agreement between the Company and the Optionee, a determination by the Administrator that the Optionee shall be dismissed as a result of (i) any material breach by the Optionee of any agreement between the Optionee and the Company; (ii) the conviction of, indictment for or plea of nolo contendere by the Optionee to a felony or a crime involving moral turpitude; or (iii) any material misconduct or willful and deliberate non-performance (other than by reason of disability) by the Optionee of the Optionee’s duties to the Company.

   (d) **Other Termination.** If the Optionee’s employment terminates for any reason other than the Optionee’s death, the Optionee’s disability, or Cause, and unless otherwise determined by the Administrator, any portion of this Stock Option outstanding on such date may be exercised, to the extent exercisable on the date of termination, for a period of three months from the date of termination or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of termination shall terminate immediately and be of no further force or effect.
The Administrator’s determination of the reason for termination of the Optionee’s employment shall be conclusive and binding on the Optionee and his or her representatives or legatees.

4. Incorporation of Plan. Notwithstanding anything herein to the contrary, this Stock Option shall be subject to and governed by all the terms and conditions of the Plan, including the powers of the Administrator set forth in Section 2(b) of the Plan. Capitalized terms in this Agreement shall have the meaning specified in the Plan, unless a different meaning is specified herein.

5. Transferability. This Agreement is personal to the Optionee, is non-assignable and is not transferable in any manner, by operation of law or otherwise, other than by will or the laws of descent and distribution. This Stock Option is exercisable, during the Optionee’s lifetime, only by the Optionee, and thereafter, only by the Optionee’s legal representative or legatee.

6. Status of the Stock Option. This Stock Option is intended to qualify as an “incentive stock option” under Section 422 of the Internal Revenue Code of 1986, as amended (the “Code”), but the Company does not represent or warrant that this Stock Option qualifies as such. The Optionee should consult with his or her own tax advisors regarding the tax effects of this Stock Option and the requirements necessary to obtain favorable income tax treatment under Section 422 of the Code, including, but not limited to, holding period requirements. To the extent any portion of this Stock Option does not so qualify as an “incentive stock option,” such portion shall be deemed to be a non-qualified stock option. If the Optionee intends to dispose or does dispose (whether by sale, gift, transfer or otherwise) of any Option Shares within the one-year period beginning on the date after the transfer of such shares to him or her, or within the two-year period beginning on the day after the grant of this Stock Option, he or she will so notify the Company within 30 days after such disposition.

7. Tax Withholding. The Optionee shall, not later than the date as of which the exercise of this Stock Option becomes a taxable event for Federal income tax purposes, pay to the Company or make arrangements satisfactory to the Administrator for payment of any Federal, state, and local taxes required by law to be withheld on account of such taxable event. The Company shall have the authority to cause the minimum required tax withholding obligation to be satisfied, in whole or in part, by withholding from shares of Stock to be issued to the Optionee a number of shares of Stock with an aggregate Fair Market Value that would satisfy the minimum withholding amount due.

8. No Obligation to Continue Employment. Neither the Company nor any Subsidiary is obligated by or as a result of the Plan or this Agreement to continue the Optionee in employment and neither the Plan nor this Agreement shall interfere in any way with the right of the Company or any Subsidiary to terminate the employment of the Optionee at any time.

9. Integration. This Agreement constitutes the entire agreement between the parties with respect to this Stock Option and supersedes all prior agreements and discussions between the parties concerning such subject matter.
10. **Data Privacy Consent.** In order to administer the Plan and this Agreement and to implement or structure future equity grants, the Company, its subsidiaries and affiliates and certain agents thereof (together, the “Relevant Companies”) may process any and all personal or professional data, including but not limited to Social Security or other identification number, home address and telephone number, date of birth and other information that is necessary or desirable for the administration of the Plan and/or this Agreement (the “Relevant Information”). By entering into this Agreement, the Optionee (i) authorizes the Company to collect, process, register and transfer to the Relevant Companies all Relevant Information; (ii) waives any privacy rights the Optionee may have with respect to the Relevant Information; (iii) authorizes the Relevant Companies to store and transmit such information in electronic form; and (iv) authorizes the transfer of the Relevant Information to any jurisdiction in which the Relevant Companies consider appropriate. The Optionee shall have access to, and the right to change, the Relevant Information. Relevant Information will only be used in accordance with applicable law.

11. **Notices.** Notices hereunder shall be mailed or delivered to the Company at its principal place of business and shall be mailed or delivered to the Optionee at the address on file with the Company or, in either case, at such other address as one party may subsequently furnish to the other party in writing.

Modernina, Inc.

By: ________________________________
Title: ______________________________

The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned. Electronic acceptance of this Agreement pursuant to the Company’s instructions to the Optionee (including through an online acceptance process) is acceptable.

Dated: ______________________________

Optionee’s Signature

Optionee’s name and address:

______________________________
______________________________
______________________________
Pursuant to the Moderna, Inc. 2018 Stock Option and Incentive Plan as amended through the date hereof (the “Plan”), Moderna, Inc. (the “Company”) hereby grants to the Optionee named above an option (the “Stock Option”) to purchase on or prior to the Expiration Date specified above all or part of the number of shares of Common Stock, par value $0.0001 per share (the “Stock”) of the Company specified above at the Option Exercise Price per Share specified above subject to the terms and conditions set forth hereinafter and in the Plan. This Stock Option is not intended to be an “incentive stock option” under Section 422 of the Internal Revenue Code of 1986, as amended.

1. Exercisability Schedule. No portion of this Stock Option may be exercised until such portion shall have become exercisable. Except as set forth below, and subject to the discretion of the Administrator (as defined in Section 2 of the Plan) to accelerate the exercisability schedule hereunder, this Stock Option shall be exercisable with respect to the following number of Option Shares on the dates indicated so long as Optionee continues to have a Service Relationship with the Company or a Subsidiary on such dates:

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<th>Incremental Number of Option Shares Exercisable</th>
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Once exercisable, this Stock Option shall continue to be exercisable at any time or times prior to the close of business on the Expiration Date, subject to the provisions hereof and of the Plan.
2. Manner of Exercise

(a) The Optionee may exercise this Stock Option only in the following manner: from time to time on or prior to the Expiration Date of this Stock Option, the Optionee may give written notice to the Administrator of his or her election to purchase some or all of the Option Shares purchasable at the time of such notice. This notice shall specify the number of Option Shares to be purchased.

Payment of the purchase price for the Option Shares may be made by one or more of the following methods: (i) in cash, by certified or bank check or other instrument acceptable to the Administrator; (ii) if permitted by the Administrator, through the delivery (or attestation to the ownership) of shares of Stock that have been purchased by the Optionee on the open market or that are beneficially owned by the Optionee and are not then subject to any restrictions under any Company plan and that otherwise satisfy any holding periods as may be required by the Administrator; (iii) by the Optionee delivering to the Company a properly executed exercise notice together with irrevocable instructions to a broker to promptly deliver to the Company cash or a check payable and acceptable to the Company to pay the option purchase price, provided that in the event the Optionee chooses to pay the option purchase price as so provided, the Optionee and the broker shall comply with such procedures and enter into such agreements of indemnity and other agreements as the Administrator shall prescribe as a condition of such payment procedure; (iv) if permitted by the Administrator, by a “net exercise” arrangement pursuant to which the Company will reduce the number of shares of Stock issuable upon exercise by the largest whole number of shares with a Fair Market Value that does not exceed the aggregate exercise price; or (v) a combination of (i), (ii), (iii) and (iv) above. Payment instruments will be received subject to collection.

The transfer to the Optionee on the records of the Company or of the transfer agent of the Option Shares will be contingent upon (i) the Company’s receipt from the Optionee of the full purchase price for the Option Shares, as set forth above, (ii) the fulfillment of any other requirements contained herein or in the Plan or in any other agreement or provision of laws, and (iii) the receipt by the Company of any agreement, statement or other evidence that the Company may require to satisfy itself that the issuance of Stock to be purchased pursuant to the exercise of Stock Options under the Plan and any subsequent resale of the shares of Stock will be in compliance with applicable laws and regulations. In the event the Optionee chooses to pay the purchase price by previously-owned shares of Stock through the attestation method, the number of shares of Stock transferred to the Optionee upon the exercise of the Stock Option shall be net of the Shares attested to.

(b) The shares of Stock purchased upon exercise of this Stock Option shall be transferred to the Optionee on the records of the Company or of the transfer agent upon compliance with the requirements hereof and of the Plan. The determination of the Administrator as to such compliance shall be final and binding on the Optionee. The Optionee shall not be deemed to be the holder of, or to have any of the rights of a holder with respect to, any shares of Stock subject to this Stock Option unless and until this Stock Option shall have been exercised pursuant to the terms hereof, the Company or the transfer agent shall have transferred the shares to the Optionee, and the Optionee’s name shall have been entered as the stockholder of record on the books of the Company. Thereupon, the Optionee shall have full voting, dividend and other ownership rights with respect to such shares of Stock.
(c) The minimum number of shares with respect to which this Stock Option may be exercised at any one time shall be 100 shares, unless the number of shares with respect to which this Stock Option is being exercised is the total number of shares subject to exercise under this Stock Option at the time.

(d) Notwithstanding any other provision hereof or of the Plan, no portion of this Stock Option shall be exercisable after the Expiration Date hereof.

3. Termination of Service Relationship. If the Optionee’s Service Relationship with the Company or a Subsidiary (as defined in the Plan) is terminated, the period within which to exercise the Stock Option may be subject to earlier termination as set forth below.

(a) Termination Due to Death. If the Optionee’s Service Relationship with the Company or a Subsidiary terminates by reason of the Optionee’s death, any portion of this Stock Option outstanding on such date, to the extent exercisable on the date of death, may thereafter be exercised by the Optionee’s legal representative or legatee for a period of 12 months from the date of death or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of death shall terminate immediately and be of no further force or effect.

(b) Termination Due to Disability. If the Optionee’s Service Relationship with the Company or a Subsidiary terminates by reason of the Optionee’s disability (as determined by the Administrator), any portion of this Stock Option outstanding on such date, to the extent exercisable on the date of such termination, may thereafter be exercised by the Optionee for a period of 12 months from the date of disability or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of disability shall terminate immediately and be of no further force or effect.

(c) Termination for Cause. If the Optionee’s Service Relationship with the Company or a Subsidiary terminates for Cause, any portion of this Stock Option outstanding on such date shall terminate immediately and be of no further force and effect. For purposes hereof, “Cause” shall mean, unless otherwise provided in an employment or other service agreement between the Company and the Optionee, a determination by the Administrator that the Optionee shall be dismissed as a result of (i) any material breach by the Optionee of any agreement between the Optionee and the Company; (ii) the conviction of, indictment for or plea of no contest by the Optionee to a felony or a crime involving moral turpitude; or (iii) any material misconduct or willful and deliberate non-performance (other than by reason of disability) by the Optionee of the Optionee’s duties to the Company.

(d) Other Termination. If the Optionee’s Service Relationship with the Company or a Subsidiary terminates for any reason other than the Optionee’s death, the Optionee’s disability or Cause, and unless otherwise determined by the Administrator, any portion of this Stock Option outstanding on such date may be exercised, to the extent exercisable on the date of termination, for a period of three months from the date of termination or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of termination shall terminate immediately and be of no further force or effect.
The Administrator's determination of the reason for termination of the Optionee's Service Relationship with the Company or a Subsidiary shall be conclusive and binding on the Optionee and his or her representatives or legatees.

4. **Incorporation of Plan.** Notwithstanding anything herein to the contrary, this Stock Option shall be subject to and governed by all the terms and conditions of the Plan, including the powers of the Administrator set forth in Section 2(b) of the Plan. Capitalized terms in this Agreement shall have the meaning specified in the Plan, unless a different meaning is specified herein.

5. **Transferability.** This Agreement is personal to the Optionee, is non-assignable and is not transferable in any manner, by operation of law or otherwise, other than by will or the laws of descent and distribution. This Stock Option is exercisable, during the Optionee's lifetime, only by the Optionee, and thereafter, only by the Optionee's legal representative or legatee.

6. **Tax Withholding.** The Optionee shall, not later than the date as of which the exercise of this Stock Option becomes a taxable event for Federal income tax purposes, pay to the Company or make arrangements satisfactory to the Administrator for payment of any Federal, state, and local taxes required by law to be withheld on account of such taxable event. The Company shall have the authority to cause the minimum required tax withholding obligation to be satisfied, in whole or in part, by withholding from shares of Stock to be issued to the Optionee a number of shares of Stock with an aggregate Fair Market Value that would satisfy the minimum withholding amount due.

7. **No Obligation to Continue Service Relationship.** Neither the Company nor any Subsidiary is obligated by or as a result of the Plan or this Agreement to continue the Optionee in a Service Relationship with the Company or a Subsidiary and neither the Plan nor this Agreement shall interfere in any way with the right of the Company or any Subsidiary to terminate the Optionee's Service Relationship with the Company or a Subsidiary at any time.

8. **Integration.** This Agreement constitutes the entire agreement between the parties with respect to this Stock Option and supersedes all prior agreements and discussions between the parties concerning such subject matter.

9. **Data Privacy Consent.** In order to administer the Plan and this Agreement and to implement or structure future equity grants, the Company, its subsidiaries and affiliates and certain agents thereof (together, the “Relevant Companies”) may process any and all personal or professional data, including but not limited to Social Security or other identification number, home address and telephone number, date of birth and other information that is necessary or desirable for the administration of the Plan and/or this Agreement (the “Relevant Information”). By entering into this Agreement, the Optionee (i) authorizes the Company to collect, process, register and transfer to the Relevant Companies all Relevant Information; (ii) waives any privacy rights the Optionee may have with respect to the Relevant Information; (iii) authorizes the
Relevant Companies to store and transmit such information in electronic form; and (iv) authorizes the transfer of the Relevant Information to any
jurisdiction in which the Relevant Companies consider appropriate. The Optionee shall have access to, and the right to change, the Relevant
Information. Relevant Information will only be used in accordance with applicable law.

10. Notices. Notices hereunder shall be mailed or delivered to the Company at its principal place of business and shall be mailed or delivered to
the Optionee at the address on file with the Company or, in either case, at such other address as one party may subsequently furnish to the other party in
writing.

Moderna, Inc.

By: ________________________________

Title: ______________________________

The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned. Electronic acceptance of this
Agreement pursuant to the Company’s instructions to the Optionee (including through an online acceptance process) is acceptable.

Dated: ____________________________

Optionee’s Signature

Optionee’s name and address:

_____________________________________________________________________

_____________________________________________________________________

5
NON-QUALIFIED STOCK OPTION AGREEMENT
FOR NON-EMPLOYEE DIRECTORS
UNDER THE MODERNA, INC.
2018 STOCK OPTION AND INCENTIVE PLAN

Name of Optionee: ____________________________
No. of Option Shares: __________________________
Option Exercise Price per Share: $__________
[FMV on Grant Date]
Grant Date: __________________________
Expiration Date: __________________________
[No more than 10 years]

Pursuant to the Moderna, Inc. 2018 Stock Option and Incentive Plan as amended through the date hereof (the “Plan”), Moderna, Inc. (the
“Company”) hereby grants to the Optionee named above, who is a Director of the Company but is not an employee of the Company, an option (the
“Stock Option”) to purchase on or prior to the Expiration Date specified above all or part of the number of shares of Common Stock, par value $0.0001
per share (the “Stock”), of the Company specified above at the Option Exercise Price per Share specified above subject to the terms and conditions set
forth herein and in the Plan. This Stock Option is not intended to be an “incentive stock option” under Section 422 of the Internal Revenue Code of
1986, as amended.

1. Exercisability Schedule. No portion of this Stock Option may be exercised until such portion shall have become exercisable. Except as set
forth below, and subject to the discretion of the Administrator (as defined in Section 2 of the Plan) to accelerate the exercisability schedule hereunder,
this Stock Option shall be exercisable with respect to the following number of Option Shares on the dates indicated so long as the Optionee remains in
service as a member of the Board on such dates:

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Notwithstanding the foregoing, in the event of a Sale Event, 100% of the then-outstanding and unvested Option Shares shall immediately be deemed vested and exercisable on the date of such Sale Event; provided, that the Optionee remains in service as a member of the Board until the date of such Sale Event. Once exercisable, this Stock Option shall continue to be exercisable at any time or times prior to the close of business on the Expiration Date, subject to the provisions hereof and of the Plan.


(a) The Optionee may exercise this Stock Option only in the following manner: from time to time on or prior to the Expiration Date of this Stock Option, the Optionee may give written notice to the Administrator of his or her election to purchase some or all of the Option Shares purchasable at the time of such notice. This notice shall specify the number of Option Shares to be purchased.

Payment of the purchase price for the Option Shares may be made by one or more of the following methods: (i) in cash, by certified or bank check or other instrument acceptable to the Administrator; (ii) if permitted by the Administrator, through the delivery (or attestation to the ownership) of shares of Stock that have been purchased by the Optionee on the open market or that are beneficially owned by the Optionee and are not then subject to any restrictions under any Company plan and that otherwise satisfy any holding periods as may be required by the Administrator; (iii) by the Optionee delivering to the Company a properly executed exercise notice together with irrevocable instructions to a broker to promptly deliver to the Company cash or a check payable and acceptable to the Company to pay the option purchase price, provided that in the event the Optionee chooses to pay the option purchase price as so provided, the Optionee and the broker shall comply with such procedures and enter into such agreements of indemnity and other agreements as the Administrator shall prescribe as a condition of such payment procedure; (iv) if permitted by the Administrator, by a “net exercise” arrangement pursuant to which the Company will reduce the number of shares of Stock issuable upon exercise by the largest whole number of shares with a Fair Market Value that does not exceed the aggregate exercise price; or (v) a combination of (i), (ii), (iii) and (iv) above. Payment instruments will be received subject to collection.

The transfer to the Optionee on the records of the Company or of the transfer agent of the Option Shares will be contingent upon (i) the Company’s receipt from the Optionee of the full purchase price for the Option Shares, as set forth above, (ii) the fulfillment of any other requirements contained herein or in the Plan or in any other agreement or provision of laws, and (iii) the receipt by the Company of any agreement, statement or other evidence that the Company may require to satisfy itself that the issuance of Stock to be purchased pursuant to the exercise of Stock Options under the Plan and any subsequent resale of the shares of Stock will be in compliance with applicable laws and regulations. In the event the Optionee chooses to pay the purchase price by previously-owned shares of Stock through the attestation method, the number of shares of Stock transferred to the Optionee upon the exercise of the Stock Option shall be net of the Shares attested to.

(b) The shares of Stock purchased upon exercise of this Stock Option shall be transferred to the Optionee on the records of the Company or of the transfer agent upon compliance to the satisfaction of the Administrator with all requirements under applicable laws or regulations in connection with such transfer and with the requirements hereof and of the Plan.
The determination of the Administrator as to such compliance shall be final and binding on the Optionee. The Optionee shall not be deemed to be the holder of, or to have any of the rights of a holder with respect to, any shares of Stock subject to this Stock Option unless and until this Stock Option shall have been exercised pursuant to the terms hereof, the Company or the transfer agent shall have transferred the shares to the Optionee, and the Optionee’s name shall have been entered as the stockholder of record on the books of the Company. Thereupon, the Optionee shall have full voting, dividend and other ownership rights with respect to such shares of Stock.

(c) The minimum number of shares with respect to which this Stock Option may be exercised at any one time shall be 100 shares, unless the number of shares with respect to which this Stock Option is being exercised is the total number of shares subject to exercise under this Stock Option at the time.

(d) Notwithstanding any other provision hereof or of the Plan, no portion of this Stock Option shall be exercisable after the Expiration Date hereof.

3. Termination as Director. If the Optionee’s service as a member of the Board ceases, the period within which to exercise the Stock Option may be subject to earlier termination as set forth below.

(a) Termination Due to Death. If the Optionee’s service as a member of the Board terminates by reason of the Optionee’s death, any portion of this Stock Option outstanding on such date, to the extent exercisable on the date of death, may thereafter be exercised by the Optionee’s legal representative or legatee for a period of 12 months from the date of death or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of death shall terminate immediately and be of no further force or effect.

(b) Other Termination. If the Optionee’s service as a member of the Board ceases for any reason other than the Optionee’s death, any portion of this Stock Option outstanding on such date may be exercised, to the extent exercisable on the date the Optionee ceased to be a Director, for a period of six months from the date the Optionee ceased to be a Director or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date the Optionee ceases to be a Director shall terminate immediately and be of no further force or effect.

4. Incorporation of Plan. Notwithstanding anything herein to the contrary, this Stock Option shall be subject to and governed by all the terms and conditions of the Plan, including the powers of the Administrator set forth in Section 2(b) of the Plan. Capitalized terms in this Agreement shall have the meaning specified in the Plan, unless a different meaning is specified herein.

5. Transferability. This Agreement is personal to the Optionee, is non-assignable and is not transferable in any manner, by operation of law or otherwise, other than by will or the laws of descent and distribution. This Stock Option is exercisable, during the Optionee’s lifetime, only by the Optionee, and thereafter, only by the Optionee’s legal representative or legatee.
6. **No Obligation to Continue as a Director.** Neither the Plan nor this Stock Option confers upon the Optionee any rights with respect to continuance as a Director.

7. **Integration.** This Agreement constitutes the entire agreement between the parties with respect to this Stock Option and supersedes all prior agreements and discussions between the parties concerning such subject matter.

8. **Data Privacy Consent.** In order to administer the Plan and this Agreement and to implement or structure future equity grants, the Company, its subsidiaries and affiliates and certain agents thereof (together, the “Relevant Companies”) may process any and all personal or professional data, including but not limited to Social Security or other identification number, home address and telephone number, date of birth and other information that is necessary or desirable for the administration of the Plan and/or this Agreement (the “Relevant Information”). By entering into this Agreement, the Optionee (i) authorizes the Company to collect, process, register and transfer to the Relevant Companies all Relevant Information; (ii) waives any privacy rights the Optionee may have with respect to the Relevant Information; (iii) authorizes the Relevant Companies to store and transmit such information in electronic form; and (iv) authorizes the transfer of the Relevant Information to any jurisdiction in which the Relevant Companies consider appropriate. The Optionee shall have access to, and the right to change, the Relevant Information. Relevant Information will only be used in accordance with applicable law.
9. Notices. Notices hereunder shall be mailed or delivered to the Company at its principal place of business and shall be mailed or delivered to the Optionee at the address on file with the Company or, in either case, at such other address as one party may subsequently furnish to the other party in writing.

Moderna, Inc.

By: _______________________________________
Title: _______________________________________

The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned. Electronic acceptance of this Agreement pursuant to the Company’s instructions to the Optionee (including through an online acceptance process) is acceptable.

Dated: ________________________________

Optionee’s Signature

Optionee’s name and address:

_____________________________________
_____________________________________

5
NON-QUALIFIED STOCK OPTION AGREEMENT
FOR COMPANY CONSULTANTS
UNDER THE MODERNA, INC.
2018 STOCK OPTION AND INCENTIVE PLAN

Name of Optionee: ____________________________________________________________

No. of Option Shares: __________________________________________________________________________

Option Exercise Price per Share: $ __________________________________________________________________________

[FMV on Grant Date]

Grant Date: ____________________________________________________________________________________________

Expiration Date: _________________________________________________________________________________________

Pursuant to the Moderna, Inc. 2018 Stock Option and Incentive Plan as amended through the date hereof (the “Plan”), Moderna, Inc. (the “Company”) hereby grants to the Optionee named above an option (the “Stock Option”) to purchase on or prior to the Expiration Date specified above all or part of the number of shares of Common Stock, par value $0.0001 per share (the “Stock”) of the Company specified above at the Option Exercise Price per Share specified above subject to the terms and conditions set forth herein and in the Plan. This Stock Option is not intended to be an “incentive stock option” under Section 422 of the Internal Revenue Code of 1986, as amended.

1. Exercisability Schedule. No portion of this Stock Option may be exercised until such portion shall have become exercisable. Except as set forth below, and subject to the discretion of the Administrator (as defined in Section 2 of the Plan) to accelerate the exercisability schedule hereunder, this Stock Option shall be exercisable with respect to the following number of Option Shares on the dates indicated so long as the Optionee continues to have a Service Relationship with the Company or a Subsidiary on such dates:

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<thead>
<tr>
<th>Incremental Number of Option Shares Exercisable</th>
<th>Exercisability Date</th>
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Once exercisable, this Stock Option shall continue to be exercisable at any time or times prior to the close of business on the Expiration Date, subject to the provisions hereof and of the Plan.
2. **Manner of Exercise.**

(a) The Optionee may exercise this Stock Option only in the following manner: from time to time on or prior to the Expiration Date of this Stock Option, the Optionee may give written notice to the Administrator of his or her election to purchase some or all of the Option Shares purchasable at the time of such notice. This notice shall specify the number of Option Shares to be purchased.

Payment of the purchase price for the Option Shares may be made by one or more of the following methods: (i) in cash, by certified or bank check or other instrument acceptable to the Administrator; (ii) if permitted by the Administrator, through the delivery (or attestation to the ownership) of shares of Stock that have been purchased by the Optionee on the open market or that are beneficially owned by the Optionee and are not then subject to any restrictions under any Company plan and that otherwise satisfy any holding periods as may be required by the Administrator; (iii) by the Optionee delivering to the Company a properly executed exercise notice together with irrevocable instructions to a broker to promptly deliver to the Company cash or a check payable and acceptable to the Company to pay the option purchase price, provided that in the event the Optionee chooses to pay the option purchase price as so provided, the Optionee and the broker shall comply with such procedures and enter into such agreements of indemnity and other agreements as the Administrator shall prescribe as a condition of such payment procedure; (iv) if permitted by the Administrator, by a “net exercise” arrangement pursuant to which the Company will reduce the number of shares of Stock issuable upon exercise by the largest whole number of shares with a Fair Market Value that does not exceed the aggregate exercise price; or (v) a combination of (i), (ii), (iii) and (iv) above. Payment instruments will be received subject to collection.

The transfer to the Optionee on the records of the Company or of the transfer agent of the Option Shares will be contingent upon (i) the Company’s receipt from the Optionee of the full purchase price for the Option Shares, as set forth above, (ii) the fulfillment of any other requirements contained herein or in the Plan or in any other agreement or provision of laws, and (iii) the receipt by the Company of any agreement, statement or other evidence that the Company may require to satisfy itself that the issuance of Stock to be purchased pursuant to the exercise of Stock Options under the Plan and any subsequent resale of the shares of Stock will be in compliance with applicable laws and regulations. In the event the Optionee chooses to pay the purchase price by previously-owned shares of Stock through the attestation method, the number of shares of Stock transferred to the Optionee upon the exercise of the Stock Option shall be net of the Shares attested to.

(b) The shares of Stock purchased upon exercise of this Stock Option shall be transferred to the Optionee on the records of the Company or of the transfer agent upon compliance with all requirements under applicable laws or regulations in connection with such transfer and with the requirements hereof and of the Plan. The determination of the Administrator as to such compliance shall be final and binding on the Optionee. The Optionee shall not be deemed to be the holder of, or to have any of the rights of a holder with respect to, any shares of Stock subject to this Stock Option unless and until this Stock Option shall have been exercised pursuant to the terms hereof, the Company or the transfer agent shall have transferred the shares to the Optionee, and the Optionee’s name shall have been entered as the stockholder of record on the books of the Company. Thereupon, the Optionee shall have full voting, dividend and other ownership rights with respect to such shares of Stock.

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(c) The minimum number of shares with respect to which this Stock Option may be exercised at any one time shall be 100 shares, unless the number of shares with respect to which this Stock Option is being exercised is the total number of shares subject to exercise under this Stock Option at the time.

(d) Notwithstanding any other provision hereof or of the Plan, no portion of this Stock Option shall be exercisable after the Expiration Date hereof.

3. Termination of Service Relationship. If the Optionee’s Service Relationship with the Company or a Subsidiary (as defined in the Plan) is terminated, the period within which to exercise the Stock Option may be subject to earlier termination as set forth below.

(a) Termination Due to Death. If the Optionee’s Service Relationship with the Company or a Subsidiary terminates by reason of the Optionee’s death, any portion of this Stock Option outstanding on such date, to the extent exercisable on the date of death, may thereafter be exercised by the Optionee’s legal representative or legatee for a period of 12 months from the date of death or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of death shall terminate immediately and be of no further force or effect.

(b) Termination Due to Disability. If the Optionee’s Service Relationship with the Company or a Subsidiary terminates by reason of the Optionee’s disability (as determined by the Administrator), any portion of this Stock Option outstanding on such date, to the extent exercisable on the date of such termination, may thereafter be exercised by the Optionee for a period of 12 months from the date of disability or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of disability shall terminate immediately and be of no further force or effect.

(c) Termination for Cause. If the Optionee’s Service Relationship with the Company or a Subsidiary terminates for Cause, any portion of this Stock Option outstanding on such date shall terminate immediately and be of no further force and effect. For purposes hereof, “Cause” shall mean, unless otherwise provided in a consulting or other service agreement between the Company and the Optionee, a determination by the Administrator that the Optionee shall be dismissed as a result of (i) any material breach by the Optionee of any agreement between the Optionee and the Company; (ii) the conviction of, indictment for or plea of nolo contendere by the Optionee to a felony or a crime involving moral turpitude; or (iii) any material misconduct or willful and deliberate non-performance (other than by reason of disability) by the Optionee of the Optionee’s duties to the Company.

(d) Other Termination. If the Optionee’s Service Relationship with the Company or a Subsidiary terminates for any reason other than the Optionee’s death, the Optionee’s disability or Cause, and unless otherwise determined by the Administrator, any portion of this Stock Option outstanding on such date may be exercised, to the extent exercisable on the date of such termination, for a period of three months from the date of termination or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of termination shall terminate immediately and be of no further force or effect.
The Administrator’s determination of the reason for termination of the Optionee’s Service Relationship with the Company or a Subsidiary shall be conclusive and binding on the Optionee and his or her representatives or legatees.

4. **Incorporation of Plan.** Notwithstanding anything herein to the contrary, this Stock Option shall be subject to and governed by all the terms and conditions of the Plan, including the powers of the Administrator set forth in Section 2(b) of the Plan. Capitalized terms in this Agreement shall have the meaning specified in the Plan, unless a different meaning is specified herein.

5. **Transferability.** This Agreement is personal to the Optionee, is non-assignable and is not transferable in any manner, by operation of law or otherwise, other than by will or the laws of descent and distribution. This Stock Option is exercisable, during the Optionee’s lifetime, only by the Optionee, and thereafter, only by the Optionee’s legal representative or legatee.

6. **No Obligation to Continue Service Relationship.** Neither the Company nor any Subsidiary is obligated by or as a result of the Plan or this Agreement to continue the Optionee’s Service Relationship with the Company or a Subsidiary and neither the Plan nor this Agreement shall interfere in any way with the right of the Company or any Subsidiary to terminate the Optionee’s Service Relationship with the Company or a Subsidiary at any time.

7. **Integration.** This Agreement constitutes the entire agreement between the parties with respect to this Stock Option and supersedes all prior agreements and discussions between the parties concerning such subject matter.

8. **Data Privacy Consent.** In order to administer the Plan and this Agreement and to implement or structure future equity grants, the Company, its subsidiaries and affiliates and certain agents thereof (together, the “Relevant Companies”) may process any and all personal or professional data, including but not limited to Social Security or other identification number, home address and telephone number, date of birth and other information that is necessary or desirable for the administration of the Plan and/or this Agreement (the “Relevant Information”). By entering into this Agreement, the Optionee (i) authorizes the Company to collect, process, register and transfer to the Relevant Companies all Relevant Information; (ii) waives any privacy rights the Optionee may have with respect to the Relevant Information; (iii) authorizes the Relevant Companies to store and transmit such information in electronic form; and (iv) authorizes the transfer of the Relevant Information to any jurisdiction in which the Relevant Companies consider appropriate. The Optionee shall have access to, and the right to change, the Relevant Information. Relevant Information will only be used in accordance with applicable law.
9. Notices. Notices hereunder shall be mailed or delivered to the Company at its principal place of business and shall be mailed or delivered to the Optionee at the address on file with the Company or, in either case, at such other address as one party may subsequently furnish to the other party in writing.

Modern, Inc.

By: 
Title: 

The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned. Electronic acceptance of this Agreement pursuant to the Company’s instructions to the Optionee (including through an online acceptance process) is acceptable.

Dated: 

Optionee’s Signature

Optionee’s name and address:
Pursuant to the Moderna, Inc. 2018 Stock Option and Incentive Plan (the “Plan”) as amended through the date hereof, Moderna, Inc. (the “Company”) hereby grants a Restricted Stock Award (an “Award”) to the Grantee named above. Upon acceptance of this Award, the Grantee shall receive the number of shares of Common Stock, par value $0.0001 per share (the “Stock”) of the Company specified above, subject to the restrictions and conditions set forth herein and in the Plan. The Company acknowledges the receipt from the Grantee of consideration with respect to the par value of the Stock in the form of cash, past or future services rendered to the Company by the Grantee or such other form of consideration as is acceptable to the Administrator.

1. **Award.** The shares of Restricted Stock awarded hereunder shall be issued and held by the Company’s transfer agent in book entry form, and the Grantee’s name shall be entered as the stockholder of record on the books of the Company. Thereupon, the Grantee shall have all the rights of a stockholder with respect to such shares, including voting and dividend rights, subject, however, to the restrictions and conditions specified in Paragraph 2 below. The Grantee shall (i) sign and deliver to the Company a copy of this Award Agreement and (ii) deliver to the Company a stock power endorsed in blank.

2. **Restrictions and Conditions.**

   (a) Any book entries for the shares of Restricted Stock granted herein shall bear an appropriate legend, as determined by the Administrator in its sole discretion, to the effect that such shares are subject to restrictions as set forth herein and in the Plan.

   (b) Shares of Restricted Stock granted herein may not be sold, assigned, transferred, pledged or otherwise encumbered or disposed of by the Grantee prior to vesting.

   (c) If the Grantee’s Service Relationship with the Company or a Subsidiary is voluntarily or involuntarily terminated for any reason (including death) prior to vesting of shares of Restricted Stock granted herein, all shares of Restricted Stock shall immediately and automatically be forfeited and returned to the Company.

3. **Vesting of Restricted Stock.** The restrictions and conditions in Paragraph 2 of this Agreement shall lapse on the Vesting Date or Dates specified in the following schedule so long as the Grantee continues to have a Service Relationship with the Company or a Subsidiary on such Dates. If a series of Vesting Dates is specified, then the restrictions and conditions in Paragraph 2 shall lapse only with respect to the number of shares of Restricted Stock specified as vested on such date.
Subsequent to such Vesting Date or Dates, the shares of Stock on which all restrictions and conditions have lapsed shall no longer be deemed Restricted Stock. The Administrator may at any time accelerate the vesting schedule specified in this Paragraph 3.

4. **Dividends.** Dividends on shares of Restricted Stock shall be paid currently to the Grantee.

5. **Incorporation of Plan.** Notwithstanding anything herein to the contrary, this Award shall be subject to and governed by all the terms and conditions of the Plan, including the powers of the Administrator set forth in Section 2(b) of the Plan. Capitalized terms in this Agreement shall have the meaning specified in the Plan, unless a different meaning is specified herein.

6. **Transferability.** This Agreement is personal to the Grantee, is non-assignable and is not transferable in any manner, by operation of law or otherwise, other than by will or the laws of descent and distribution.

7. **Tax Withholding.** The Grantee shall, not later than the date as of which the receipt of this Award becomes a taxable event for Federal income tax purposes, pay to the Company or make arrangements satisfactory to the Administrator for payment of any Federal, state, and local taxes required by law to be withheld on account of such taxable event. Except in the case where an election is made pursuant to Paragraph 8 below, the Company shall have the authority to cause the required minimum tax withholding obligation to be satisfied, in whole or in part, by withholding from shares of Stock to be issued or released by the transfer agent a number of shares of Stock with an aggregate Fair Market Value that would satisfy the minimum withholding amount due.

8. **Election Under Section 83(b).** The Grantee and the Company hereby agree that the Grantee may, within 30 days following the Grant Date of this Award, file with the Internal Revenue Service and the Company an election under Section 83(b) of the Internal Revenue Code. In the event the Grantee makes such an election, he or she agrees to provide a copy of the election to the Company. The Grantee acknowledges that he or she is responsible for obtaining the advice of his or her tax advisors with regard to the Section 83(b) election and that he or she is relying solely on such advisors and not on any statements or representations of the Company or any of its agents with regard to such election.
9. **No Obligation to Continue Service Relationship.** Neither the Company nor any Subsidiary is obligated by or as a result of the Plan or this Agreement to continue the Grantee in a Service Relationship with the Company or a Subsidiary and neither the Plan nor this Agreement shall interfere in any way with the right of the Company or any Subsidiary to terminate the Grantee’s Service Relationship with the Company or a Subsidiary at any time.

10. **Integration.** This Agreement constitutes the entire agreement between the parties with respect to this Award and supersedes all prior agreements and discussions between the parties concerning such subject matter.

11. **Data Privacy Consent.** In order to administer the Plan and this Agreement and to implement or structure future equity grants, the Company, its subsidiaries and affiliates and certain agents thereof (together, the “Relevant Companies”) may process any and all personal or professional data, including but not limited to Social Security or other identification number, home address and telephone number, date of birth and other information that is necessary or desirable for the administration of the Plan and/or this Agreement (the “Relevant Information”). By entering into this Agreement, the Grantee (i) authorizes the Company to collect, process, register and transfer to the Relevant Companies all Relevant Information; (ii) waives any privacy rights the Grantee may have with respect to the Relevant Information; (iii) authorizes the Relevant Companies to store and transmit such information in electronic form; and (iv) authorizes the transfer of the Relevant Information to any jurisdiction in which the Relevant Companies consider appropriate. The Grantee shall have access to, and the right to change, the Relevant Information. Relevant Information will only be used in accordance with applicable law.
12. **Notices.** Notices hereunder shall be mailed or delivered to the Company at its principal place of business and shall be mailed or delivered to the Grantee at the address on file with the Company or, in either case, at such other address as one party may subsequently furnish to the other party in writing.

**Moderna, Inc.**

By: 

Title: 

The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned. Electronic acceptance of this Agreement pursuant to the Company’s instructions to the Grantee (including through an online acceptance process) is acceptable.

Dated: ______________________

Grantee’s Signature

Grantee’s name and address:

________________________________________

________________________________________

________
Name of Grantee: 
No. of Restricted Stock Units: 
Grant Date:  

Pursuant to the Moderna, Inc. 2018 Stock Option and Incentive Plan as amended through the date hereof (the “Plan”), Moderna, Inc. (the “Company”) hereby grants an award of the number of Restricted Stock Units listed above (an “Award”) to the Grantee named above. Each Restricted Stock Unit shall relate to one share of Common Stock, par value $0.0001 per share (the “Stock”) of the Company.

1. Restrictions on Transfer of Award. This Award may not be sold, transferred, pledged, assigned or otherwise encumbered or disposed of by the Grantee, and any shares of Stock issuable with respect to the Award may not be sold, transferred, pledged, assigned or otherwise encumbered or disposed of until (i) the Restricted Stock Units have vested as provided in Paragraph 2 of this Agreement and (ii) shares of Stock have been issued to the Grantee in accordance with the terms of the Plan and this Agreement.

2. Vesting of Restricted Stock Units. The restrictions and conditions of Paragraph 1 of this Agreement shall lapse on the Vesting Date or Dates specified in the following schedule so long as the Grantee continues to have a Service Relationship with the Company or a Subsidiary on such Dates. If a series of Vesting Dates is specified, then the restrictions and conditions in Paragraph 1 shall lapse only with respect to the number of Restricted Stock Units specified as vested on such date.

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<tr>
<th>Incremental Number of Restricted Stock Units Vested</th>
<th>Vesting Date</th>
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<tbody>
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The Administrator may at any time accelerate the vesting schedule specified in this Paragraph 2.

3. Termination of Service Relationship. If the Grantee’s Service Relationship with the Company or a Subsidiary terminates for any reason (including death or disability) prior to the satisfaction of the vesting conditions set forth in Paragraph 2 above, any Restricted Stock Units that have not vested as of such date shall automatically and without notice terminate and be forfeited, and neither the Grantee nor any of his or her successors, heirs, assigns, or personal representatives will thereafter have any further rights or interests in such unvested Restricted Stock Units.
4. **Issuance of Shares of Stock.** As soon as practicable following each Vesting Date (but in no event later than two and one-half months after the end of the year in which the Vesting Date occurs), the Company shall issue to the Grantee the number of shares of Stock equal to the aggregate number of Restricted Stock Units that have vested pursuant to Paragraph 2 of this Agreement on such date and the Grantee shall thereafter have all the rights of a stockholder of the Company with respect to such shares.

5. **Incorporation of Plan.** Notwithstanding anything herein to the contrary, this Agreement shall be subject to and governed by all the terms and conditions of the Plan, including the powers of the Administrator set forth in Section 2(b) of the Plan. Capitalized terms in this Agreement shall have the meaning specified in the Plan, unless a different meaning is specified herein.

6. **Tax Withholding.** The Grantee shall, not later than the date as of which the receipt of this Award becomes a taxable event for Federal income tax purposes, pay to the Company or make arrangements satisfactory to the Administrator for payment of any Federal, state, and local taxes required by law to be withheld on account of such taxable event. The Company shall have the authority to cause the required minimum tax withholding obligation to be satisfied, in whole or in part, by withholding from shares of Stock to be issued to the Grantee a number of shares of Stock with an aggregate Fair Market Value that would satisfy the withholding amount due.

7. **Section 409A of the Code.** This Agreement shall be interpreted in such a manner that all provisions relating to the settlement of the Award are exempt from the requirements of Section 409A of the Code as “short-term deferrals” as described in Section 409A of the Code.

8. **No Obligation to Continue Service Relationship.** Neither the Company nor any Subsidiary is obligated by or as a result of the Plan or this Agreement to continue the Grantee’s Service Relationship with the Company or a Subsidiary and neither the Plan nor this Agreement shall interfere in any way with the right of the Company or any Subsidiary to terminate the Grantee’s Service Relationship with the Company or a Subsidiary at any time.

9. **Integration.** This Agreement constitutes the entire agreement between the parties with respect to this Award and supersedes all prior agreements and discussions between the parties concerning such subject matter.

10. **Data Privacy Consent.** In order to administer the Plan and this Agreement and to implement or structure future equity grants, the Company, its subsidiaries and affiliates and certain agents thereof (together, the “Relevant Companies”) may process any and all personal or professional data, including but not limited to Social Security or other identification number, home address and telephone number, date of birth and other information that is necessary or desirable for the administration of the Plan and/or this Agreement (the “Relevant Information”). By entering into this Agreement, the Grantee (i) authorizes the Company to collect, process, register and transfer to the Relevant Companies all Relevant Information; (ii) waives any privacy
rights the Grantee may have with respect to the Relevant Information; (iii) authorizes the Relevant Companies to store and transmit such information in electronic form; and (iv) authorizes the transfer of the Relevant Information to any jurisdiction in which the Relevant Companies consider appropriate. The Grantee shall have access to, and the right to change, the Relevant Information. Relevant Information will only be used in accordance with applicable law.

11. Notices. Notices hereunder shall be mailed or delivered to the Company at its principal place of business and shall be mailed or delivered to the Grantee at the address on file with the Company or, in either case, at such other address as one party may subsequently furnish to the other party in writing.

Moderna, Inc.

By: ________________________________

Title: ________________________________

The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned. Electronic acceptance of this Agreement pursuant to the Company’s instructions to the Grantee (including through an online acceptance process) is acceptable.

Dated: ________________________________

Grantee’s Signature

Grantee’s name and address:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

3
Pursuant to the Moderna, Inc. 2018 Stock Option and Incentive Plan as amended through the date hereof (the "Plan"), Moderna, Inc. (the “Company”) hereby grants an award of the number of Restricted Stock Units listed above (an “Award”) to the Grantee named above. Each Restricted Stock Unit shall relate to one share of Common Stock, par value $0.0001 per share (the “Stock”) of the Company.

1. Restrictions on Transfer of Award. This Award may not be sold, transferred, pledged, assigned or otherwise encumbered or disposed of by the Grantee, and any shares of Stock issuable with respect to the Award may not be sold, transferred, pledged, assigned or otherwise encumbered or disposed of until (i) the Restricted Stock Units have vested as provided in Paragraph 2 of this Agreement and (ii) shares of Stock have been issued to the Grantee in accordance with the terms of the Plan and this Agreement.

2. Vesting of Restricted Stock Units. The restrictions and conditions of Paragraph 1 of this Agreement shall lapse on the Vesting Date or Dates specified in the following schedule so long as the Grantee remains in service as a member of the Board on such Dates. If a series of Vesting Dates is specified, then the restrictions and conditions in Paragraph 1 shall lapse only with respect to the number of Restricted Stock Units specified as vested on such date.

| Incremental Number of Restricted Stock Units Vested | Vesting Date |
| ___________________________________________ | _____________ |
| ( %)                                      |              |
| ( %)                                      |              |
| ( %)                                      |              |
| ( %)                                      |              |

Notwithstanding the foregoing, in the event of a Sale Event, 100% of the then-outstanding and unvested Restricted Stock Units shall immediately be deemed vested on the date of such Sale Event; provided, that the Grantee remains in service as a member of the Board until the date of such Sale Event. The Administrator may at any time accelerate the vesting schedule specified in this Paragraph 2.
3. **Termination of Service.** If the Grantee’s service as a member of the Board terminates for any reason (including death or disability) prior to the satisfaction of the vesting conditions set forth in Paragraph 2 above, any Restricted Stock Units that have not vested as of such date shall automatically and without notice terminate and be forfeited, and neither the Grantee nor any of his or her successors, heirs, assigns, or personal representatives will thereafter have any further rights or interests in such unvested Restricted Stock Units.

4. **Issuance of Shares of Stock.** As soon as practicable following each Vesting Date (but in no event later than two and one-half months after the end of the year in which the Vesting Date occurs), the Company shall issue to the Grantee the number of shares of Stock equal to the aggregate number of Restricted Stock Units that have vested pursuant to Paragraph 2 of this Agreement on such date and the Grantee shall thereafter have all the rights of a stockholder of the Company with respect to such shares.

5. **Incorporation of Plan.** Notwithstanding anything herein to the contrary, this Agreement shall be subject to and governed by all the terms and conditions of the Plan, including the powers of the Administrator set forth in Section 2(b) of the Plan. Capitalized terms in this Agreement shall have the meaning specified in the Plan, unless a different meaning is specified herein.

6. **Section 409A of the Code.** This Agreement shall be interpreted in such a manner that all provisions relating to the settlement of the Award are exempt from the requirements of Section 409A of the Code as “short-term deferrals” as described in Section 409A of the Code.

7. **No Obligation to Continue as a Director.** Neither the Plan nor this Award confers upon the Grantee any rights with respect to continuance as a Director.

8. **Integration.** This Agreement constitutes the entire agreement between the parties with respect to this Award and supersedes all prior agreements and discussions between the parties concerning such subject matter.

9. **Data Privacy Consent.** In order to administer the Plan and this Agreement and to implement or structure future equity grants, the Company, its subsidiaries and affiliates and certain agents thereof (together, the “Relevant Companies”) may process any and all personal or professional data, including but not limited to Social Security or other identification number, home address and telephone number, date of birth and other information that is necessary or desirable for the administration of the Plan and/or this Agreement (the “Relevant Information”). By entering into this Agreement, the Grantee (i) authorizes the Company to collect, process, register and transfer to the Relevant Companies all Relevant Information; (ii) waives any privacy rights the Grantee may have with respect to the Relevant Information; (iii) authorizes the Relevant Companies to store and transmit such information in electronic form; and (iv) authorizes the transfer of the Relevant Information to any jurisdiction in which the Relevant Companies consider appropriate. The Grantee shall have access to, and the right to change, the Relevant Information. Relevant Information will only be used in accordance with applicable law.
10. **Notices.** Notices hereunder shall be mailed or delivered to the Company at its principal place of business and shall be mailed or delivered to the Grantee at the address on file with the Company or, in either case, at such other address as one party may subsequently furnish to the other party in writing.

**Moderna, Inc.**

By: 

Title: 

The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned. Electronic acceptance of this Agreement pursuant to the Company’s instructions to the Grantee (including through an online acceptance process) is acceptable.

Dated: 

Grantee’s Signature

Grantee’s name and address:

3
MODERNA, INC.

[FORM OF] DIRECTOR INDEMNIFICATION AGREEMENT

This Indemnification Agreement ("Agreement") is made as of [_______] by and between Moderna, Inc., a Delaware corporation (the "Company"), and [Director] ("Indemnitee").

RECITALS

WHEREAS, the Company desires to attract and retain the services of highly qualified individuals, such as Indemnitee, to serve the Company;

WHEREAS, in order to induce Indemnitee to provide or continue to provide services to the Company, the Company wishes to provide for the indemnification of, and advancement of expenses to, Indemnitee to the maximum extent permitted by law;

WHEREAS, the Amended and Restated Certificate of Incorporation (as amended and in effect from time to time, the "Charter") and the Amended and Restated Bylaws (as amended and in effect from time to time, the "Bylaws") of the Company require indemnification of the officers and directors of the Company, and Indemnitee may also be entitled to indemnification pursuant to the General Corporation Law of the State of Delaware (the "DGCL");

WHEREAS, the Charter, the Bylaws and the DGCL expressly provide that the indemnification provisions set forth therein are not exclusive, and thereby contemplate that contracts may be entered into between the Company and members of the board of directors, officers and other persons with respect to indemnification;

WHEREAS, the Board of Directors of the Company (the "Board") has determined that the increased difficulty in attracting and retaining highly qualified persons such as Indemnitee is detrimental to the best interests of the Company’s stockholders;

WHEREAS, it is reasonable and prudent for the Company contractually to obligate itself to indemnify, and to advance expenses on behalf of, such persons to the fullest extent permitted by applicable law, regardless of any amendment or revocation of the Charter or the Bylaws, so that they will serve or continue to serve the Company free from undue concern that they will not be so indemnified;

WHEREAS, this Agreement is a supplement to and in furtherance of the indemnification provided in the Charter, the Bylaws and any resolutions adopted pursuant thereto, and shall not be deemed a substitute therefor, nor to diminish or abrogate any rights of Indemnitee thereunder; and

[WHEREAS, Indemnitee has certain rights to indemnification and/or insurance provided by [Affiliated Entity] ("[Affiliated Entity]") which Indemnitee and [Affiliated Entity] intend to be secondary to the primary obligation of the Company to indemnify Indemnitee as provided in this Agreement, with the Company’s acknowledgment and agreement to the foregoing being a material condition to Indemnitee’s willingness to serve or continue to serve on the Board.]
NOW, THEREFORE, in consideration of the premises and the covenants contained herein, the Company and Indemnitee do hereby covenant and agree as follows:

Section 1. Services to the Company. Indemnitee agrees to [continue to] serve as a director of the Company. Indemnitee may at any time and for any reason resign from such position (subject to any other contractual obligation or any obligation imposed by law), in which event the Company shall have no obligation under this Agreement to continue Indemnitee in such position. This Agreement shall not be deemed an employment contract between the Company (or any of its subsidiaries or any Enterprise) and Indemnitee.

Section 2. Definitions.

As used in this Agreement:

(a) “Change in Control” shall mean (i) the sale of all or substantially all of the assets of the Company on a consolidated basis to an unrelated person or entity, (ii) a merger, reorganization or consolidation pursuant to which the holders of the Company’s outstanding voting power and outstanding stock immediately prior to such transaction do not own a majority of the outstanding voting power and outstanding stock or other equity interests of the resulting or successor entity (or its ultimate parent, if applicable) immediately upon completion of such transaction, (iii) the sale of all of the Stock of the Company to an unrelated person, entity or group thereof acting in concert, or (iv) any other transaction in which the owners of the Company’s outstanding voting power immediately prior to such transaction do not own at least a majority of the outstanding voting power of the Company or any successor entity immediately upon completion of the transaction other than as a result of the acquisition of securities directly from the Company.

(b) “Corporate Status” describes the status of a person as a current or former director of the Company or current or former director, manager, partner, officer, employee, agent or trustee of any other Enterprise which such person is or was serving at the request of the Company.

(c) “Enforcement Expenses” shall include all reasonable attorneys’ fees, court costs, transcript costs, fees of experts, travel expenses, duplicating costs, printing and binding costs, telephone charges, postage, delivery service fees, and all other out-of-pocket disbursements or expenses of the types customarily incurred in connection with an action to enforce indemnification or advancement rights, or an appeal from such action. Expenses, however, shall not include fees, salaries, wages or benefits owed to Indemnitee.

(d) “Enterprise” shall mean any corporation (other than the Company), partnership, joint venture, trust, employee benefit plan, limited liability company, or other legal entity of which Indemnitee is or was serving at the request of the Company as a director, manager, partner, officer, employee, agent or trustee.
(e) “Expenses” shall include all reasonable attorneys’ fees, court costs, transcript costs, fees of experts, travel expenses, duplicating costs, printing and binding costs, telephone charges, postage, delivery service fees, and all other out-of-pocket disbursements or expenses of the types customarily incurred in connection with prosecuting, defending, preparing to prosecute or defend, investigating, being or preparing to be a witness in, or otherwise participating in, a Proceeding or an appeal resulting from a Proceeding. Expenses, however, shall not include amounts paid in settlement by Indemnitee, the amount of judgments or fines against Indemnitee or fees, salaries, wages or benefits owed to Indemnitee.

(f) “Independent Counsel” means a law firm, or a partner (or, if applicable, member or shareholder) of such a law firm, that is experienced in matters of Delaware corporation law and neither presently is, nor in the past five (5) years has been, retained to represent: (i) the Company, any subsidiary of the Company, any Enterprise or Indemnitee in any matter material to any such party; or (ii) any other party to the Proceeding giving rise to a claim for indemnification hereunder. Notwithstanding the foregoing, the term “Independent Counsel” shall not include any person who, under the applicable standards of professional conduct then prevailing, would have a conflict of interest in representing either the Company or Indemnitee in an action to determine Indemnitee’s rights under this Agreement. The Company agrees to pay the reasonable fees and expenses of the Independent Counsel referred to above and to fully indemnify such counsel against any and all expenses, claims, liabilities and damages arising out of or relating to this Agreement or its engagement pursuant hereto.

(g) The term “Proceeding” shall include any threatened, pending or completed action, suit, arbitration, alternate dispute resolution mechanism, investigation, inquiry, administrative hearing or any other actual, threatened or completed proceeding, whether brought in the right of the Company or otherwise and whether of a civil, criminal, administrative, regulatory or investigative nature, and whether formal or informal, in which Indemnitee was, is or will be involved as a party or otherwise by reason of the fact that Indemnitee is or was a director of the Company or is or was serving at the request of the Company as a director, manager, partner, officer, employee, agent or trustee of any Enterprise or by reason of any action taken by Indemnitee or of any action taken on his or her part while acting as a director of the Company or while serving at the request of the Company as a director, manager, partner, officer, employee, agent or trustee of any Enterprise, in each case whether or not serving in such capacity at the time any liability or expense is incurred for which indemnification, reimbursement or advancement of expenses can be provided under this Agreement; provided, however, that the term “Proceeding” shall not include any action, suit or arbitration, or part thereof, initiated by Indemnitee to enforce Indemnitee’s rights under this Agreement as provided for in Section 12(a) of this Agreement.

Section 3. Indemnity in Third-Party Proceedings. The Company shall indemnify Indemnitee to the extent set forth in this Section 3 if Indemnitee is, or is threatened to be made, a party to or a participant in any Proceeding, other than a Proceeding by or in the right of the Company to procure a judgment in its favor. Pursuant to this Section 3, Indemnitee shall be indemnified against all Expenses, judgments, fines, penalties, excise taxes, and amounts paid in settlement actually and reasonably incurred by Indemnitee or on his or her behalf in connection
with such Proceeding or any claim, issue or matter therein, if Indemnitee acted in good faith and in a manner he or she reasonably believed to be in or not opposed to the best interests of the Company and, in the case of a criminal proceeding, had no reasonable cause to believe that his or her conduct was unlawful.

Section 4. **Indemnity in Proceedings by or in the Right of the Company.** The Company shall indemnify Indemnitee to the extent set forth in this Section 4 if Indemnitee is, or is threatened to be made, a party to or a participant in any Proceeding by or in the right of the Company to procure a judgment in its favor. Pursuant to this Section 4, Indemnitee shall be indemnified against all Expenses actually and reasonably incurred by Indemnitee or on his or her behalf in connection with such Proceeding or any claim, issue or matter therein, if Indemnitee acted in good faith and in a manner he or she reasonably believed to be in or not opposed to the best interests of the Company. No indemnification for Expenses shall be made under this Section 4 in respect of any claim, issue or matter as to which Indemnitee shall have been finally adjudged by a court to be liable to the Company, unless and only to the extent that the Delaware Court of Chancery (the “Delaware Court”) shall determine upon application that, despite the adjudication of liability but in view of all the circumstances of the case, Indemnitee is fairly and reasonably entitled to indemnification for such expenses as the Delaware Court shall deem proper.

Section 5. **Indemnification for Expenses of a Party Who is Wholly or Partly Successful.** Notwithstanding any other provisions of this Agreement and except as provided in Section 7, to the extent that Indemnitee is a party to or a participant in any Proceeding and is successful in such Proceeding or in defense of any claim, issue or matter therein, the Company shall indemnify Indemnitee against all Expenses actually and reasonably incurred by him or her in connection therewith. If Indemnitee is not wholly successful in such Proceeding but is successful as to one or more but less than all claims, issues or matters in such Proceeding, the Company shall indemnify Indemnitee against all Expenses actually and reasonably incurred by Indemnitee or on his or her behalf in connection with each successfully resolved claim, issue or matter. For purposes of this Section and without limitation, the termination of any claim, issue or matter in such a Proceeding by dismissal, with or without prejudice, shall be deemed to be a successful result as to such claim, issue or matter.

Section 6. **Reimbursement for Expenses of a Witness or in Response to a Subpoena.** Notwithstanding any other provision of this Agreement, to the extent that Indemnitee, by reason of his or her Corporate Status, (i) is a witness in any Proceeding to which Indemnitee is not a party and is not threatened to be made a party or (ii) receives a subpoena with respect to any Proceeding to which Indemnitee is not a party and is not threatened to be made a party, the Company shall reimburse Indemnitee for all Expenses actually and reasonably incurred by him or her on his or her behalf in connection therewith.

Section 7. **Exclusions.** Notwithstanding any provision in this Agreement to the contrary, the Company shall not be obligated under this Agreement:

(a) to indemnify for amounts otherwise indemnifiable hereunder (or for which advancement is provided hereunder) if and to the extent that Indemnitee has otherwise actually received such amounts under any insurance policy, contract, agreement or otherwise; provided that the foregoing shall not affect the rights of Indemnitee or the Secondary Indemnitors as set forth in Section 13(c);
(b) to indemnify for an accounting of profits made from the purchase and sale (or sale and purchase) by Indemnitee of securities of the Company within the meaning of Section 16(b) of the Securities Exchange Act of 1934, as amended, or similar provisions of state statutory law or common law, or from the purchase or sale by Indemnitee of such securities in violation of Section 306 of the Sarbanes Oxley Act of 2002, as amended ("SOX");

(c) to indemnify with respect to any Proceeding, or part thereof, brought by Indemnitee against the Company, any legal entity which it controls, any director or officer thereof or any third party, unless (i) the Board has consented to the initiation of such Proceeding or part thereof and (ii) the Company provides the indemnification, in its sole discretion, pursuant to the powers vested in the Company under applicable law; provided, however, that this Section 7(c) shall not apply to (A) counterclaims or affirmative defenses asserted by Indemnitee in an action brought against Indemnitee or (B) any action brought by Indemnitee for indemnification or advancement from the Company under this Agreement or under any directors’ and officers’ liability insurance policies maintained by the Company in the suit for which indemnification or advancement is being sought as described in Section 12; or

(d) to provide any indemnification or advancement of expenses that is prohibited by applicable law (as such law exists at the time payment would otherwise be required pursuant to this Agreement).

Section 8. Advancement of Expenses. Subject to Section 9(b), the Company shall advance, to the extent not prohibited by law, the Expenses incurred by Indemnitee in connection with any Proceeding, and such advancement shall be made as incurred, and such advancement shall be made within thirty (30) days after the receipt by the Company of a statement or statements requesting such advances (including any invoices received by Indemnitee, which such invoices may be redacted as necessary to avoid the waiver of any privilege accorded by applicable law) from time to time, whether prior to or after final disposition of any Proceeding. Advances shall be unsecured and interest free. Advances shall be made without regard to Indemnitee’s (i) ability to repay the expenses, (ii) ultimate entitlement to indemnification under the other provisions of this Agreement, and (iii) entitlement to and availability of insurance coverage, including advancement, payment or reimbursement of defense costs, expenses of covered loss under the provisions of any applicable insurance policy (including, without limitation, whether such advancement, payment or reimbursement is withheld, conditioned or delayed by the insurer(s)). Indemnitee shall qualify for advances upon the execution and delivery to the Company of this Agreement which shall constitute an undertaking providing that Indemnitee undertakes to the fullest extent required by law to repay the advance if and to the extent that it is ultimately determined by a court of competent jurisdiction in a final judgment, not subject to appeal, that Indemnitee is not entitled to be indemnified by the Company. The right to advances under this paragraph shall in all events continue until final disposition of any Proceeding, including any appeal therein. Nothing in this Section 8 shall limit Indemnitee’s right to advancement pursuant to Section 12(e) of this Agreement.
Section 9. **Procedure for Notification and Defense of Claim**

(a) To obtain indemnification under this Agreement, Indemnitee shall submit to the Company a written request therefor specifying the basis for the claim, the amounts for which Indemnitee is seeking payment under this Agreement, and all documentation related thereto as reasonably requested by the Company.

(b) In the event that the Company shall be obligated hereunder to provide indemnification for or make any advancement of Expenses with respect to any Proceeding, the Company shall be entitled to assume the defense of such Proceeding, or any claim, issue or matter therein, with counsel approved by Indemnitee (which approval shall not be unreasonably withheld or delayed) upon the delivery to Indemnitee of written notice of the Company’s election to do so. After delivery of such notice, approval of such counsel by Indemnitee and the retention of such counsel by the Company, the Company will not be liable to Indemnitee under this Agreement for any fees or expenses of separate counsel subsequently employed by or on behalf of Indemnitee with respect to the same Proceeding; provided that (i) Indemnitee shall have the right to employ separate counsel in any such Proceeding at Indemnitee’s expense and (ii) if (A) the employment of separate counsel by Indemnitee has been previously authorized by the Company, (B) Indemnitee shall have reasonably concluded that there may be a conflict of interest between the Company and Indemnitee in the conduct of such defense, or (C) the Company shall not continue to retain such counsel to defend such Proceeding, then the fees and expenses actually and reasonably incurred by Indemnitee with respect to his or her separate counsel shall be Expenses hereunder.

(c) In the event that the Company does not assume the defense in a Proceeding pursuant to paragraph (b) above, then the Company will be entitled to participate in the Proceeding at its own expense.

(d) The Company shall not be liable to indemnify Indemnitee under this Agreement for any amounts paid in settlement of any Proceeding effected without its prior written consent (which consent shall not be unreasonably withheld or delayed). The Company shall not, without the prior written consent of Indemnitee (which consent shall not be unreasonably withheld or delayed), enter into any settlement which (i) includes an admission of fault of Indemnitee, any non-monetary remedy imposed on Indemnitee or any monetary damages for which Indemnitee is not wholly and actually indemnified hereunder or (ii) with respect to any Proceeding with respect to which Indemnitee may be or is made a party or may be otherwise entitled to seek indemnification hereunder, does not include the full release of Indemnitee from all liability in respect of such Proceeding.

Section 10. **Procedure Upon Application for Indemnification**

(a) Upon written request by Indemnitee for indemnification pursuant to Section 9(a), a determination, if such determination is required by applicable law, with respect to Indemnitee’s entitlement to indemnification hereunder shall be made in the specific case by one of the following methods: (x) if a Change in Control shall have occurred, by Independent Counsel in a written opinion to the Board; or (y) if a Change in Control shall not have occurred: (i) by a majority vote of the disinterested directors, even though less than a quorum; (ii) by a
committee of disinterested directors designated by a majority vote of the disinterested directors, even though less than a quorum; or (iii) if there are no disinterested directors or if the disinterested directors so direct, by Independent Counsel in a written opinion to the Board. For purposes hereof, disinterested directors are those members of the Board who are not parties to the action, suit or proceeding in respect of which indemnification is sought. In the case that such determination is made by Independent Counsel, a copy of Independent Counsel’s written opinion shall be delivered to Indemnitee and, if it is so determined that Indemnitee is entitled to indemnification, payment to Indemnitee shall be made within thirty (30) days after such determination. Indemnitee shall cooperate with the Independent Counsel or the Company, as applicable, in making such determination with respect to Indemnitee’s entitlement to indemnification, including providing to such counsel or the Company, upon reasonable advance request, any documentation or information which is not privileged or otherwise protected from disclosure and which is reasonably available to Indemnitee and reasonably necessary to such determination. Any out-of-pocket costs or expenses (including reasonable attorneys’ fees and disbursements) actually and reasonably incurred by Indemnitee in so cooperating with the Independent Counsel or the Company shall be borne by the Company (irrespective of the determination as to Indemnitee’s entitlement to indemnification) and the Company hereby indemnifies and agrees to hold Indemnitee harmless therefrom.

(b) If the determination of entitlement to indemnification is to be made by Independent Counsel pursuant to Section 10(a), the Independent Counsel shall be selected by the Board if a Change in Control shall not have occurred or, if a Change in Control shall have occurred, by Indemnitee. Indemnitee or the Company, as the case may be, may, within ten (10) days after written notice of such selection, deliver to the Company or Indemnitee, as the case may be, a written objection to such selection; provided, however, that such objection may be asserted only on the ground that the Independent Counsel so selected does not meet the requirements of “Independent Counsel” as defined in Section 2 of this Agreement, and the objection shall set forth with particularity the factual basis of such assertion. Absent a proper and timely objection, the person so selected shall act as Independent Counsel. If such written objection is so made and substantiated, the Independent Counsel so selected may not serve as Independent Counsel unless and until such objection is withdrawn or the Delaware Court has determined that such objection is without merit. If, within twenty (20) days after the later of (i) submission by Indemnitee of a written request for indemnification pursuant to Section 9(a), and (ii) the final disposition of the Proceeding, including any appeal therein, no Independent Counsel shall have been selected without objection, either Indemnitee or the Company may petition the Delaware Court for resolution of any objection which shall have been made by Indemnitee or the Company to the selection of Independent Counsel and/or for the appointment as Independent Counsel of a person selected by the court or by such other person as the court shall designate. The person with respect to whom all objections are so resolved or the person so appointed shall act as Independent Counsel under Section 10(a) hereof. Upon the due commencement of any judicial proceeding or arbitration pursuant to Section 12(a) of this Agreement, Independent Counsel shall be discharged and relieved of any further responsibility in such capacity (subject to the applicable standards of professional conduct then prevailing).
Section 11. Presumptions and Effect of Certain Proceedings

(a) To the extent permitted by applicable law, in making a determination with respect to entitlement to indemnification hereunder, it shall be presumed that Indemnitee is entitled to indemnification under this Agreement if Indemnitee has submitted a request for indemnification in accordance with Section 9(a) of this Agreement, and the Company shall have the burden of proof to overcome that presumption in connection with the making of any determination contrary to that presumption. Neither (i) the failure of the Company or of Independent Counsel to have made a determination prior to the commencement of any action pursuant to this Agreement that indemnification is proper in the circumstances because Indemnitee has met the applicable standard of conduct, nor (ii) an actual determination by the Company or by Independent Counsel that Indemnitee has not met such applicable standard of conduct, shall be a defense to the action or create a presumption that Indemnitee has not met the applicable standard of conduct.

(b) The termination of any Proceeding or of any claim, issue or matter therein, by judgment, order, settlement or conviction, or upon a plea of guilty, *nolo contendere* or its equivalent, shall not (except as otherwise expressly provided in this Agreement) of itself adversely affect the right of Indemnitee to indemnification or create a presumption that Indemnitee did not act in good faith and in a manner which he or she reasonably believed to be in or not opposed to the best interests of the Company or, with respect to any criminal Proceeding, that Indemnitee had reasonable cause to believe that his or her conduct was unlawful.

(c) The knowledge and/or actions, or failure to act, of any director, manager, partner, officer, employee, agent or trustee of the Company, any subsidiary of the Company, or any Enterprise shall not be imputed to Indemnitee for purposes of determining the right to indemnification under this Agreement.

Section 12. Remedies of Indemnitee

(a) Subject to Section 12(f), in the event that (i) a determination is made pursuant to Section 10 of this Agreement that Indemnitee is not entitled to indemnification under this Agreement, (ii) advancement of Expenses is not timely made pursuant to Section 8 of this Agreement, (iii) no determination of entitlement to indemnification shall have been made pursuant to Section 10(a) of this Agreement within sixty (60) days after receipt by the Company of the request for indemnification for which a determination is to be made other than by Independent Counsel, (iv) payment of indemnification or reimbursement of expenses is not made pursuant to Section 5 or 6 or the last sentence of Section 10(a) of this Agreement within thirty (30) days after receipt by the Company of a written request therefor (including any invoices received by Indemnitee, which such invoices may be redacted as necessary to avoid the waiver of any privilege accorded by applicable law) or (v) payment of indemnification pursuant to Section 3 or 4 of this Agreement is not made within thirty (30) days after a determination has been made that Indemnitee is entitled to indemnification, Indemnitee shall be entitled to an adjudication by the Delaware Court of his or her entitlement to such indemnification or advancement. Alternatively, Indemnitee, at his or her option, may seek an award in arbitration to be conducted by a single arbitrator pursuant to the Commercial Arbitration Rules of the
American Arbitration Association. Indemnitee shall commence such proceeding seeking an adjudication or an award in arbitration within 180 days following the date on which Indemnitee first has the right to commence such proceeding pursuant to this Section 12(a); provided, however, that the foregoing time limitation shall not apply in respect of a proceeding brought by Indemnitee to enforce his or her rights under Section 5 of this Agreement. The Company shall not oppose Indemnitee’s right to seek any such adjudication or award in arbitration.

(b) In the event that a determination shall have been made pursuant to Section 10(a) of this Agreement that Indemnitee is not entitled to indemnification, any judicial proceeding or arbitration commenced pursuant to this Section 12 shall be conducted in all respects as a de novo trial, or arbitration, on the merits and Indemnitee shall not be prejudiced by reason of that adverse determination. In any judicial proceeding or arbitration commenced pursuant to this Section 12, the Company shall have the burden of proving Indemnitee is not entitled to indemnification or advancement, as the case may be.

(c) If a determination shall have been made pursuant to Section 10(a) of this Agreement that Indemnitee is entitled to indemnification, the Company shall be bound by such determination in any judicial proceeding or arbitration commenced pursuant to this Section 12, absent (i) a misstatement by Indemnitee of a material fact, or an omission of a material fact necessary to make Indemnitee’s statement not materially misleading, in connection with the request for indemnification, or (ii) a prohibition of such indemnification under applicable law.

(d) The Company shall be precluded from asserting in any judicial proceeding or arbitration commenced pursuant to this Section 12 that the procedures and presumptions of this Agreement are not valid, binding and enforceable and shall stipulate in any such court or before any such arbitrator that the Company is bound by all the provisions of this Agreement.

(e) The Company shall indemnify Indemnitee to the fullest extent permitted by law against any and all Enforcement Expenses and, if requested by Indemnitee, shall (within thirty (30) days after receipt by the Company of a written request therefor) advance, to the extent not prohibited by law, such Enforcement Expenses to Indemnitee, which are incurred by Indemnitee in connection with any action brought by Indemnitee for indemnification or advancement from the Company under this Agreement or under any directors’ and officers’ liability insurance policies maintained by the Company in the suit for which indemnification or advancement is being sought. Such written request for advancement shall include invoices received by Indemnitee in connection with such Enforcement Expenses but, in the case of invoices in connection with legal services, any references to legal work performed or to expenditures made that would cause Indemnitee to waive any privilege accorded by applicable law need not be included with the invoice.

(f) Notwithstanding anything in this Agreement to the contrary, no determination as to entitlement to indemnification under this Agreement shall be required to be made prior to the final disposition of the Proceeding, including any appeal therein.
Section 13. **Non-exclusivity; Survival of Rights; Insurance; Primacy of Indemnification; Subrogation.**

(a) The rights of indemnification and to receive advancement as provided by this Agreement shall not be deemed exclusive of any other rights to which Indemnitee may at any time be entitled under applicable law, the Charter, the Bylaws, any agreement, a vote of stockholders or a resolution of directors, or otherwise. No amendment, alteration or repeal of this Agreement or of any provision hereof shall limit or restrict any right of Indemnitee under this Agreement in respect of any action taken or omitted by such Indemnitee in his or her Corporate Status prior to such amendment, alteration or repeal. To the extent that a change in Delaware law, whether by statute or judicial decision, permits greater indemnification or advancement than would be afforded currently under the Charter, Bylaws and this Agreement, it is the intent of the parties hereto that Indemnitee shall enjoy by this Agreement the greater benefits so afforded by such change. No right or remedy herein conferred is intended to be exclusive of any other right or remedy, and every other right and remedy shall be cumulative and in addition to every other right and remedy given hereunder or now or hereafter existing at law or in equity or otherwise. The assertion or employment of any right or remedy hereunder, or otherwise, shall not prevent the concurrent assertion or employment of any other right or remedy.

(b) To the extent that the Company maintains an insurance policy or policies providing liability insurance for directors, managers, partners, officers, employees, agents or trustees of the Company or of any other Enterprise, Indemnitee shall be covered by such policy or policies in accordance with its or their terms to the maximum extent of the coverage available for any such director, manager, partner, officer, employee, agent or trustee under such policy or policies. If, at the time of the receipt of a notice of a claim pursuant to the terms hereof, the Company has director and officer liability insurance in effect, the Company shall give prompt notice of the commencement of such proceeding to the insurers in accordance with the procedures set forth in the respective policies. The Company shall thereafter take all necessary or desirable action to cause such insurers to pay, on behalf of Indemnitee, all amounts payable as a result of such proceeding in accordance with the terms of such policies.

(c) [The Company hereby acknowledges that Indemnitee has certain rights to indemnification, advancement of expenses and/or insurance provided by [Affiliated Entity] and certain of its affiliates (collectively, the “Secondary Indemnitors”). The Company hereby agrees (i) that it is the indemnitor of first resort (i.e., its obligations to Indemnitee are primary and any obligation of the Secondary Indemnitors to advance expenses or to provide indemnification for the same expenses or liabilities incurred by Indemnitee are secondary), (ii) that it shall be required to advance the full amount of expenses incurred by Indemnitee and shall be liable for the full amount of all Expenses, judgments, penalties, fines and amounts paid in settlement to the extent legally permitted and as required by the terms of this Agreement and the Charter and/or Bylaws (or any other agreement between the Company and Indemnitee), without regard to any rights Indemnitee may have against the Secondary Indemnitors, and (iii) that it irrevocably waives, relinquishes and releases the Secondary Indemnitors from any and all claims against the Secondary Indemnitors for contribution, subrogation or any other recovery of any kind in respect thereof. The Company further agrees that no advancement or payment by the Secondary Indemnitors on behalf of Indemnitee with respect to any claim for which Indemnitee has sought indemnification from the Company shall affect the foregoing and the Secondary Indemnitors.
shall have a right of contribution and/or be subrogated to the extent of such advancement or payment to all of the rights of recovery of Indemnitee against the Company. The Company and Indemnitee agree that the Secondary Indemnitors are express third party beneficiaries of the terms of this Section 13(c).

(d) [Except as provided in paragraph (c) above,] in the event of any payment under this Agreement, the Company shall be subrogated to the extent of such payment to all of the rights of recovery of Indemnitee [other than against the Secondary Indemnitors], who shall execute all papers required and take all action necessary to secure such rights, including execution of such documents as are necessary to enable the Company to bring suit to enforce such rights.

(e) [Except as provided in paragraph (c) above,] the Company’s obligation to provide indemnification or advancement hereunder to Indemnitee who is or was serving at the request of the Company as a director, manager, partner, officer, employee, agent or trustee of any other Enterprise shall be reduced by any amount Indemnitee has actually received as indemnification or advancement from such other Enterprise.

Section 14. Duration of Agreement. This Agreement shall continue until and terminate upon the later of: (a) ten (10) years after the date that Indemnitee shall have ceased to serve as a director of the Company or (b) one (1) year after the final termination of any Proceeding, including any appeal, then pending in respect of which Indemnitee is granted rights of indemnification or advancement hereunder and of any proceeding commenced by Indemnitee pursuant to Section 12 of this Agreement relating thereto. This Agreement shall be binding upon the Company and its successors and assigns and shall inure to the benefit of Indemnitee and his or her heirs, executors and administrators. The Company shall require and cause any successor (whether direct or indirect by purchase, merger, consolidation or otherwise) to all, substantially all or a substantial part, of the business and/or assets of the Company, by written agreement in form and substance satisfactory to Indemnitee, expressly to assume and agree to perform this Agreement in the same manner and to the same extent that the Company would be required to perform if no such succession had taken place.

Section 15. Severability. If any provision or provisions of this Agreement shall be held to be invalid, illegal or unenforceable for any reason whatsoever: (a) the validity, legality and enforceability of the remaining provisions of this Agreement (including, without limitation, each portion of any section of this Agreement containing any such provision held to be invalid, illegal or unenforceable, that is not itself invalid, illegal or unenforceable) shall not in any way be affected or impaired thereby and shall remain enforceable to the fullest extent permitted by law; (b) such provision or provisions shall be deemed reformed to the extent necessary to conform to applicable law and to give the maximum effect to the intent of the parties hereto; and (c) to the fullest extent possible, the provisions of this Agreement (including, without limitation, each portion of any section of this Agreement containing any such provision held to be invalid, illegal or unenforceable, that is not itself invalid, illegal or unenforceable) shall be construed so as to give effect to the intent manifested thereby.

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Section 16. Enforcement.

(a) The Company expressly confirms and agrees that it has entered into this Agreement and assumed the obligations imposed on it hereby in order to induce Indemnitee to serve or continue to serve as a director of the Company, and the Company acknowledges that Indemnitee is relying upon this Agreement in serving as a director of the Company.

(b) This Agreement constitutes the entire agreement between the parties hereto with respect to the subject matter hereof and supersedes all prior agreements and understandings, oral, written and implied, between the parties hereto with respect to the subject matter hereof; provided, however, that this Agreement is a supplement to and in furtherance of the Charter, the Bylaws and applicable law, and shall not be deemed a substitute therefor, nor to diminish or abrogate any rights of Indemnitee thereunder.

Section 17. Modification and Waiver. No supplement, modification or amendment, or waiver of any provision, of this Agreement shall be binding unless executed in writing by the parties thereto. No waiver of any of the provisions of this Agreement shall be deemed or shall constitute a waiver of any other provisions of this Agreement nor shall any waiver constitute a continuing waiver. No supplement, modification or amendment of this Agreement or of any provision hereof shall limit or restrict any right of Indemnitee under this Agreement in respect of any action taken or omitted by such Indemnitee prior to such supplement, modification or amendment.

Section 18. Notice by Indemnitee. Indemnitee agrees promptly to notify the Company in writing upon being served with any summons, citation, subpoena, complaint, indictment, information or other document relating to any Proceeding or matter which may be subject to indemnification, reimbursement or advancement as provided hereunder. The failure of Indemnitee to so notify the Company shall not relieve the Company of any obligation which it may have to Indemnitee under this Agreement or otherwise.

Section 19. Notices. All notices, requests, demands and other communications under this Agreement shall be in writing and shall be deemed to have been duly given if (i) delivered by hand and receipted for by the party to whom said notice or other communication shall have been directed, (ii) mailed by certified or registered mail with postage prepaid, on the third business day after the date on which it is so mailed, (iii) mailed by reputable overnight courier and receipted for by the party to whom said notice or other communication shall have been directed or (iv) sent by facsimile transmission, with receipt of oral confirmation that such transmission has been received:

(a) If to Indemnitee, at such address as Indemnitee shall provide to the Company.

(b) If to the Company to:

Moderna, Inc.
200 Technology Square
Cambridge, MA 02139
Attention: Chief Executive Officer

or to any other address as may have been furnished to Indemnitee by the Company.
Section 20. **Contribution.** To the fullest extent permissible under applicable law, if the indemnification provided for in this Agreement is unavailable to Indemnitee for any reason whatsoever, the Company, in lieu of indemnifying Indemnitee, shall contribute to the amount incurred by Indemnitee, whether for judgments, fines, penalties, excise taxes, amounts paid or to be paid in settlement and/or for Expenses, in connection with any Proceeding in such proportion as is deemed fair and reasonable in light of all of the circumstances in order to reflect (i) the relative benefits received by the Company and Indemnitee in connection with the event(s) and/or transaction(s) giving rise to such Proceeding; and/or (ii) the relative fault of the Company (and its directors, officers, employees and agents) and Indemnitee in connection with such event(s) and/or transactions.

Section 21. **Internal Revenue Code Section 409A.** The Company intends for this Agreement to comply with the Indemnification exception under Section 1.409A-1(b)(10) of the regulations promulgated under the Internal Revenue Code of 1986, as amended (the “Code”), which provides that indemnification of, or the purchase of an insurance policy providing for payments of, all or part of the expenses incurred or damages paid or payable by Indemnitee with respect to a bona fide claim against Indemnitee or the Company do not provide for a deferral of compensation, subject to Section 409A of the Code, where such claim is based on actions or failures to act by Indemnitee in his or her capacity as a service provider of the Company. The parties intend that this Agreement be interpreted and construed with such intent.

Section 22. **Applicable Law and Consent to Jurisdiction.** This Agreement and the legal relations among the parties shall be governed by, and construed and enforced in accordance with, the laws of the State of Delaware, without regard to its conflict of laws rules. Except with respect to any arbitration commenced by Indemnitee pursuant to Section 12(a) of this Agreement, the Company and Indemnitee hereby irrevocably and unconditionally (i) agree that any action or proceeding arising out of or in connection with this Agreement shall be brought only in the Delaware Court, and not in any other state or federal court in the United States of America or any court in any other country, (ii) consent to submit to the exclusive jurisdiction of the Delaware Court for purposes of any action or proceeding arising out of or in connection with this Agreement, (iii) consent to service of process at the address set forth in Section 19 of this Agreement with the same legal force and validity as if served upon such party personally within the State of Delaware, (iv) waive any objection to the laying of venue of any such action or proceeding in the Delaware Court, and (v) waive, and agree not to plead or to make, any claim that any such action or proceeding brought in the Delaware Court has been brought in an improper or inconvenient forum.

Section 23. **Headings.** The headings of the paragraphs of this Agreement are inserted for convenience only and shall not be deemed to constitute part of this Agreement or to affect the construction thereof.

Section 24. **Identical Counterparts.** This Agreement may be executed in one or more counterparts, each of which shall for all purposes be deemed to be an original but all of which
together shall constitute one and the same Agreement. Only one such counterpart signed by the party against whom enforceability is sought needs to be produced to evidence the existence of this Agreement.

[Remainder of Page Intentionally Left Blank]
IN WITNESS WHEREOF, the parties have caused this Agreement to be signed as of the day and year first above written.

MODERNA, INC.

By: _________________________________

Name: ______________________________

Title: _______________________________

______________________________
[Indemnitee]
Master Collaboration and License Agreement

by and between

MODERNA THERAPEUTICS, INC.

and

MERCK SHARP & DOHME CORP.

January 12, 2015
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Master Collaboration and License Agreement

This Master Collaboration and License Agreement (this “Agreement”), dated as of January 12, 2015 (the “Effective Date”), is made by and between Moderna Therapeutics, Inc., a corporation organized and existing under the laws of Delaware (“Moderna”), and Merck Sharp & Dohme Corp., a corporation organized and existing under the laws of New Jersey (“Merck”). Each of Moderna and Merck may be referred to herein as a “Party” or together as the “Parties”.

WHEREAS, Moderna has developed expertise and technology useful for the discovery, development, Manufacture, characterization, or use of pharmaceutical products that function using mRNA;

WHEREAS, Merck is a pharmaceutical company focused on identifying, Developing and Commercializing innovative therapeutic products;

WHEREAS, Moderna and Merck wish to collaborate together to discover and Develop therapeutic and vaccine products using mRNA Constructs, with the goal of identifying or creating Collaboration mRNA Constructs that are suitable for Development and Commercialization by Merck; and

WHEREAS, Moderna is, as of the Effective Date, granting Merck a license under Moderna Technology to Develop, Commercialize and otherwise Exploit certain Product Candidates, Elected Candidates and Products (including [***]), in each case as further described herein.

NOW, THEREFORE, in consideration of the mutual covenants contained herein, and for other good and valuable consideration, the amount and sufficiency of which are hereby acknowledged, the Parties hereby agree as follows:

1. Definitions

The following terms and their correlatives will have the following meanings:

1.1. “AAA” has the meaning set forth in Section 16.1(c).

1.2. “Act” means, as applicable, the United States Federal Food, Drug and Cosmetic Act, 21 U.S.C. §§ 301 et seq., and/or the Public Health Service Act, 42 U.S.C. §§ 262 et seq., as such may be amended from time to time.

1.3. “Activity” means [***].

1.4. [***]

1.5. “Affiliate” of a Person means any other Person which (directly or indirectly) is controlled by, controls or is under common control with such Person. A Person will be deemed to “control” another Person if: (a) with respect to such other Person that is a corporation, owns, directly or indirectly, beneficially or legally, more than fifty percent (50%) of the outstanding voting securities or capital stock (or such lesser percentage which is the maximum allowed to be owned by such Person in a particular jurisdiction) of such other Person, or, with respect to such
other Person that is not a corporation, has other comparable ownership interest; or (b) has the power, whether pursuant to contract, ownership of securities or otherwise, to direct the management and policies of such other Person. For the avoidance of doubt, as of the Effective Date, Moderna LLC and Valera LLC are Affiliates of Moderna.

1.6. “Agreement” has the meaning set forth in Recitals.

1.7. “Applicable Field” means, with respect to (a) an R&D Program, the applicable Collaboration Field for such R&D Program, (b) the period prior to the first Regulatory Approval of a Product Candidate, Elected Candidate and Product, the applicable Collaboration Field of the Target Product Profile of such Product Candidate, Elected Candidate and Product, and (c) the period following the first Regulatory Approval of a Product, [***]; provided that, for purposes of this clause (c), [***].

1.8. “Back-Up Elected Candidate” has the meaning set forth in Section 2.10(d)(i).

1.9. “Bankruptcy Code” has the meaning set forth in Section 9.5.

1.10. [***]

1.11. “BLA” means a Biologics License Application filed with the FDA or an equivalent application to any Regulatory Authority (including an NDA or its foreign equivalent) requesting Regulatory Approval for a new product.

1.12. “Business Combination” means with respect to a Party (or its Affiliate), any of the following events: (a) any Third Party (or group of Third Parties acting in concert) acquires (including by way of a tender or exchange offer or issuance by such Party (or its Affiliate)), directly or indirectly, beneficial ownership or a right to acquire beneficial ownership of shares of such Party (or its Affiliate) representing fifty percent (50%) or more of the voting shares (where voting refers to being entitled to vote for the election of directors) then outstanding of such Party (or its Affiliate); (b) such Party (or its Affiliate) consolidates with or merges into another corporation or entity which is a Third Party, or any corporation or entity which is a Third Party consolidates with or merges into such Party (or its Affiliate), in either event pursuant to a transaction in which more than fifty percent (50%) of the voting shares of the acquiring or resulting entity outstanding immediately after such consolidation or merger is not held by the holders of the outstanding voting shares of such Party (or its Affiliate) immediately preceding such consolidation or merger; or (c) such Party (or its Affiliate) sells, transfers, leases or otherwise disposes of all or substantially all of the assets to which this Agreement relates to a Third Party.

1.13. “Business Day” means any day other than a Saturday or Sunday on which banking institutions in New York, NY are open for business.

1.14. “Calendar Quarter” means the respective periods of three (3) consecutive calendar months ending on March 31, June 30, September 30 and December 31; provided, however, that (i) the first Calendar Quarter of this Agreement shall commence on the Effective Date and end at the end of the Calendar Quarter in which the Effective Date occurs and (ii) the last Calendar Quarter of this Agreement shall commence at the commencement of such Calendar Quarter and end on the date of expiration or termination of this Agreement.
1.15. “Calendar Year” means each twelve (12)-month period beginning on January 1, 2015 and each subsequent anniversary thereof; provided, however, that (i) the first Calendar Year of this Agreement shall commence on the Effective Date and end on December 31 of the same year and (ii) the last Calendar Year of this Agreement shall commence on January 1 of the Calendar Year in which this Agreement terminates or expires and end on the date of expiration or termination of this Agreement.

1.16. “cGMP” means the then current good manufacturing practices, standards, guidelines and regulations promulgated and published by FDA, European Medicines Agency and/or any other applicable Regulatory Authorities having jurisdiction over the Manufacture of Moderna mRNA API (or Drug Product) or the Development or sale of any Product containing such Moderna mRNA API (or Drug Product), as applicable, relating to the testing, manufacturing, processing, packaging, holding or distribution of drug substances and finished drugs including any standards, guidelines and regulations as promulgated by, as applicable: (i) the FDA under and in accordance with the U.S. Federal Food, Drug and Cosmetic Act and Title 21, Parts 210 and 211 of the U.S. Code of Federal Regulations; (ii) the EMA and the EU Commission under European Directive 2003/94/EC; and/or (iii) the ICH Harmonised Tripartite Good Manufacturing Practice Guide For Active Pharmaceutical Ingredients (ICH Q7), as such standards, guidelines and regulations may be amended from time to time.

1.17. “Clinical Data” means all information with respect to a Collaboration mRNA Construct, Product Candidate, Elected Candidate or Product made, collected or otherwise generated under or in connection with clinical studies for such Collaboration mRNA Construct, Product Candidate, Elected Candidate or Product, including any data, reports and results with respect thereto.

1.18. “Clinical Supply Agreement” has the meaning set forth in Section 4.2.

1.19. “Code” has the meaning set forth in Section 2.16(d).

1.20. “Collaboration Activities” means the collaborative program of activities for the Development of Collaboration mRNA Constructs and Product Candidates that is engaged in by or on behalf of the Parties under this Agreement during the Collaboration Term, including [***].

1.21. “Collaboration Fields” means the [***], the RSV Field, the [***] and the [***].

1.22. “Collaboration Know-How” means all Know-How conceived, discovered, developed or otherwise made by or on behalf of a particular Party or any of its Affiliates or permitted subcontractors of any of the foregoing (solely or jointly by or on behalf of a particular Party or any of its Affiliates or permitted subcontractors of any of the foregoing) in the course of [***].

1.23. “Collaboration mRNA Constructs” means [***].

1.24. “Collaboration Pathogens” means [***] and RSV.

1.25. “Collaboration Patents” means any and all Patents that claim or cover any of the Collaboration Know-How.
1.26. “Collaboration Technology” means [***].

1.27. “Collaboration Term” means, collectively, the R&D Term and the Post-R&D Period.

1.28. “Combination Product” means a Product which includes one or more active ingredients other than an Elected Candidate. Drug delivery vehicles, adjuvants, and excipients shall not be deemed to be “active ingredients”, except in the case where such delivery vehicle, adjuvant, or excipient is recognized as an active ingredient in accordance with 21 C.F.R. 210.3(b)(7). All references to Product in this Agreement shall be deemed to include Combination Product, provided that the licenses granted to Merck herein apply only with respect to those mRNA Constructs which are Collaboration mRNA Constructs, as incorporated in Products Candidates or Elected Candidates, and not to any other mRNA Constructs.

1.29. “Commencement” means, with respect to a clinical study for a product, [***] in such clinical study.

1.30. “Commercialization” means any and all activities related to the import, export, marketing, detailing, promotion, distribution and/or sale of a pharmaceutical or vaccine product in a country or region in the Territory. When used as a verb, “to Commercialize” and “Commercializing” means to engage in Commercialization, and “Commercialized” has a corresponding meaning. [***]

1.31. “Commercially Reasonable Efforts” means with respect to the efforts to be expended by a Party with respect to any objective, [***].

1.32. “Competitive Infringement” means [***].

1.33. “Competitive TPP” means a TPP proposed by Merck in accordance with Section 2.9 that is [***].

1.34. “Confidentiality Agreement” means the Mutual Confidential Disclosure Agreement between the Parties made effective as of February 27, 2013 (as amended on February 5, 2014).

1.35. “Confidential Information” has the meaning set forth in Section 12.1(a).

1.36. [***]

1.37. [***]

1.38. [***]

1.39. [***]

1.40. “Control” or “Controlled” means, with respect to any Know-How or Patent, the possession (whether by ownership, license or sublicense, other than by a license, sublicense or other right granted (but not assignment) pursuant to this Agreement) by a Party (or its Affiliate) of
the ability to assign or grant to the other Party the licenses, sublicenses or rights to access and use such Know-How or Patent as provided for in this Agreement, without violating the terms of any agreement or other arrangement with any Third Party in existence as of the time such Party would be required hereunder to grant such license, sublicense, or rights of access and use, provided that Know-How and Patents that are licensed to Moderna pursuant to a Moderna In-License are not “Controlled” for purposes of this Agreement unless and only after such Moderna In-License is deemed to be a Moderna Collaboration In-License pursuant to Section 7.

1.41. [***]
1.42. [***]
1.43. “Development” means any and all research, preclinical and clinical drug development activities, including all activities relating to the identification of mRNA Constructs, the testing of mRNA Constructs, test method development and stability testing, toxicology, formulation, process development, qualification and validation, Manufacture scale-up, development-stage Manufacturing, quality assurance/quality control, holding/keeping (whether for disposal or otherwise), clinical studies, statistical analysis and report writing, the preparation and submission of Regulatory Filings, regulatory affairs with respect to the foregoing and all other activities necessary or reasonably useful or otherwise requested or required by a Regulatory Authority as a condition or in support of obtaining or maintaining a Regulatory Approval, and “Develop”, “Developed” and “Developing” will have corresponding meanings. For clarity, (a) “Development” excludes [***] and (b) with respect to a Product, Development shall include modifying, enhancing and/or improving such Product (e.g., changing dosage, formulation, etc.) provided that such modification, enhancement and/or improvement does not change the Collaboration mRNA Construct(s) in such Product.

1.44. “Development Milestone Product” has the meaning set forth in Section 8.4(a).
1.45. “Disclosing Party” has the meaning set forth in Section 12.1(a).
1.46. “Discontinued mRNA Construct” means any Collaboration mRNA Construct that has by any of the terms of this Agreement become a “Discontinued mRNA Construct”.
1.47. “Discontinued Program” means any R&D Program that has by any of the terms of this Agreement become a “Discontinued Program”.
1.48. “Discontinued Target” means any Target that has by any of the terms of this Agreement become a “Discontinued Target”.
1.49. “Disputes” has the meaning set forth in Section 16.1(a).
1.50. “Distributor” means any Person, other than a Sublicensee or an Affiliate of Merck, in one or more countries in the Territory that (a) purchases Product from Merck, its Affiliates or Sublicensees for such country(ies), (b) assumes responsibility from Merck for all or a portion of the Commercialization of such Product in such country(ies), and (c) sells Product in such country(ies).
1.51. “DMF” means any drug master file filed with the FDA, and any equivalent filing in other countries or regulatory jurisdictions.

1.52. “Drug Product” means [***].

1.53. [***]

1.54. “Effective Date” has the meaning set forth in the Preamble.

1.55. “Elected Candidate” means a Product Candidate for which Merck has issued an “Elected Candidate Notice” pursuant to Section 2.10(a) or “Replacement Notice” pursuant to Section 2.10(d), including [***].

1.56. “Elected Candidate Cap” has the meaning set forth in Section 2.10(a).

1.57. “Elected Candidate Notice” has the meaning set forth in Section 2.10(a).

1.58. “EMA” means the Regulatory Authority known as the European Medicines Agency and any successor agency thereto.

1.59. “Environmental, Health and Safety (EHS) Laws” means all applicable environmental and similar Laws, directives, rules, ordinances, codes, guidelines, regulations, governmental, administrative or judicial orders or decrees or other legal requirements of any kind, whether currently in existence or hereafter promulgated, enacted, adopted or amended, relating to (a) safety (including occupational health and safety); conservation, preservation or protection of human health, drinking water, natural resources, biota and the environment; (b) the introduction of any chemical substances, products or finished articles into the stream of commerce; (c) the imposition of any discharge levy or other economic instrument to prevent or reduce discharge of pollutants; (d) the conduct of environmental impact assessment in connection with the design, development and operation of any facility or project; (e) the notification, classifications, registrations and labeling of new chemical substances; or (f) the generation, use, storage, handling, treatment, transportation or disposal of waste, including any matters related to releases and threatened releases of hazardous materials.

1.60. [***]

1.61. “Executive Officer” means, for Moderna, [***], and for Merck, [***]. Either Party may change its Executive Officer upon written notice to the other Party, provided that such replacement individual has decision-making authority on behalf of such Party in respect of this Agreement.

1.62. “Existing Partner” means each of the [***] Development and Commercialization partners of Moderna as of the Effective Date with which Moderna has entered into an Existing Partner Agreement that is in effect as of the Effective Date.

1.63. “Existing Partner Agreements” mean, [***].

1.64. “Existing Partner Fields” means the fields listed on Exhibit D.
1.65. “Exploit” means to make, have made, import, use, sell, or offer for sale, including to Develop, Commercialize, register, Manufacture, have Manufactured, hold, or keep (whether for disposal or otherwise), formulate, have used, export, transport, distribute, promote, market, or have sold or otherwise dispose of, and “Exploiting” and “Exploitation” will have corresponding meanings. [*]

1.66. “FDA” means the United States Food and Drug Administration and any successor agency thereto.

1.67. “FFDCA” means the United States Food, Drug, and Cosmetic Act, as amended from time to time, together with any rules, regulations and requirements promulgated thereunder (including all additions, supplements, extensions, and modifications thereto).

1.68. “First Commercial Sale” means, with respect to a Product and a country, the first sale for monetary value for use or consumption by the general public of such Product in such country after all required Regulatory Approvals for commercial sale of such Product have been obtained in such country. Sales prior to receipt of Regulatory Approval for such Licensed Product, such as so-called “treatment IND sales,” “named patient sales,” and “compassionate use sales,” shall not be construed as a First Commercial Sale.

1.69. “FTE” means the equivalent of a full-time scientific or technical person’s work time over a twelve (12) month period (including normal vacation, sick days and holidays) devoted to, and directly related to, conducting Collaboration Activities [*] under an R&D Program, [*], in accordance with this Agreement, based on [*] person-hours or greater per year. In the event that an individual devotes less than such full time to conducting Collaboration Activities [*] under an R&D Program, [*] in accordance with this Agreement during such twelve (12) month period, then for purposes of this Agreement, such individual shall only count as a portion of an FTE which shall be determined by dividing the number of full days during the applicable twelve (12) month period devoted to, and directly related to, conducting Collaboration Activities [*] in accordance with this Agreement by the total number of working days during such twelve (12) month period. No individual may be charged at greater than one (1) FTE in a given Calendar Year.

1.70. “FTE Costs” means, (a) with respect to Moderna, the actual FTEs employed by Moderna or its Affiliates in the conduct of any Collaboration Activities [*] pursuant to the [*] and (b) with respect to Merck, the actual FTEs employed by Merck and its Affiliates in the conduct of Collaboration Activities pursuant to [*], in each case (a) and (b), multiplied by the FTE Rate, which represents [*].

1.71. “FTE Rate” means [*] per one (1) full FTE per full twelve (12) month Calendar Year; provided, that, starting [*], [*] such rate shall adjust [*] of each Calendar Year by an amount equal to the change, if any, in [*]. Notwithstanding the foregoing for any Calendar Year during the Term that is less than a full year, the above referenced rate shall be proportionately reduced to reflect such portion of such full Calendar Year.

1.72. “GAAP” means U.S. generally accepted accounting principles or International Financial Reporting Standards, consistently applied, as designated and used by the applicable Party.
1.73. [***]

1.74. “GLP Toxicology Study” means a GLP study of the toxicological effects of a product.

1.75. “Good Laboratory Practice” or “GLP” means the applicable then-current standards for laboratory activities for pharmaceuticals (including biologicals) or vaccines, as applicable, as set forth in the Act and any regulations or guidance documents promulgated thereunder, as amended from time to time, together with any similar standards of good laboratory practice as are required by any Regulatory Authority having jurisdiction over the applicable activity.

1.76. [***]

1.77. [***]

1.78. “Human Materials” shall have the meaning set forth in Section 2.16(b).

1.79. “[***] Target” means [***].

1.80. “IND” means with respect to a Product Candidate, an Investigational New Drug Application filed with the FDA with respect to such Product Candidate pursuant to 21 C.F.R. § 312 before the commencement of human clinical trials involving such Product Candidate, including all amendments and supplements to such application, or any equivalent filing with any Regulatory Authority outside the United States.

1.81. “Indemnification Claim Notice” has the meaning set forth in Section 14.5(c).

1.82. “Indemnified Party” has the meaning set forth in Section 14.5(c).

1.83. [***]

1.84. [***]

1.85. “Initial R&D Term” has the meaning set forth in Section 2.2(a).

1.86. “In-License Payments” means any amounts payable under any Moderna Collaboration In-License that are incurred by Moderna or its Affiliates as a result of (a) the grant of [***] or (b) the grant of any [***], in each ((a) and (b)) under this Agreement. Any such payments may include [***]. Notwithstanding the foregoing, In-License Payments shall not include any [***].

1.87. “Issuing Party” has the meaning set forth in Section 12.3(c).

1.88. “Joint Know-How” means all Collaboration Know-How that is jointly owned by the Parties in accordance with Section 10.5.

1.89. “Joint Patents” means all Collaboration Patents that are jointly owned by the Parties in accordance with Section 10.5.
1.90. “Joint Technology” means all Collaboration Technology that is jointly owned by the Parties in accordance with Section 10.5.

1.91. “JSC” has the meaning set forth in Section 3.2(a).

1.92. “Know-How” means all non-public technical, scientific, and other know-how and information, trade secrets, knowledge, technology, means, methods, processes, practices, formulae, instructions, skills, techniques, procedures, experiences, ideas, designs, drawings, assembly procedures, computer programs, apparatuses, specifications, data, results and Materials, including: biological, chemical, vaccine-related, pharmacological, toxicological, pharmaceutical, physical and analytical, pre-clinical, clinical, safety, manufacturing and quality control data and information, including study designs and protocols, assays, and biological methodology, in all cases, whether or not copyrightable or patentable, in written, electronic or any other form now known or hereafter developed.

1.93. “Knowledge” means with respect to the matter in question, the knowledge of [***].

1.94. “Law” or “Laws” means all laws, statutes, enactments, acts of legislature, rules, regulations, orders, judgments, guidelines, policies, directions, directives, or ordinances having the effect of law of any federal, national, multinational, state, provincial, county, city or other political subdivision of any jurisdiction which are applicable to any of the Parties or their respective Affiliates in carrying out activities hereunder or to which any of the Parties or their respective Affiliates in carrying out the activities hereunder is subject, including the Act and GLPs and cGMPs.

1.95. [***]

1.96. [***]

1.97. “Losses” has the meaning set forth in Section 14.5(a).

1.98. “Manufacturing” means the production, manufacture, synthesis, processing, filling, finishing, packaging, labeling, shipping and holding of product or any intermediate thereof, including process development, process qualification and validation, scale-up, commercial manufacture and analytic development, product characterization, stability testing, quality assurance and quality control. “Manufacturing” refers to both pre-clinical and clinical Manufacturing for Development, and Manufacturing for Commercialization. “Manufacture” and “Manufactured” will have corresponding meanings.

1.99. “Materials” means any tangible chemical or biological material, including any compounds, DNA and RNA (modified and unmodified), mRNA Constructs, Polypeptides, clones, cells, constructs, vectors, receptors and other nucleic acids, proteins, peptides and any expression product, progeny, derivative or improvement thereto, along with any tangible chemical or biological material embodying any Know-How.

1.100. “Merck” has the meaning set forth in Recitals.

1.101. “Merck Acquisition” has the meaning set forth in Section 11.9.
1.102. “Merck Background Know-How” means any and all Know-How Controlled by Merck or its Affiliates as of the Effective Date or as to which Merck or its Affiliates obtains Control during the Collaboration Term that [***], including [***], but in each case [***] excluding any Merck Collaboration Know-How.

1.103. “Merck Background Patents” means those Patents that are Controlled by Merck or its Affiliates as of the Effective Date or as to which Merck or its Affiliates obtains Control during the Collaboration Term that claim or cover the Merck Background Know-How, excluding any Merck Collaboration Patents.

1.104. “Merck Background Technology” means the Merck Background Know-How and the Merck Background Patents.

1.105. “Merck Business Program” has the meaning set forth in Section 11.9.

1.106. “Merck Collaboration Know-How” means any and all Collaboration Know-How owned by Merck or any of its Affiliates [***], including Merck’s right and interest in any Joint Know-How.

1.107. “Merck Collaboration Patents” means any and all Patents that claim or cover any of the Merck Collaboration Know-How, including Merck’s right and interest in any Joint Patents.

1.108. “Merck Collaboration Technology” means the Merck Collaboration Know-How and the Merck Collaboration Patents. For clarity, all Merck Collaboration Technology will be “Controlled” by Merck for purposes of this Agreement.

1.109. “Merck Election Period” has the meaning set forth in Section 2.11(d).

1.110. “Merck Exclusive Targets” means the Targets identified on Exhibit C.

1.111. [***]

1.112. [***]

1.113. “Merck Indemnitees” has the meaning set forth in Section 14.5(b).

1.114. “Merck In-License” has the meaning set forth in Section 7.8.

1.115. “Merck Program Director” has the meaning set forth in Section 3.1.

1.116. [***]

1.117. “Merck Technology” means collectively, Merck Background Technology and Merck Collaboration Technology.

1.118. “Milestone Event” has the meaning set forth in Section 8.4.

1.119. “Milestone Payment” has the meaning set forth in Section 8.4.
1.120. "Moderna" has the meaning set forth in Recitals.

1.121. "Moderna Acquisition" has the meaning set forth in Section 11.8(a).

1.122. "Moderna Background Know-How" means any and all Know-How Controlled by Moderna or any of its Affiliates as of the Effective Date or as to which Moderna or any of its Affiliates obtains Control during the Term that [***], excluding any Moderna Collaboration Know-How. For the avoidance of doubt, Moderna Background Know-How shall not include any Know-How licensed to Moderna pursuant to a Moderna In-License unless and until such Moderna In-License becomes a Moderna Collaboration In-License pursuant to Section 7.

1.123. "Moderna Background Patents" means those Patents that are Controlled by Moderna or any of its Affiliates as of the Effective Date or as to which Moderna or any of its Affiliates obtains Control during the Term that [***], including those set forth on Schedule 1.123 but excluding [***]. For the avoidance of doubt, Moderna Background Patents shall not include any Patents licensed to Moderna pursuant to a Moderna In-License unless and until such Moderna In-License becomes a Moderna Collaboration In-License pursuant to Section 7.

1.124. "Moderna Background Technology" means Moderna Background Know-How and Moderna Background Patents.

1.125. "Moderna Business Program" has the meaning set forth in Section 11.8(a).

1.126. "Moderna Collaboration In-License" has the meaning set forth in Section 7.4.

1.127. "Moderna Collaboration Know-How" means any and all Collaboration Know-How owned by Moderna or any of its Affiliates [***], including Moderna’s right and interest in any Joint Know-How.

1.128. "Moderna Collaboration Patents" means any and all Patents that claim or cover any of the Moderna Collaboration Know-How, including Moderna’s right and interest in any Joint Patents.

1.129. [***]

1.130. "Moderna Collaboration Technology" means the Moderna Collaboration Know-How and Moderna Collaboration Patents. For clarity, all Moderna Collaboration Technology will be “Controlled” by Moderna for the purpose of this Agreement.

1.131. "Moderna Collaboration Technology In-License" has the meaning set forth in Section 7.2.

1.132. [***].

1.133. [***]

1.134. [***].
1.135. [***]

1.136. [***]

1.137. “Moderna [***] In-License” means an agreement between Moderna (or its Affiliate) and a Third Party [***] pursuant to which a Third Party grants rights or licenses under Patents or Know-How that [***]. Each such agreement is set forth on Schedule 1.137. For clarity, no Moderna [***] In-License will be a Moderna Collaboration In-License until included as such pursuant to Section 7.

1.138. “Moderna [***] In-License” means an agreement between Moderna (or its Affiliate) and a Third Party in effect as of the Effective Date pursuant to which a Third Party grants rights or licenses under any [***]. Each such agreement is set forth on Schedule 1.138.

1.139. [***]

1.140. “Moderna [***] In-License” has the meaning set forth in Section 7.1(b).

1.141. [***]

1.142. “Moderna Indemnitees” has the meaning set forth in Section 14.5(a).

1.143. “Moderna In-License” means a Moderna [***] In-License, a Moderna [***] In-License or a Moderna [***] In-License.

1.144. “Moderna Internal Virology Program” means a program for the Development of mRNA Constructs and associated mRNA Products [***] in the [***]. All Moderna Internal Virology Programs in existence as of the Effective Date are set forth on Schedule 1.144.


1.146. “Moderna mRNA API” means [***].

1.147. “Moderna Patents” means the Moderna Background Patents and Moderna Collaboration Patents.

1.148. [***]

1.149. [***]

1.150. [***]

1.151. [***]

1.152. [***]

1.153. [***]
1.154. [***]
1.155. “Moderna Program Director” has the meaning set forth in Section 3.1.
1.156. [***]
1.158. “mRNA Construct” means [***].
1.159. [***]
1.160. “mRNA Product” means [***].
1.161. “mRNA Technology” means any Know-How and Patents directed or otherwise pertaining to [***].
1.162. “Net Sales” means the gross invoice price (not including [***]) of Product sold by a Selling Party to the first Third Party after deducting, if not previously deducted, from the amount invoiced or received:
   (a) [***]
   (b) [***]
   (c) [***]
   (d) [***]
   (e) [***]
   (f) [***]
   (g) [***]
   wherein the foregoing actual deductions incurred in (a) through (g) shall be determined in a manner [***]. [***] With respect to sales of Combination Products, Net Sales shall be calculated on a country-by-country basis as follows:
   [***] [***]
   [***] [***]
   [***] [***]
1.163. [***]
1.164. “New Program” has the meaning set forth in Section 11.8(b).

1.165. “Non-cGMP Construct Cap” has the meaning set forth in Section 4.1(b)(i).

1.166. “non-cGMP Order Form” has the meaning set forth in Section 4.1(a).

1.167. [***]

1.168. [***]

1.169. [***]

1.170. [***]

1.171. “Officials” has the meaning set forth in Section 2.16(e).

1.172. [***]

1.173. [***]

1.174. [***]

1.175. “Out-of-Pocket Costs” means costs and expenses paid [***] to Third Parties by [***], all in accordance with the budget set forth in the applicable R&D Plan, Post R&D Plan, [***].

1.176. “Parties” has the meaning set forth in Recitals.

1.177. “Party” has the meaning set forth in Recitals.

1.178. “Patent” means (a) a patent or a patent application, (b) any additions, priority applications, divisions, continuations, and continuations-in-part of any of the foregoing and (c) all patents issuing on any of the foregoing patent applications, together with all invention certificates, substitutions, reissues, reexaminations, registrations, supplementary protection certificates, confirmations, renewals and extensions of any of (a), (b) or (c), and foreign counterparts of any of the foregoing, but not including any rights that give rise to Regulatory Exclusivity Periods (other than supplementary protection certificates, which will be treated as “Patents” hereunder).

1.179. “Patent Costs” means the reasonable, documented, out-of-pocket costs and expenses paid to outside legal counsel, and filing and maintenance expenses, [***] in Prosecuting and Maintaining Patents.

1.180. “Payment” has the meaning set forth in Section 2.16(e).

1.181. “Person” means any individual, partnership, joint venture, limited liability company, corporation, firm, trust, association, unincorporated organization, governmental authority or agency, or any other entity not specifically listed herein.
1.182. “Phase I Clinical Study” means a human clinical study of a product, the principal purpose of which is a preliminary determination of safety in healthy individuals or patients, as described in 21 C.F.R. 312.21(a).

1.183. “Phase II Clinical Study” means a human clinical study of a product initiated to determine the safety and efficacy in the target patient population, as described 21 C.F.R. 312.21(b).

1.184. “Phase III Clinical Study” means a human clinical study of a product on a sufficient number of subjects that is designed to establish that such product is safe and efficacious for its intended use, and to determine warnings, precautions, and adverse reactions that are associated with such product in the dosage range to be prescribed, which trial is intended to support Regulatory Approval of such product, as described in 21 C.F.R. 312.21(c).

1.185. [***]

1.186. [***]

1.187. “Polypeptide” means [***].

1.188. “Post-R&D Period” means the period beginning on the expiration of the R&D Term and ending on the earlier to occur of (a) the date on which Merck has properly designated its fifth (5th) Elected Candidate hereunder, (b) if Merck elects to add the R&D Extension Term pursuant to Section 2.2(b), the seventh anniversary of the Effective Date, and (c) if Merck does not elect to add the R&D Extension Term pursuant to Section 2.2(b), the sixth anniversary of the Effective Date, as such period may be extended pursuant to Section 2.8(c).

1.189. “Post R&D Plan” has the meaning set forth in Section 2.14(b).

1.190. “Product” means a pharmaceutical or vaccine product comprised of [***], in all forms, presentations, formulations and dosage forms. For clarity, different forms, presentations, formulations and dosage forms of a given Product (regardless of whether for human beings and/or animals) shall be considered the same Product for the purposes of this Agreement.

1.191. “Product Candidate” means, with respect to Product Candidate Pool, [***].

1.192. “Product Candidate Notice” has the meaning set forth in Section 2.9(d).

1.193. “Product Candidate Pool” means, with respect to a Target Product Profile, all Collaboration mRNA Constructs that are [***].

1.194. “Program Directors” has the meaning set forth in Section 3.1.

1.195. [***].

1.196. “Prosecution and Maintenance” means, with regard to a particular Patent, the preparation, filing, prosecution and maintenance of such Patent, as well as re-examinations, reissues and the like with respect to that Patent, together with the conduct of interferences, the defense of oppositions and other similar proceedings with respect to that Patent.
1.197. “Providers” has the meaning set forth in Section 2.16(b).

1.198. [***]

1.199. “R&D Collaboration” means the activities undertaken by or on behalf of the Parties to Develop Collaboration mRNA Constructs (including [***]) and associated mRNA Products under the R&D Programs pursuant to the R&D Plans.

1.200. “R&D Extension Term” has the meaning set forth in Section 2.2(b).

1.201. “R&D [***] Target” means a [***] Target that is selected and included in an R&D Program in accordance with Section 2.3(b), and that is not a Discontinued Target.

1.202. “R&D Plan” has the meaning set forth in Section 2.4(a)(i).

1.203. “R&D Polypeptide” means, with respect to an R&D Program, [***].

1.204. “R&D Program” means each collaborative program of Development activities established in accordance with Sections 2.3(a) or 2.7, as applicable, and conducted by or on behalf of the Parties during the R&D Term in accordance with the terms and conditions of this Agreement, and that is not a Discontinued R&D Program.

1.205. “R&D Program Costs” means all Out-of-Pocket Costs and FTE Costs incurred by Moderna or Merck and their respective Affiliates after the Effective Date directly in connection with the performance of[***].

1.206. “R&D Program Pathogen” means a Collaboration Pathogen or that is the subject of an R&D Program.

1.207. “R&D Program Proposal” has the meaning set forth in Section 2.3(a).

1.208. “R&D Target” means a Merck Exclusive Target that is selected and included in an R&D Program in accordance with Section 2.3(b), and that is not a Discontinued Target.

1.209. “R&D Term” has the meaning set forth in Section 2.2(b).


1.211. “Registrational Study” means, with respect to a given product, any clinical study that is intended to be the basis for initial Regulatory Approval of such product.

1.212. “Regulatory Approval” means, with respect to a country or extra-national territory, any and all approvals (including BLAs), licenses, registrations or authorizations of any Regulatory Authority necessary in order to commercially distribute, sell or market a Product in such country or some or all of such extra-national territory, including any pricing or reimbursement approvals.
1.213. “Regulatory Authority” means any national (e.g., the FDA), supra-national (e.g., the EMA), regional, state or local regulatory agency, department, bureau, commission, council or other governmental entity, in any jurisdiction in the world, involved in the granting of Regulatory Approval or otherwise involved in regulating the Exploitation of a Product.

1.214. “Regulatory Exclusivity Period” means with respect to a Product in a country, the period of time during which Merck or any of its Sublicensees has been granted the exclusive legal right, other than Patent protection, by a Regulatory Authority (or is otherwise entitled to the exclusive legal right by operation of Law) in such country to market and sell the Product (e.g., pediatric exclusivity, or any applicable data exclusivity).

1.215. “Regulatory Filing” means any submission to a Regulatory Authority, including all applications, registrations, licenses, authorizations and approvals (including Regulatory Approvals), together with any related correspondence and documentation submitted to or received from Regulatory Authorities (including minutes and official contact reports relating to any communications with any Regulatory Authority) and all supporting documents and all clinical studies and tests, relating to a product and all data contained in any of the foregoing, including all INDs, Drug Approval Applications, regulatory drug lists, advertising and promotion documents, Clinical Data, adverse event files and complaint files, and include any submission to a regulatory advisory board, marketing authorization application, and any supplement or amendment thereto.

1.216. “Release” has the meaning set forth in Section 12.3(c).

1.217. “Replacement Notice” has the meaning set forth in Section 2.10(d)(i).

1.218. “Response Notice” has the meaning set forth in Section 2.3(d).

1.219. “Reviewing Party” has the meaning set forth in Section 12.3(c).

1.220. [***]

1.221. [***]

1.222. [***]

1.223. “Royalty Term” has the meaning set forth in Section 8.5(b).

1.224. “RSV” means human respiratory syncytial virus, [***].

1.225. “RSV Field” means the prevention, treatment, control, palliation or elimination of RSV infection.

1.226. “SEC” has the meaning set forth in Section 12.3(b).

1.227. “Selling Party” means Merck and its Sublicensees (including its Affiliates that have been granted sublicenses pursuant to Section 9.4), but not Distributors.

1.228. [***]
1.229. [***]
1.230. “Sublicensee” means any person or entity that is granted a sublicense as permitted by Section 9.4, either directly by Merck or indirectly by any other Sublicensee (including any Affiliate that is granted a sublicense hereunder but excluding, for clarity, any Distributors).
1.231. “Supply Agreement” means any supply agreement entered into by the Parties pursuant to Section 4.
1.232. “Supply Failure” has the meaning set forth in Exhibit A.
1.233. [***]
1.234. “Target” means [***].
1.235. [***]
1.236. “Target Product Profile” or “TPP” means, with respect to a given R&D Program, collectively, [***].
1.237. “Tax” and “Taxation” means any form of tax or taxation, levy, duty, charge or withholding (including any related fine, penalty, addition to tax, surcharge or interest) imposed by, or payable to, a governmental authority.
1.238. “Term” has the meaning set forth in Section 15.1.
1.239. “Terminated Rights” has the meaning set forth in Section 15.4.
1.240. “Termination Costs” has the meaning set forth in Section 2.15(d)(i).
1.241. “Territory” means all the countries and territories of the world.
1.242. “Therapeutic Product” means, [***].
1.244. “Third Party Acquiror” has the meaning set forth in Section 11.8(b).
1.245. “Third Party Claims” has the meaning set forth in Section 14.5(a).
1.246. “Third Party Exclusive Target” means a Target regarding which Moderna or its Affiliates has, as of the Effective Date ([***]), granted to a Third Party [***] for such Target, which license would preclude Moderna from granting licenses or other rights to Merck to Develop or Commercialize [***] for such Target hereunder.
1.247. “TPP Notice” has the meaning set forth in Section 2.9(b).
1.248. “United States” or “U.S.” means the United States of America, including its territories and possessions, the District of Columbia and Puerto Rico.

1.249. “Upfront Payment” has the meaning set forth in Section 8.1.

1.250. “Vaccine Product” means [***].

1.251. “Valid Claim” means [***].

1.252. [***]

1.253. “Violation” means that Moderna or any of its officers or directors or any other Moderna personnel (or other permitted agents of Moderna performing activities hereunder) has been: (1) convicted of any of the felonies identified among the exclusion authorities listed on the U.S. Department of Health and Human Services, Office of Inspector General (OIG) website, including 42 U.S.C. 1320a-7(a) (http://oig.hhs.gov/exclusions/authorities.asp); (2) identified in the OIG List of Excluded Individuals/Entities (LEIE) database (http://exclusions.oig.hhs.gov/) or listed as having an active exclusion in the System for Award Management (http://www.sam.gov); or (3) listed by any US Federal agency as being suspended, debarred, or otherwise ineligible to participate in Federal procurement or non-procurement programs, including under 21 U.S.C. 335a (http://www.fda.gov/ora/compliance_ref/debar/) (each of (1), (2) and (3) collectively the “Exclusions Lists”).

2. R&D Collaboration.

2.1. General. Subject to and in accordance with the terms of this Agreement, during the R&D Term the Parties will [***] undertake Development activities as set forth in R&D Plans with the goal of identifying and Developing Collaboration mRNA Constructs and Product Candidates directed to R&D Program Pathogens, [***] the “R&D Programs”) and (c) [***]. Following the expiration of the R&D Term there will be a Post-R&D Period during which Merck may define up to five (5) Target Product Profiles for which Merck may Develop [***] Product Candidates incorporating Collaboration mRNA Constructs from the Product Candidate Pool for such Target Product Profiles. Prior to the expiration of the Collaboration Term, Merck may designate up to five (5) Elected Candidates for which Merck will continue Development, [***] and Commercialization activities. All of the foregoing shall be subject to and in accordance with the terms of this Agreement.

2.2. R&D Term.

(a) Duration. Unless (i) terminated pursuant to Section 15 hereof, (ii) extended by Merck as set forth in Section 2.2(b), or (iii) extended on an R&D Program-by-R&D Program basis pursuant to Section 2.8(c), the term of the R&D Collaboration will commence on the Effective Date and continue for a period of three (3) years (the “Initial R&D Term”).

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(b) *Extension Right.* If, upon expiration of the Initial R&D Term, Merck (a) has not designated its fifth (5th) Elected Candidate in accordance with Section 2.10 and [***], Merck may, at its written election, extend the R&D Collaboration for [***] that will begin upon the expiration of the Initial R&D Term and end on the earlier to occur of (i) the fourth anniversary of the Effective Date and (ii) the date on which Merck designates its fifth (5th) Elected Candidate hereunder (the “R&D Extension Term”, and together with the Initial R&D Term, the “R&D Term”). Merck may exercise such right by providing written notice to Moderna at [***] prior to the expiration of the Initial R&D Term and, subject to [***], the R&D Extension Term will automatically go into effect. Absent further agreement of the Parties but subject to Section 2.8(c) for an applicable R&D Program, the maximum duration of the R&D Term is four (4) years, and all R&D Programs will terminate upon expiration of the R&D Term.

(c) *Discontinuance of a given R&D Program by Merck.* Merck shall have the right, in its discretion, to discontinue a given R&D Program upon [***] prior written notice to Moderna. Upon the effective date of any such discontinuance, such R&D Program will become a Discontinued Program. For clarity, any such notice shall not be applicable to any other R&D Programs or otherwise affect the R&D Term.

### 2.3. R&D Program Initiation

(a) *R&D Program Proposals.* Subject to the remainder of this Section 2.3, at any time during the R&D Term, Merck may propose new R&D Programs by providing Moderna with written notice identifying for each such proposed new R&D Program, (i) the proposed R&D Program Pathogen, the proposed R&D Targets (and, if applicable, [***]), and (ii) if Merck is nominating a new R&D Program to replace an existing R&D Program, the proposed R&D Targets (and, if applicable, [***]), and (ii) if Merck is nominating a new R&D Program to replace an existing R&D Program, the proposed R&D Program that is being replaced (each such notice, an “R&D Program Proposal”), provided that the number of concurrent R&D Programs in effect during the R&D Term may not exceed [***]. If an R&D Program Proposal submitted by Merck satisfies the requirements of this Section 2.3(a), Section 2.3(b) and Section 2.3(c), the proposed R&D Program will become an R&D Program hereunder. Any R&D Program that is being replaced by a new R&D Program will be a Discontinued Program hereunder.

(b) *Inclusion of R&D Targets.* Merck may nominate and include any Merck Exclusive Target as an R&D Target in any R&D Program Proposal. Furthermore, during the R&D Term, Merck at its sole discretion may add or remove any Merck Exclusive Target as an R&D Target of an established R&D Program by providing written notice to Moderna.

(c) *Inclusion of R&D [***] Targets.*

(i) Subject to the remainder of this Section 2.3(c), Merck may nominate and include any [***] Target as an R&D [***] Target in any R&D Program Proposal, provided that [***].

(ii) [***]

(iii) Notwithstanding any other provision of this Agreement to the contrary:

A. [***]
(iv) Subject to the terms and conditions of this Agreement, during the R&D Term, Merck may add or remove any [***] Target as an R&D [***] Target of an established R&D Program by providing written notice to Moderna; provided that if Merck desires to add a [***] Target, the foregoing provisions of this Section 2.3(c) shall apply.

(v) At least [***] during the R&D Term, the JSC will review Merck’s Development efforts with respect to R&D [***] Targets against available data and anticipated experimental plans of such R&D Programs and [***]. Merck agrees that it will make available to Moderna, in advance of each such review by the JSC, a copy of the relevant data and results generated from the applicable R&D Program that would be useful for the JSC’s review (which will be Confidential Information of Merck).

(d) R&D Program Proposal Review and Addition of R&D [***] Target. Within [***] of Moderna’s receipt of an R&D Program Proposal issued in accordance with Section 2.3(a), or a proposal to add a new R&D Target or R&D [***] Target to an R&D Program in accordance with Section 2.3(b) or 2.3(c), as applicable, Moderna will provide Merck with written notice (each such notice, a “Response Notice”) indicating whether or not the R&D Program Proposal and the proposed R&D Program satisfy the requirements of Sections 2.3(a), 2.3(b) and 2.3(c). If Moderna notifies Merck in a Response Notice that the R&D Program Proposal and the proposed R&D Program described therein (or the addition of new Targets, as applicable) satisfy the requirements of Sections 2.3(a), 2.3(b) and 2.3(c), as applicable, or Moderna fails to provide a Response Notice to Merck within such [***] period, such proposed R&D Program or proposed additional Targets, as applicable, will be included as an R&D Program.

(c) Non-Conforming Proposals. If Moderna issues a Response Notice stating that the R&D Program Proposal or the proposed R&D Program (or additional Targets, as applicable) described therein does not satisfy the requirements of Sections 2.3(a), 2.3(b) and 2.3(c), then Moderna will include in such Response Notice the specific provision of 2.3(a), 2.3(b) or 2.3(c) that such R&D Program Proposal, proposed R&D Program or proposed additional Target, as applicable, failed to satisfy. If Merck in good faith disputes any assertion by Moderna in a Response Notice, Merck may deliver written notice of such dispute to Moderna within [***] of Merck’s receipt of the applicable Response Notice, in which case the dispute will be resolved in accordance with the dispute resolution procedure set forth in [***].

(f) Confirmation. Once a R&D Program Proposal and the proposed R&D Program (or additional Targets, as applicable) are confirmed to comply with the requirements of this Agreement pursuant to Sections 2.3(d) or 2.3(e) or pursuant to the dispute resolution procedure set forth in [***], as applicable, (i) such proposed R&D Program will become an R&D Program, (ii) the proposed R&D Program Pathogens will become the R&D Program Pathogens for such R&D Program, and (iii) the proposed R&D Targets and proposed R&D [***] Targets will become the R&D Targets and R&D [***] Targets for such R&D Program, as applicable.
(g) **JSC List.** The JSC will maintain a current list of all R&D Program Pathogens, R&D Targets and R&D [***] Targets included in each R&D Program.

2.4. **R&D Plans.**

(a) **R&D Plan Preparation.**

(i) Collaboration Activities of the Parties with respect to each R&D Program, but excluding [***] will be described in separate written Development plans (each, an “R&D Plan”). Within [***] of the establishment of a new R&D Program in accordance with Section 2.3, Merck shall prepare an R&D Plan for such R&D Program, which R&D Plan shall set forth: [***], provided that the Parties acknowledge and agree that, [***].

(ii) Merck shall provide the proposed R&D Plan to Moderna for review and comment by Moderna, which comments shall be provided within [***] of receipt. To the extent Merck agrees with such comments, Merck shall update the proposed R&D Plan accordingly. Notwithstanding the foregoing, if Moderna, in good faith provides comments to Merck within such [***]-period reflecting Moderna’s reasonable belief that [***].

(b) **Contents.** The purpose of each R&D Plan is to set forth [***].

(c) **Responsibilities.** The Parties acknowledge and agree that (i) it is their expectation that each R&D Plan will provide that Merck will be primarily responsible for preclinical Development activities (excepting those preclinical Development activities that are specified in an R&D Plan as being Moderna’s responsibility), (ii) Moderna, subject to Section 2.5 and Section 4 and Exhibit A, will be responsible for designing Collaboration mRNA Constructs and Manufacturing all Moderna mRNA API for use under any R&D Program during the R&D Term, [***], and (iii) unless otherwise agreed to by the Parties pursuant to Section 4, Merck shall be responsible for Manufacturing Drug Product utilizing Moderna mRNA API supplied by or on behalf of Moderna for use under any R&D Program during the R&D Term.

(d) **Updates.** Each of Merck and Moderna will have the right to propose modifications or amendments to a given R&D Plan, provided that, subject to Section 2.7, any modifications or amendments to any R&D Plan that are proposed by either Party will be subject to review and approval by the JSC pursuant to and in accordance with the terms of Section 3.2(c).

2.5. **Moderna Design Activities.** For each R&D Program, Moderna shall design [***] Collaboration mRNA Constructs [***], and such Collaboration mRNA Constructs will be Manufactured and supplied by or on behalf of Moderna in accordance with Section 4.1 for use in the applicable R&D Program. For purposes of this Agreement, the design activities included in the Customary Design/Manufacturing Activities, shall be deemed to be performed under the R&D Plan (and R&D Program) and shall be subject to the same terms and conditions hereunder (other than cost reimbursement) as are applicable to the performance of activities under an R&D Plan (and R&D Program), mutatis mutandis. [***]

2.6. [***]

2.7. [***]
2.8. Program Performance.

(a) Generally. Each Party will use Commercially Reasonable Efforts to perform (itself or through its Affiliates or by permitted subcontracting hereunder) its respective obligations under each R&D Program, and will cooperate with and provide reasonable support to the other Party in such other Party’s performance of its responsibilities under such Program. Each Party will keep the other Party reasonably informed of such Party’s Development activities under each R&D Program and will reasonably consult with such other Party and reasonably consider such other Party’s comments and advice with respect to all material decisions relating to such activities. The Parties acknowledge and agree that no outcome or success is or can be assured and that failure to achieve desired results will not in and of itself constitute a breach or default of any obligation in this Agreement (notwithstanding the focus of the R&D Programs described above).

(b) FTEs. Moderna will support the Development and other activities to be undertaken by Moderna hereunder as set forth in each R&D Plan, with FTEs selected by Moderna to perform such activities, provided such FTEs will [***]. Moderna’s obligation to provide FTEs across all R&D Programs (excluding the [***]) at any one time shall not exceed [***] without Moderna’s prior written consent. For clarity, Moderna shall also be required to provide, at its own cost, sufficient FTEs to perform the [***].

(c) [***]

2.9. Target Product Profile; Product Candidate Designation.

(a) Target Product Profile. During the Post R&D Period, Collaboration Activities will be directed to the Development of Collaboration mRNA Constructs against specified Target Product Profiles, in each case as determined [***].

(b) [***]

(c) Product Candidate Pool Determination. Prior to issuing any TPP Notice, Merck will review the most current data and results generated from performance of the applicable R&D Program and will make a good faith determination, based on such data and results, as to which Collaboration mRNA Constructs from such R&D Program should be included in the Product Candidate Pool [***].

(d) [***]

(e) [***]

(f) Discontinuance of a given TPP by Merck. Merck shall have the right, in its discretion, to discontinue a given TPP upon [***] prior written notice to Moderna. Upon the effective date of any such discontinuance, such TPP shall no longer exist and all [***] under such discontinued TPP [***] will become Discontinued Targets and all Collaboration mRNA Constructs in the Product Candidate Pool for such TPP will become Discontinued mRNA Constructs (to the extent such mRNA Constructs are not within another Product Candidate Pool). For clarity, any such notice shall not be applicable to any other TPP.

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2.10. Elected Candidate Designation.

(a) Elected Candidate Notice. Prior to the expiration of the Collaboration Term, Merck may designate a Product Candidate as an “Elected Candidate” hereunder by providing Moderna with written notice of the same (an “Elected Candidate Notice”); provided that Merck may make no more than five (5) such designations, in the aggregate, hereunder (the “Elected Candidate Cap”). Upon Moderna’s receipt of the Elected Candidate Notice, such designated Product Candidate will be an Elected Candidate. For the avoidance of doubt, a separate Elected Candidate Notice is required for each of the five (5) possible designations of Elected Candidates, and following the designation of the fifth (5th) Elected Candidate, Merck shall no longer have the right to designate any additional Elected Candidates hereunder.

(b) Target Product Profile Update. Within [***] of the designation of an Elected Candidate, Merck shall update, if required, the Target Product Profile from which such Elected Candidate was selected by providing written notice to Moderna of [***].

(c) Designation of Patents. At the time an Elected Candidate is selected, the Parties shall mutually agree upon which [***] claim or cover such Elected Candidate; provided that if the Parties are not able to agree upon which category of Patents a particular patent falls into, such disagreement shall be resolved in accordance with the dispute resolution procedure set forth in [***].

(d) Replacement of Elected Candidates.

(i) Elected Candidate Replacement Notice. Subject to Section 2.10(d)(ii), on an Elected Candidate-by-Elected Candidate basis, Merck may elect at any time prior to the earlier to occur of [***], to replace such Elected Candidate with a back-up Elected Candidate (a “Back-Up Elected Candidate”) by providing Moderna with written notice of same (a “Replacement Notice”).

(ii) Back-Up Elected Candidate. Each Back-Up Elected Candidate identified in a Replacement Notice (i) may be comprised of [***], and (ii) must have [***]. For the avoidance of doubt, [***].

(iii) Moderna Support. Following Merck’s issuance of a Replacement Notice, Merck may request Moderna’s reasonable support to initiate the Manufacturing of the Backup Elected Candidate, such support from Moderna not to be unreasonably conditioned or withheld. Any such support will be conducted consistent with the terms of this Agreement and any applicable Supply Agreement, and Merck will pay for any reasonable expenses incurred by Moderna in providing such support.

(iv) Results of Elected Candidate Replacement. Upon any replacement of an Elected Candidate pursuant to this Section 2.10(d), (A) the Back-Up Elected Candidate that replaced such Elected Candidate shall be deemed to be the same Elected Candidate as the Elected Candidate that is being replaced for the purposes of (1) Merck’s Milestone Payment obligations hereunder, and (2) the Elected Candidate Cap and (B) such Elected Candidate that was replaced shall no longer be the Elected Candidate from such TPP and the Collaboration mRNA Constructs in such replaced Elected Candidate remain part of the Product Candidate Pool.
(v) Target Product Profile Update. Within [***] of the designation of a Back-Up Elected Candidate, Merck shall update, if required, the Target Product Profile from which such Back-Up Elected Candidate was selected by providing written notice to Moderna of [***].

(vi) Designation of Patents. At the time a Back-Up Elected Candidate is selected, the Parties shall mutually agree upon which [***] claim or cover such Back-Up Elected Candidate; provided that if the Parties are not able to agree upon which category of Patents a particular patent falls into, such disagreement shall be resolved in accordance with the dispute resolution procedure set forth in [***].

2.11. [***].

(a) [***]/

(b) [***]/

(c) [***]

(d) Merck [***].

(e) [***]/[***]

2.12. Subcontracting. Each Party may subcontract any of its activities to be performed under this Agreement to an Affiliate or Third Party, provided that any such Third Party will have entered into a written agreement with such Party that includes terms and conditions protecting and limiting use and disclosure of Confidential Information and Know-How at least to the same extent as under this Agreement, and such Party shall require such Affiliate or Third Party and its personnel to assign to such Party all right, title and interest in and to any Patents or Know-How created, conceived or discovered in connection with the performance of subcontracted activities. [***]. Each Party shall oversee the performance by any of its Affiliate or Third Party subcontractors, and shall remain responsible and primarily liable for the performance of such activities in accordance with this Agreement. Each Party hereby expressly waives any requirement that the other Party exhaust any right, power or remedy, or proceed against any subcontractor for any obligation or performance hereunder, prior to proceeding directly against the Party engaging the subcontractor.


(a) Records. Each Party will maintain, or cause to be maintained, records of its activities under the R&D Programs [***] in sufficient detail and in good scientific manner appropriate for scientific, Patent and regulatory purposes, that will properly reflect all work performed therein, for a period consistent with such Party’s record retention policies, but in no event less than required by applicable Laws. Each Party will have the right to reasonably request a copy of any such records upon providing reasonable rationale for needing such records.
(b) **Collaboration Reports.** Each Party will furnish to the JSC a summary written report within [***] after each [***] and [***] occurring during the R&D Term, describing its progress under the R&D Plans and [***] as part of the Collaboration Activities during the previous [***] period. Each Party agrees that it will promptly respond to the other Party’s reasonable questions regarding any of such Party’s reports.

(c) **Materials.** Each Party will use any Materials provided by the other Party hereunder only in accordance with the R&D Plans and otherwise in accordance with the terms and conditions of this Agreement (including [***]) and any reasonable instructions provided by the Party furnishing the Materials. Except with the prior written consent of the supplying Party [***], the Party receiving any Materials will not distribute or otherwise allow the release of such Materials to any Third Party, except for [***]. All Materials delivered to the receiving Party, other than [***], will remain the sole property of the supplying Party and will be used in compliance with all applicable Law. The Materials supplied under this Agreement will be used with prudence and appropriate caution in any experimental work because not all of their characteristics may be known.

2.14. **Post-R&D Period.**

(a) **Generally.** The purpose of the Post-R&D Period is to provide Merck with an opportunity to, at its election, further Develop Product Candidates. Subject to Section 2.14(b) and any obligation of Moderna to supply Merck with Moderna mRNA API, Merck will be solely responsible for all Development activities during the Post-R&D Period.

(b) **Moderna Activities.** If during the Post-R&D Period, Merck reasonably requests that Moderna perform additional activities (excluding [***]) in support of Merck’s Development of Product Candidates, Elected Candidates or Products during the Post-R&D Period, the Parties will negotiate in good faith the terms and conditions of this Agreement shall apply to any such activities, [***] (each, a “Post R&D Plan”), and in connection therewith, the provisions of Sections 2.4(a)(ii) and 2.4(b) shall apply, mutatis mutandis. Upon finalization of such Post R&D Plan, Moderna will use Commercially Reasonable Efforts to perform (itself or through its Affiliates or by permitted subcontracting pursuant to Section 2.12) such activities in accordance with the terms and conditions of this Agreement as if such Post R&D Plan were an R&D Plan hereunder, mutatis mutandis.

(c) **Non-cGMP mRNA Construct Supply.** In addition to Section 4, Exhibit A and any Supply Agreement, during the Post-R&D Period Merck may request, and Moderna will supply, reasonable quantities of Collaboration mRNA Constructs for Merck to conduct such assays and Development as necessary to identify and nominate new Product Candidates, provided that the Parties acknowledge and agree that Merck may only request Collaboration mRNA Constructs that were included in a Product Candidate Pool established pursuant to Section 2.9.

(d) [***]

   (i) [***]

   (ii) [***]
2.15. Termination of Collaboration Activities.

(a) **Collaboration Activity Termination.** Each Party will perform its respective activities for a given R&D Program as set forth in the R&D Plan for such R&D Program until the earlier to occur of [***]. Subject to Moderna’s obligation to supply Merck with Moderna mRNA API and/or Drug Product as set forth in Section 4, all Development work performed hereunder by Moderna will terminate upon the expiration of the R&D Term, unless Moderna will perform Development activities to support Merck’s Development of Product Candidates during the Post-R&D Period pursuant to Section 2.14(b).

(b) **R&D Program Termination.** At the expiration of the R&D Term, (i) all R&D Programs will become “Discontinued Programs” (ii) all R&D Targets and R&D [***] Targets that are not Locked Targets will become Discontinued Targets and (iii) all Collaboration mRNA Constructs that are not in a Product Candidate Pool will become Discontinued mRNA Constructs. For the avoidance of doubt, upon the expiration of the R&D Term, [***].

(c) [***] of Effective Date. Upon the [***] of the Effective Date [***] For the avoidance of doubt, upon the [***] of the Effective Date, [***]. [***]

(d) **Discontinued Items.**

(i) In the event an R&D Program is discontinued or replaced by Merck pursuant to Section 2.2(c) or 2.3(a), as applicable and becomes a Discontinued Program, the rights and obligations of the Parties under the applicable R&D Work Plan shall terminate, and the Out-of-Pocket Costs incurred by Moderna and its Affiliates with respect to such R&D Program will be deemed to include amounts payable for non-cancellable commitments made to Third Parties in order to [***] (the “Termination Costs”).

(ii) The licenses and other rights granted to Merck hereunder will not apply with respect to any Discontinued Program, Discontinued Target or Discontinued mRNA Construct.

(iii) Subject to Section 11, Merck hereby grants to Moderna a non-exclusive, royalty free and fully paid-up, [***], sublicenseable (through multiple tiers), worldwide license under the Merck Collaboration Technology owned by Merck or its Affiliate relating to any Discontinued mRNA Construct to Exploit such Discontinued mRNA Constructs and mRNA Products incorporating such Discontinued mRNA Constructs in any field (other than within the TPP of any Elected Candidate or Product), provided that [***].

2.16. Compliance.

(a) **General.** Moderna shall conduct the R&D Programs and other activities hereunder in compliance with all applicable Laws. Moderna shall notify Merck in writing of any deviations from applicable Laws. In addition, Moderna hereby certifies that it has not employed or otherwise used in any capacity and will not employ or otherwise use in any capacity, the services of any person debarred under United States law, including Section 21 USC 335a, or any foreign equivalent thereof, in performing any portion of an R&D Program and other activities hereunder. Moderna shall notify Merck in writing immediately if any such debarment occurs or comes to its
attention, and shall, with respect to any person or entity so debarred promptly remove such person or entity from performing any R&D Program activities and other activities hereunder, function or capacity related thereto. Without limiting the foregoing, if animals are used in Development hereunder, Moderna will comply with the Animal Welfare Act and any other applicable Laws relating to the care and use of laboratory animals. Merck encourages Moderna to use the highest standards, such as those set forth in the Guide for the Care and Use of Laboratory Animals (NRC, 1996), for the humane handling, care and treatment of such research animals. Any animals which are used in the course of an R&D Program or other activities hereunder, or products derived from those animals, such as eggs or milk, will not be used for food purposes, nor will these animals be used for commercial breeding purposes.

(b) Use of Human Materials. Without limiting the provisions of Section 2.16(a), if any human cell lines, tissue, human clinical isolates or similar human-derived materials ("Human Materials") are to be collected and/or used in an R&D Program or other activity hereunder, Moderna represents and warrants (i) that it shall comply with all applicable Laws relating to the collection and/or use of the Human Materials and (ii) that it has obtained or shall obtain, all necessary approvals and appropriate informed consents, in writing, for the collection and/or use of such Human Materials. Moderna shall provide documentation of such approvals and consents upon Merck’s request. Moderna further represents and warrants that such Human Materials may be used as contemplated in this Agreement without any obligations to the individuals or entities ("Providers") who contributed the Human Materials, including any obligations of compensation to such Providers or any other Third Party for the intellectual property associated with, or commercial use of, the Human Materials for any purpose.

(c) Compliance with Corporate Policy. Moderna acknowledges that Merck’s corporate policies require that business must be conducted within the letter and spirit of the law. By signing this Agreement, Moderna agrees to conduct the activities contemplated herein in a manner which is consistent with both law and good business ethics.

(d) Business Partner Code of Conduct. Merck endeavors to hold itself and its business partners to the highest performance, ethical and compliance standards, including basic human rights, encouraging fair and equal treatment for all persons, the provision of safe and healthy working conditions, respect for the environment, the adoption of appropriate management systems and the conduct of business in an ethical manner. In performing its duties under this Agreement, Moderna acknowledges the value and importance of performance and ethical behavior in its performance under this Agreement. Without limiting any of Moderna’s other obligations hereunder, Merck expects that Moderna will abide by the letter and spirit of Merck’s Supplier Performance Expectations and Business Partner Code of Conduct (the “Code”), a copy of which is available at http://www.merck.com/about/how-we-operate/code-of-conduct/values.html, in its performance of this Agreement. Moderna is also expected to follow the Pharmaceutical Supply Chain Initiative (PSCI) principles, a copy of which is available at http://www.pharmaceuticalsupplychain.org/.

(e) Governments and International Public Organizations. Without limitation of the foregoing, Moderna warrants that none of its employees, agents, officers or other members of its management are officials, officers, agents, representatives of any government or international public organization. Moderna agrees that it shall not make any payment, either directly or
indirectly, of money or other assets, including to the compensation derived from this Agreement (hereinafter collectively referred as a “Payment”), to
government or political party officials, officials of international public organizations, candidates for public office, or representatives of other businesses or
persons acting on behalf of any of the foregoing (hereinafter collectively referred as “Officials”) where such Payment would constitute a violation of any Law.
In addition, regardless of legality, Moderna shall make no Payment either directly or indirectly to Officials if such Payment is for the purpose of influencing
decisions or actions with respect to the subject matter of this Agreement or any other aspect of Merck’s businesses.

(f) No Authority. Moderna acknowledges that no employee of Merck or its Affiliates shall have authority to give any direction, either written or oral,
relating to the making of any commitment by Moderna or its agents to any Third Party in violation of terms of this or any other provisions of this Agreement.

(g) Exclusions Lists. Moderna certifies to Merck that as of the Effective Date Moderna has screened itself, and its officers and directors, against the
Exclusions Lists and that it has informed Merck whether Moderna, or any of its officers or directors has been in Violation. After the execution of this
Agreement, Moderna shall notify Merck in writing immediately if any Violation occurs or comes to its attention, and shall, with respect to any person or
entity in Violation, promptly remove such person or entity from performing any R&D Program activities or and other activities hereunder, function or
capacity related thereto.

3. Governance.

3.1. Collaboration Management. Promptly after the Effective Date, each Party will appoint a person who will oversee day-to-day contact between the
Parties for all matters related to the management of the Collaboration Activities in between meetings of the JSC and will have such other responsibilities as
the Parties may agree in writing after the Effective Date. One person will be designated by Merck (the “Merck Program Director”) and one person will be
designated by Moderna (the “Moderna Program Director,”) together will be the “Program Directors”. Each Party may replace its Program Director at any time
by notice in writing to the other Party. Any Program Director may designate a substitute to temporarily perform the functions of that Program Director by
written notice to the other Party. The initial Program Directors will be:

For Moderna: [***]
For Merck: [***]

3.2. Joint Steering Committee.

(a) Formation and Membership. As soon as practicable (but not later than sixty (60) days) following the Effective Date, the Parties will establish a joint
steering committee (the “JSC”), comprised of [***] representatives of Moderna (or its Affiliate) and [***] representatives of Merck (or its Affiliate). Each JSC
member will be a senior development leader or have similar experience and expertise as a senior development leader. Each Party may replace its
representatives on the JSC at any time upon written notice to the other Party. With the consent of the other Party (such consent not to be unreasonably
withheld, delayed or conditioned), each Party may invite non-voting employees and consultants to attend meetings of the JSC, subject to their agreement to
be bound to the same extent as a permitted subcontractor under Section 2.12.

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(b) **Meetings.** While in existence, the JSC will meet (or more frequently as may be determined by the JSC) and may hold meetings in person or by audio or video conference as determined by the JSC, but at a minimum, of such meetings each Calendar Year starting in 2015 will be in person (which in-person meeting will be held at one of Moderna’s U.S. facilities, and the other held at Merck’s U.S. facilities). Meetings of the JSC will be effective only if at least of such meetings each Calendar Year starting in 2015 will be in person (which in-person meeting will be held at one of Moderna’s U.S. facilities, and the other held at Merck’s U.S. facilities). Meetings of the JSC will be effective only if at least representative of each Party is present or participating. Each Party will be responsible for all of its own expenses of participating in the meetings. The Parties will endeavor to schedule meetings of the JSC at least in advance. The JSC will determine the JSC operating procedures, which shall in all cases be consistent with the terms of this Agreement, and will codify these operating procedures in the written minutes of the first meeting (or subsequent meetings as such procedures are updated). The JSC will prepare and circulate a meeting agenda prior to each such meeting. The Parties will alternate in preparing written minutes of such meeting, and the preparing Party will circulate such minutes within after such meeting. The Parties will agree on the minutes of each meeting promptly, but in no event later than the next meeting of the JSC. Each Party will designate one of its representatives who is empowered by such Party to make decisions regarding issues within the purview of the JSC as set forth below in Section 3.2(c) to act as the co-chair of each JSC. The co-chairs will be responsible for overseeing the activities of its JSC members consistent with the responsibilities set forth in Section 3.2(c).

(c) **Responsibilities.** The JSC will oversee the Collaboration Activities and the performance of the R&D Plans. The JSC may form project teams to deal with the day-to-day work to execute the R&D Plans. Without limiting the generality of the foregoing, within such scope, the JSC will have the following responsibilities:

(i) Review each Party’s performance of Collaboration Activities;

(ii) Review and approve (other than the any proposed modifications or amendments to any R&D Plan;

(iii) Prioritize and oversee execution of specific activities to be performed under the R&D Plans;

(iv) Review data, reports or other information submitted by either Party with respect to Development activities performed under R&D Plans;

(v) Form such other committees or project teams as the JSC may deem appropriate (including any project teams to deal with the day-to-day work to execute any R&D Plan) and oversee the work of any committees or project teams formed by the JSC, including by receiving and reviewing reports and other information submitted by those joint committees and project teams (if applicable); provided, that any such committee or project team may make recommendations to the JSC but may not be delegated JSC decision-making authority;

(vi) Review proposed publications regarding the results of the R&D Programs proposed to be published in accordance with Section 12.2;
(vii) Review Third Party technology identified by Modena that could have reasonable utility for the Collaboration Activities; and

(viii) Attempt to resolve any disputes relating to this Agreement on an informal basis.

(d) Decision-making. The [***] JSC representatives of each Party will collectively have one (1) vote. The JSC members will use diligent efforts to reach agreement on all matters. If, despite such efforts, agreement on a particular matter cannot be reached by the JSC within [***] days after the JSC first considers such matter (or such shorter time as may be reasonable in the circumstances), then [***].

(e) Resolution of Certain Matters. Notwithstanding the provisions of Section 3.2(d) in the event of a dispute or disagreement arising in, or referred to, the JSC relating to [***] that cannot be resolved by the members of the JSC, upon the written request of a Party, such matter will be referred to the Executive Officers (or their designees, which designee is required to have decision-making authority on behalf of such Party), who will attempt in good faith to resolve such dispute by negotiation and consultation for a [***] period following receipt of such written notice. If, despite such efforts, agreement on a particular matter cannot be reached by the Executive Officers within such [***] period, then [***].

(f) Limits on JSC Authority. Each Party will retain the rights, powers and discretion granted to it under this Agreement and no such rights, powers, or discretion will be delegated to or vested in the JSC unless such delegation or vesting of rights is expressly provided for in this Agreement or the Parties expressly so agree in writing. The JSC will not have the power [***]. Any dispute between the Parties regarding the issues set forth in this Section 3.2(f) will be resolved pursuant to the procedures set forth in [***].

(g) JSC Term. The JSC will cease to exist [***] after the end of the R&D Term, provided that during the Post R&D Period, the JSC shall be maintained to oversee any ongoing activities but it shall meet on ad hoc basis to govern activities as specified in Section 2.14.

4. Moderna mRNA API and Drug Product Supply

4.1. Non-cGMP Supply. The following provisions of this Section 4.1 shall apply with respect to Manufacture of non-cGMP Moderna API:

(a) Manufacture by Moderna. Moderna will Manufacture (or have Manufactured) and supply to Merck, and Merck will purchase exclusively from Moderna, [***], quantities of non-cGMP Moderna mRNA API as Merck may reasonably require in connection with the performance of its Collaboration Activities. Such supply shall be in accordance with the terms of this Section 4.1 and the terms with respect to non-cGMP Moderna API or supply hereunder set forth in Exhibit A, including the pricing terms set forth therein. Merck shall issue purchase orders in substantially the form set forth on Schedule 1 to Exhibit A to Moderna for the purchase of non-cGMP Moderna mRNA API (the “non-cGMP Order Form”). [***]

(b) mRNA Construct Cap. During the R&D Term or Post R&D Period, as applicable, the aggregate number of different non-cGMP mRNA Constructs being Manufactured [***] by Moderna under this Agreement may not exceed the Non-cGMP Construct Cap without Moderna’s prior written consent. [***]

For the purposes of the foregoing:
(i) During the R&D Term, the non-cGMP Construct Cap shall be [***] (“the “Non-cGMP Construct Cap”) [***];
(ii) During the Post-R&D Period [***], the non-cGMP Construct Cap shall be [***];
(iii) During the Post-R&D Period [***], the Non-cGMP Construct Cap shall be [***].

4.2. cGMP Moderna mRNA API Supply for Early Clinical Studies. The Parties shall negotiate and execute a clinical supply agreement and quality agreement containing the provisions set forth in Exhibit A, and such other terms and conditions that are customary for agreements of this type as the Parties mutually agree (the “Clinical Supply Agreement”). Such Clinical Supply Agreement and quality agreement shall be entered into no later than [***] after the Effective Date (or such longer period of time as the Parties may agree), but in any event prior to the commencement of any activities relating to such supply, and the Parties will enter into specific statements of work for each Product Candidate and Elected Candidate, as additional Product Candidates and Elected Candidates are identified under this Agreement. Without limiting the Clinical Supply Agreement, the following provisions of this Section 4.2 shall apply with respect to Manufacture of cGMP Moderna mRNA API on a Product Candidate-by-Product Candidate or Elected Candidate-by-Elected Candidate basis to be supplied by Moderna under the Clinical Supply Agreement for the period commencing [***]:

(a) Manufacture by Moderna.

(i) Moderna will Manufacture (or have Manufactured) and supply to Merck, and Merck will purchase exclusively from Moderna, quantities of cGMP Moderna mRNA API (on a Product Candidate-by-Product Candidate or Elected Candidate-by-Elected Candidate basis) as Merck may reasonably require; provided that, [***]. Notwithstanding the foregoing described exclusivity, from and after the initiation of a Registrational Study with respect to a given Product Candidate or Elected Candidate, Merck and/or its Third Party Manufacturer can Manufacture, and Merck may purchase, cGMP Moderna mRNA API for each such Product Candidate or Elected Candidate, in accordance with Section 4.3; provided, that, [***].

(ii) In connection with [***], at the reasonable request of Moderna, Merck may, at Merck’s discretion and to the extent determined by Merck, consult with Moderna regarding [***]. Further, Moderna’s [***].

(iii) In the event that Moderna [***], then such supply activities shall be in accordance with the Clinical Supply Agreement. Within [***] after Merck notifies Moderna of Merck’s reasonably anticipated needs for supplies of cGMP Moderna mRNA API [***], Moderna will [***]

(iv) If Merck identifies any audit observations in connection with any audit under this Section 4, Exhibit A or the Clinical Supply Agreement, the Parties will discuss in good faith suitable approaches for correcting such observations, and Moderna shall have a reasonable time following such consultation with Merck to make appropriate corrections.
(vi) Without limiting the foregoing, the Parties acknowledge and agree that the Clinical Supply Agreement will include provisions addressing material non-compliance with the terms and conditions of the Clinical Supply Agreement, this Section 4 or Exhibit A (including the audit provisions), which provisions will include appropriate remedies that may include [***].

(b) Clinical Supply cGMP Supply Cap. Unless otherwise agreed by the Parties, during the Collaboration Term, Merck may request cGMP mRNA Constructs pursuant to Section 4.2(a) for up to [***] Product Candidates concurrently, and Moderna will supply such cGMP mRNA Constructs in accordance with the terms of this Agreement. For the avoidance of doubt, [***], provided that [***]. For the purposes of the foregoing, “concurrently” means with respect to Product Candidates, [***].

(c) [***] If Moderna (a) complies with the relevant terms and conditions of Section 4 and Exhibit A (including the audit provisions), and (b) Moderna complies with the following criteria, then Moderna [***]:

(i) Moderna shall ensure that Merck has the right within [***] after the Effective Date, or such longer period of time as agreed to by Merck, to [***]. Within [***] of receipt of an audit report from Merck, Moderna shall [***]. Upon [***], Moderna shall address and correct [***] audit observations provided by Merck [***] prior to Manufacturing of cGMP Moderna mRNA API for Merck.

(ii) [***]

(iii) [***]

(iv) As part of Merck’s audit of Moderna’s proposed manufacturing location, Merck’s audit may include [***].

4.3 cGMP Supply For Registrational Study and Commercial Supply. The following provisions of this Section 4.3 shall apply with respect to Manufacture of cGMP Moderna mRNA API for Registrational Studies and commercial supply on a Product Candidate-by-Product Candidate or Elected Candidate-by-Elected Candidate basis from and after the earlier of [***]:

(a) [***]

(b) [***]

(c) [***]

4.4 Drug Product. At the request of Merck, and if agreed to by the Parties, such agreement not to be unreasonably withheld, conditioned or delayed, the Parties shall discuss and agree on the terms pursuant to which Moderna would Manufacture and supply of Drug Product to
Merck. If the Parties agree to enter into an agreement with respect to the Manufacture and supply of Drug Product, such agreement will include similar terms and conditions, including similar quality standards and audit rights, as set forth in this Section 4 and Exhibit A, provided, that the Parties acknowledge and agree that different pricing will need to be negotiated with respect to the Manufacture and supply of Drug Product.

5. Regulatory Responsibilities

5.1. In General. As set forth in greater detail below in this Section 5, but subject to Sections 5.4, 5.5 and 15.5, [*] will lead and have sole control of, and bear all costs of, all regulatory efforts for Collaboration mRNA Constructs, Product Candidates, Elected Candidates and Products worldwide, including with respect to preparing and filing the relevant Regulatory Filings and all communications (formal and informal) with Regulatory Authorities.

5.2. Regulatory Filings. Other than with respect to the performance of the [*], (a) [*] will be responsible for preparing and submitting all Regulatory Filings related to Collaboration mRNA Constructs, Product Candidates, Elected Candidates and Products, including all applications for Regulatory Approval, and (b) all applications for Regulatory Approval, the Regulatory Approvals, and other Regulatory Filings (including all INDs) relating to Collaboration mRNA Constructs, Product Candidates, Elected Candidates and Products will be the property of [*] and held in the name of [*] or its designees.

5.3. Interactions with Regulatory Authorities. Other than with respect to the performance of the [*] or as otherwise set forth in Section 4 or Exhibit A, [*] will have the sole right to conduct all communications with the Regulatory Authorities, including all meetings, conferences and discussions (including advisory committee meetings and formal agency/sponsor meetings), including all requests and materials submitted for such, with regard to Collaboration mRNA Constructs, Product Candidates, Elected Candidates and Products in the Territory.

5.4. Moderna Support for Regulatory Filings. If not previously prepared and filed, Moderna will, at Merck’s request, prepare and file with all applicable Regulatory Authorities a DMF for the Moderna mRNA API and Moderna shall also provide such other information and assistance as Merck may reasonably request in connection with the completion of and submission of applications for Regulatory Approvals for Products and the maintenance thereof. Merck and its Affiliates and Sublicensees may refer to such DMF in any filing made in connection with obtaining or maintaining a Regulatory Approval for a Product. Moderna will be responsible for assuring that during the Term, such DMF will be in the form appropriate for filing with all applicable Regulatory Authorities, including those in the United States, the European Union, Japan and such other countries as requested by Merck, and such DMF shall be maintained in full force and effect by Moderna during the Term and will not be amended without the consent of Merck. Moderna will, on written request by Merck or its Affiliate or Sublicensee, provide to the requesting party and to any specified Regulatory Authority a letter, in the form reasonably required by the requesting party, acknowledging that the requesting party has a right of reference to any such DMF. If [*] has not filed [*] will provide such [*]. In the case where information [*] will provide such other information and assistance [*] in connection with responding to Regulatory Authorities. This includes [*].
6. Development Meetings & Reports; Diligence.

6.1. Annual Update Meetings. At least [***] during each consecutive [***] period from the date of the Elected Candidate Notice until the first Regulatory Approval for Product, within [***] of Moderna’s written request, the Parties will meet in person at a U.S. site of Merck for Merck to provide Moderna with an update on the Development of a Product by Merck and its Affiliates and Sublicensees.

6.2. Reports by Merck. Merck will prepare and maintain, and will cause its Affiliates and Sublicensees to prepare and maintain, reasonably complete and accurate records regarding the Development of Product Candidates, Elected Candidates and Products. At least [***] every [***] period from the Effective Date, Merck shall provide to Moderna a written progress report which shall [***]. For clarity, all such reports shall be considered the Confidential Information of Merck.

6.3. Diligence. Merck, directly or through one or more of its Affiliates or Sublicensees, will use Commercially Reasonable Efforts: to (a) Develop [***] Product Candidate from each TPP; (b) seek to obtain Regulatory Approval for a Product for each Elected Candidate; and (c) Commercialize Products after obtaining such Regulatory Approval.

7. Third Party In-Licenses.

7.1. Moderna [***] In-Licenses.

(a) Moderna [***] In-Licenses. All Moderna [***] In-Licenses shall be deemed to be Moderna Collaboration In-Licenses for purposes of this Agreement and the Patents and Know-How in-licensed under such Moderna [***] In-Licenses will be deemed Moderna Technology, provided that notwithstanding anything to the contrary contained herein (including Section 7.7), Moderna shall be solely responsible for [***].

(b) Moderna [***] In-Licenses. In the event that after the Effective Date, Moderna identifies any Patents or Know-How of a Third Party related to the Moderna [***] Technology to which Moderna (and its Affiliates) does not have rights and that [***] in order for Moderna to perform its obligations under the Collaboration Activities, then such Moderna [***] In-License shall automatically be deemed to be a Moderna [***] In-License for purposes of this Agreement, and shall be treated in accordance with the provisions of Section 7.1(a). With respect to the Moderna [***] In-Licenses, Moderna (i) will [***] and (ii) will use [***].

7.2. Moderna Collaboration Technology In-Licenses. In the event that, Moderna identifies any Patents or Know-How of a Third Party related to the Development or Commercialization of any Collaboration mRNA Construct, and associated Products, including [***], to which Moderna (and its Affiliates) does not have rights and that [***] pursuant to the
terms of this Agreement, in either case other than those related to [***] (each such agreement, a “Moderna Collaboration Technology In-License”); Moderna may independently negotiate and enter into such Moderna Collaboration Technology In-License to obtain a license to such Patents or Know-How provided that (i) [***], (ii) Moderna will [***] and (iii) will use [***].

7.3. Moderna [***] In-Licenses. Moderna shall not use any [***] in connection with Collaboration Activities that is [***] licensed to Moderna pursuant to a Moderna [***] In-License without the prior written approval of Merck. In the event that Merck desires to use any such [***] in connection with Collaboration Activities, Merck may provide written notice to Moderna of same, and, [***], such notice will constitute Merck’s approval to use such [***] in connection with Collaboration Activities, (a) such Moderna [***] In-License shall become a Moderna Collaboration In-license in accordance with Section 7.4, and (b) the applicable milestone, royalty and other payments due under the applicable Moderna Collaboration In-License will be passed through to Merck [***] pursuant to Section 7.7.

7.4. Moderna Collaboration In-Licenses. Moderna shall notify Merck in writing of the terms of any Moderna In-License promptly after entering into such Moderna In-License (subject to confidentiality obligations and reasonable redactions), including any restrictions or obligations with respect to the Prosecution and Maintenance and/or enforcement any Patents licensed thereunder. To the extent that the rights granted to Moderna under a Moderna In-License are limited (e.g., [***]), Moderna, [***], will equitably apportion such limited rights amongst Moderna and its Affiliates, Merck and Moderna’s and its Affiliates’ Third Party Development and Commercialization partners. If Merck notifies Moderna in writing that a Moderna In-License should be made available for use by either Party for the performance of Collaboration Activities, or [***], in each case pursuant to the terms of this Agreement and to the extent permissible under such Moderna In-License (each such Moderna In-License, a “Moderna Collaboration In-License”), then (a) the Patents and Know-How in-licensed under such Moderna In-License will be deemed Moderna Technology (but subject to any limitations set forth in such Moderna In-License [***]), and (b) Merck will be required to make the payments set forth in Section 7.7; provided, that [***]. If Merck concludes that a Moderna In-License should not be made available for use by either Party for the performance of Collaboration Activities, or made available for use by Merck to Exploit or Optimize Elected Candidates and Products, in each case pursuant to the terms of this Agreement, then [***].

7.5. [***] Conversion of Moderna In-Licenses. If Merck [***], then subject to [***], Merck may [***] elect to convert such Moderna In-License to a Moderna Collaboration In-License by (a) providing written notice to Moderna of the same and (b) being required to make the payments set forth in Section 7.7; provided, that such amounts have been disclosed to Merck pursuant to Section 7.4. Upon Moderna’s receipt of such notice, Merck will promptly notify [***] and, to the extent [***], then such Moderna In-License will thereafter be deemed to a Moderna Collaboration In-License hereunder, and the provisions of this Agreement applicable to Moderna Collaboration In-Licenses will apply with respect to such Moderna In-License. Notwithstanding the foregoing, prior to converting any Moderna In-License to a Moderna Collaboration In-License, the Parties will agree on [***].

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7.6. Moderna Collaboration In-License Requirements. Merck will abide, and will cause all its Affiliates and applicable Sublicensees to abide, by all requirements of each Moderna Collaboration In-License in all material respects (and in any case in all respects in the case that [***]), to the extent applicable to sublicensees thereunder and to the extent disclosed by Moderna to Merck pursuant to Section 7.4 prior to Merck’s conclusion to have the Moderna In-License made available and converted to a Moderna Collaboration In-License hereunder, with the understanding that disclosure by Moderna of the terms of any Moderna Collaboration In-License to Merck will be deemed disclosure of such requirements of such Moderna Collaboration In-License so disclosed to Merck.

7.7. Moderna Collaboration In-License Payments. If any In-License Payments previously disclosed to Merck pursuant to Section 7.3 or 7.4, as applicable, become due during the Term under any Moderna Collaboration In-License, Merck will be responsible for such payments, provided, that Merck will reimburse Moderna for [***] such In-License Payment within [***] days of Merck’s receipt of Moderna’s invoice therefor (a) that [***].

7.8. Merck In-Licenses. In the event that Merck identifies any Patents or Know-How of a Third Party that may be [***] pursuant to this Agreement, Merck may independently negotiate and enter into an agreement to obtain a license or other rights to such Patents or Know-How for use in connection with such Development or Commercialization (each such agreement, an “Merck In-License”). Merck will notify Moderna of such Merck In-License. In the event that such notice is given and Moderna concludes that such Merck In-License should be made available for use by Moderna to perform Collaboration Activities or other Manufacturing activities, then the Parties will discuss in good faith whether and on what terms Merck would grant Moderna rights under any such Merck In-License.

7.9. [***]

7.10. Moderna Collaboration In-Licenses. Moderna represents, warrants and covenants to Merck that it has [***] as of the Effective Date [***]. Moderna further covenants and agrees that during the Term, (a) it shall satisfy all of its material obligations under (including making all payments), and maintain in full force and effect, each of the Moderna Collaboration In-Licenses; (b) it will not assign (except an assignment to a party to which this Agreement has been assigned as permitted under Section 16.13), [***] without the prior written consent of Merck, not to be unreasonably withheld, to the extent any of the foregoing actions would reasonably be expected to have an adverse effect on Merck’s rights hereunder or thereunder or Moderna’s obligations hereunder; (c) it will provide Merck with prompt notice of any claim of [***] and (d) to the extent permitted under the applicable Moderna Collaboration In-License, it shall promptly [***].

8. Payments

8.1. Up-Front Payment. Within ten (10) Business Days after the Effective Date and receipt of an invoice from Moderna, Merck will pay to Moderna a one-time payment of US $50,000,000 as consideration for access to Moderna’s research capabilities and the licenses granted herein (the “Upfront Payment”), which payment will be non-refundable, non-creditable, not subject to set-off, and not be reduced by any withholding or similar taxes.
8.2. R&D Program Costs. Except as set forth in Section 8.3, commencing on the Effective Date and continuing during the Collaboration Term, Merck will reimburse Moderna for all R&D Program Costs incurred by Moderna and its Affiliates on a Calendar Quarter-by-Calendar Quarter basis. Moderna will send a reasonably detailed invoice to Merck for each Calendar Quarter, which invoice will include a summary of all non-identifiable costs. All of the foregoing shall be auditable by Merck pursuant to Section 8.6(c). For clarity, unless otherwise mutually agreed in writing by the Parties, in no event shall Moderna be entitled to receive payment for any FTEs or other R&D Program Costs in a given Calendar Quarter in connection with the performance of activities that are not included in the applicable R&D Plan or that are not specifically included in the budget set forth therein. Merck agrees to pay undisputed amounts in each such invoice within [***] days of Merck’s receipt thereof.

8.3. Sharing of Certain R&D Program Costs.

(a) [***]

(b) [***]

8.4. Milestone Payments. Subject to the remainder of this Section 8.4, Merck will make the following milestone payments set forth in Section 8.4(d) (each, a "Milestone Payment") to Moderna upon the first achievement by Merck (or its Affiliate or Sublicensee) of each of the milestone events set forth in the tables below in Section 8.4(d) (each, a "Milestone Event"), and such payments when owed or paid will be non-refundable and non-creditable and not subject to set-off.

(a) Development Milestones. The Milestone Payments for Development events are set forth in Table 1 below. Such Milestone Payments will be payable to Moderna by Merck within [***] of the first achievement [***] by Merck (or its Affiliate or Sublicensee) of the applicable Milestone Event with respect to a Development Milestone Product (as defined below). For the purposes of this Section 8.4, “Development Milestone Product” shall mean:

(i) With respect to [***]; provided that if [***]

(ii) With respect to [***]; provided that if [***];

(b) Commercialization Milestones. The Milestone Payments for Commercialization Milestone Events are set forth in Table 2 below. Such Milestone Payments will be payable to Moderna by Merck within [***] days of the end of the Calendar Quarter in which first achievement [***] by Merck of the applicable Milestone Event with respect to a given Product occurs.

(c) Exceptions; Additional Conditions. Notwithstanding the foregoing, the following shall apply:

(i) With respect to a Development Milestone Product from the [***] or [***] for which Merck has issued an Elected Candidate Notice pursuant to Section 2.11(d), the Milestone Payment [***]. Furthermore, if a Milestone Event is achieved that triggers a Milestone Payment set forth in Table 1 below for a given Development Milestone Product, and the preceding Milestone Events set forth in Table 1 for such Development Milestone Product have not occurred such that the previous Milestone Payments set forth in Table 1 have not been previously paid for such Development Milestone Product (to the extent such Milestone Payment would otherwise be payable with respect to such Development Milestone Product), then all such previous Milestone Payments shall become due and payable upon achievement of such Milestone Event for such Development Milestone Product.
(ii) In the event that more than one Milestone Event set forth in Table 2 are achieved in the same Calendar Year with respect to a Product, Milestone Payments will be payable with respect to each such Milestone Event [***].

(iii) In all cases, the maximum number of times a Milestone Payment shall be payable for a given Milestone Event is [***].

(d) Milestones and Payments.

\[
\begin{array}{|c|c|}
\hline
\text{Milestone Event} & \text{Milestone Payment} \\
\hline
[***] & [***] \\
[***] & [***] \\
[***] & [***] \\
\hline
\end{array}
\]

Table 1: Development Milestone Payments

\[
\begin{array}{|c|c|}
\hline
\text{Milestone Event} & \text{Milestone Payment} \\
\hline
[***] & [***] \\
[***] & [***] \\
[***] & [***] \\
\hline
\end{array}
\]

Table 2: Commercialization Milestone Payments

8.5. Royalties.

(a) Rates. Subject to the terms and conditions of this Agreement, Merck will pay to Moderna running royalties, as set forth in this Section 8.5, which royalties [***] shall be determined on a Product-by-Product basis and shall only be payable with respect to Net Sales occurring during the Royalty Term, based on the total global aggregate annual Net Sales [***][***] by Selling Parties of such Product in a given Calendar Year at the following royalty rates (provided that the Royalty Term for such Product in the applicable country has not expired):

\[
\begin{array}{|c|c|}
\hline
\text{Annual Net Sales} & \text{Royalty Rate} \\
\text{of each Product in a Calendar Year} & \\

\hline
[***] & [***] \\
[***] & [***] \\
[***] & [***] \\
[***] & [***] \\
\hline
\end{array}
\]

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(b) Royalty Term. Royalties under Section 8.5(a) will be payable commencing with the First Commercial Sale of a Product, on a Product-by-Product and country-by-country basis, on the Net Sales of such Product if during any period at least one of the following [***] conditions apply (the "Royalty Term"):

(i) if one or more Valid Claims within [***] in such Product in such country (even if such Patent is a Joint Patent);

(ii) if such Product in such country is covered by a Regulatory Exclusivity Period; or

(iii) for [***] from the First Commercial Sale of such Product in such country.

(c) [***] Notwithstanding Section 8.5(b), if the Royalty Term for a particular Product in a given country is scheduled to expire pursuant to Section 8.5(b) in a given Calendar Quarter, and during the next Calendar Quarter, [***], then the Royalty Term for such Product in such Country shall [***].

(d) Royalty Reduction. If a Product is royalty-bearing only on account of Section 8.5(b)(iii), then the royalty rates set forth in Section 8.5(a) with respect to Net Sales attributable to such Product will be reduced by [***].

(e) Third Party Royalty Payments. If a Selling Party, [***] a license from any Third Party under any intellectual property right [***], and if such Selling Party is required after the Effective Date to pay to such Third Party under such license [***], or if such Selling Party is required by a court of competent jurisdiction to pay amounts [***], then the amount of Merck’s royalty obligations under this Section 8.5(a) will be reduced by [***], provided however, that the royalties payable under Section 8.5(a) will not be reduced in any such event pursuant to this Section 8.5(e) below [***] of the amounts set forth in Section 8.5(a) [***]: provided further, however, [***]. Any royalties or other payments payable under any Modera Collaboration In-License may not be deducted under this Section 8.5(e) from royalties owed to Moderna.

(f) Compulsory Licenses. If a court or a governmental agency of competent jurisdiction requires Merck or its Sublicensee to grant a compulsory license to a Third Party with respect to Product in any country in the Territory with a royalty rate lower than the royalty rate provided by Section 8.5(a), then the royalty rate to be paid by Merck on Net Sales in that country under Section 8.5(a) shall be reduced [***].

(g) Additional Royalty Provisions. The royalties payable under Section 8.5(a) will be subject to the following:

(i) only one royalty will be payable hereunder with respect to each Product unit;
(ii) royalties when owed or paid hereunder will, except as provided in Section 8.5(e), be non-refundable and non-creditable and not subject to set-off;

(iii) no royalties shall be due upon the sale or other transfer among Merck or its Selling Parties, but in such cases the royalty shall be due and calculated upon Merck’s or its Selling Party’s Net Sales to the first independent Third Party;

(iv) no royalties shall accrue on the sale or other disposition of Product by Merck or its Selling Parties for use in any clinical trial;

(v) for purposes of this Section 8.5, all sales of a Product by any Selling Party for use in the [***] field (to the extent permitted pursuant to Section 9.2) shall be counted as “Net Sales” of such Product for the purposes of calculating Net Sales, applicable royalty tiers and otherwise under this Section 8.5;

(vi) except as expressly set forth in Sections 8.5(d), 8.5(e) and 8.5(f), no other royalty deductions are permitted hereunder; and

(vii) no royalties shall accrue on the disposition or sale of Product (A) in reasonable quantities by Merck, its Affiliates or Sublicensees as part of an expanded access program or (B) as donations (for example, to non-profit institutions or government agencies for non-commercial purposes) or as test marketing or samples (promotion or otherwise) or (C) at no margin (including taking into account the royalties that would be payable to Moderna).
due hereunder for any Calendar Year ending not more than [***] following the end of any Calendar Year. Such examinations may not be conducted more than once in any Calendar Year or be repeated for any Calendar Year. The accounting firm shall disclose to the auditing Party only whether the reports are correct or incorrect and the amount of any discrepancy. No other Confidential Information shall be provided. If such accounting firm correctly identifies a discrepancy made during such period, the appropriate Party shall pay the other Party the amount of the discrepancy within [***] of the date of delivery of such accounting firm's written report so correctly concluding, or as otherwise agreed upon by the Parties. The fees charged by such accounting firm shall be paid by the auditing Party, provided that if the underpayment or overcharge exceeds [***], the audited Party shall pay the fees. Upon the expiration of [***] following the end of any Calendar Year, absent willful misconduct or fraud by a Party (its Affiliates, as applicable) the calculation of amounts payable with respect to such Calendar Year shall be binding and conclusive upon the Parties, and the Parties shall be released from any liability or accountability with respect to amounts payable for such Calendar Year. The auditing Party shall treat all financial information subject to review under this Section 8.6(c) in accordance with the confidentiality and non-use provisions of this Agreement, and shall cause its accounting firm to enter into an acceptable confidentiality agreement with the audited Party obligating it to retain all such Confidential Information in confidence pursuant to such confidentiality agreement.

(d) Taxes. Subject to Section 8.1, Merck may deduct or withhold from any payments due to Moderna amounts for payment of any withholding Tax that is required by Law to be paid to any Tax Authority with respect to such payments. To the extent that any such amounts are so deducted or withheld, such amounts will be treated for all purposes of this Agreement as having been paid to Moderna. Merck will give written notice of its intent to withhold any amounts under this Section 8.6(d) at least [***] days in advance of any payment being made. Merck will give proper evidence from time to time as to the payment of any such Tax. Moderna will provide Merck all necessary documents and correspondence, and will also use commercially reasonable efforts to provide to Merck any other cooperation or assistance on a reasonable basis as may be necessary to enable Merck to claim exemption from such deduction or withholding Taxes. The Parties will reasonably cooperate with each other in seeking relief or reduction in the deduction or withholding of any Tax under any double Taxation or other similar treaty or agreement from time to time in force and in seeking to receive a refund of any withholding Tax or to claim a foreign Tax credit.

(e) Currency Exchange. With respect to Net Sales invoiced in U.S. dollars, the Net Sales and the amounts due to Moderna hereunder will be expressed in U.S. dollars. In the case of sales outside the United States, the rate of exchange to be used in computing the monthly amount of currency equivalent in United States Dollars due Moderna shall be made at the monthly rate of exchange utilized by Merck in its worldwide accounting system. For purposes of calculating the Net Sales thresholds set forth in Sections 8.4(d) and 8.5(a), the aggregate Net Sales with respect to each Calendar Quarter within a Calendar Year will be calculated based on the currency exchange rates for the Calendar Quarter in which such Net Sales occurred, in a manner consistent with the exchange rate procedures set forth in the immediately preceding sentence.

(f) Blocked Payments. In the event that, by reason of applicable Law in any country, it becomes impossible or illegal for Merck (or any other Selling Party) to transfer, or have transferred on its behalf, payments owed Moderna hereunder, Merck will promptly notify
Modern of the conditions preventing such transfer and such payments will be deposited in local currency in the relevant country to the credit of Moderna in a recognized banking institution designated by Moderna or, if none is designated by Moderna within a period of [***] days, in a recognized banking institution selected by Merck or another Selling Party, as the case may be, and identified in a written notice given to Moderna.

(g) Interest Due. If any payment due to either Party under this Agreement is overdue (and is not subject to a good faith dispute), then such paying Party will pay interest thereon [***] at an annual rate [***] after payment of such sum became due until payment thereof in full together with such interest.

(h) Mutual Convenience of the Parties. The royalty and other payment obligations set forth hereunder have been agreed to by the Parties for the purpose of reflecting and advancing their mutual convenience, including the ease of calculating and paying royalties and other amounts to Moderna.

(i) Other Expenses. Except as expressly set forth herein or in any Supply Agreement, each Party will be solely responsible for costs and expenses incurred by such Party in connection with the activities contemplated by this Agreement.

9. Licenses


(a) Development & Commercialization Licenses. Subject to the terms of this Agreement, including Section 9.1(b), Moderna, on behalf of itself and its Affiliates, hereby grants to Merck a royalty-bearing, worldwide, exclusive license in the Applicable Field, with the right to grant sublicenses in compliance with Section 9.4, under the Moderna Technology:

(i) On an R&D Program-by-R&D Program basis, to Develop Collaboration mRNA Constructs, under and in accordance with the applicable R&D Plan during the R&D Term;

(ii) To Develop [***] Collaboration mRNA Constructs in a Product Candidate Pool or in an Elected Candidate or Product;

(iii) To Develop Product Candidates, Elected Candidates and Products (including the Collaboration mRNA Constructs as they are included therein);

(iv) To Commercialize and otherwise Exploit Elected Candidates and Products (including the Collaboration mRNA Constructs as they are included therein); and

(v) Subject to Article 4 (including Exhibit A), to Manufacture Collaboration mRNA Constructs, Product Candidates, Elected Candidates and Products.

(b) [***]
(c) Retained Rights; Limitations. Notwithstanding the exclusive licenses set forth in Section 9.1(a), Moderna retains rights under the Moderna Technology to perform and to have performed its obligations under this Agreement and any Supply Agreement.

9.2. [***]

9.3. Development License by Merck. Subject to the terms and conditions of this Agreement, Merck hereby grants to Moderna a non-exclusive, worldwide license, with the right to grant sublicenses to permitted subcontractors pursuant to Section 2.12 only, under the Merck Background Technology and Merck Collaboration Technology, solely to perform the Collaboration Activities in accordance with the terms of this Agreement and the applicable R&D Plan provided that the grant of any such sublicense shall not relieve Moderna of its obligations under this Agreement, and Moderna will be responsible for ensuring the performance and compliance by such sublicensee with the terms this Agreement as if such sublicensee were “Moderna”, in each case, to the extent applicable to such sublicensee.

9.4. Sublicensing.

(a) Merck Sublicensing. Merck may grant sublicenses under any of the licenses granted to Merck by Moderna under Section 9.1, without Moderna’s consent, to (x) one or more Affiliates (with the right to sublicense through multiple tiers), (y) to one or more Third Party subcontractors (in accordance with Section 2.12) of Merck (or its Affiliate) and/or (z) with respect to an Elected Candidate or Product to one or more Third Parties (with the right to sublicense through multiple tiers), provided that the grant of any such sublicense to an Affiliate or Third Party shall not relieve Merck of its obligations under this Agreement, and Merck will be responsible for ensuring the performance and compliance by such Affiliate or Third Party with the terms this Agreement and any Moderna Collaboration In-License as if such Affiliate or Third Party were “Merck”, in each case, to the extent applicable to such Sublicensee, and provided further that, as a condition precedent to and requirement of any such sublicense to a Third Party under the foregoing clause (z):

(i) such sublicense is set forth in a written agreement;

(ii) Merck will provide Moderna with a copy of any such sublicense agreement and each material amendment thereto within [***] days of execution thereof, which may be redacted as necessary to protect confidential information and other commercially sensitive information; and

(iii) such sublicense agreement shall be consistent with and subject to the applicable terms and conditions of this Agreement.

9.5. Section 365(n) of the Bankruptcy Code. All rights and licenses granted under or pursuant to any section of this Agreement, are, and will be deemed to be for all purposes of Section 365(n) of Title 11 of the United States Code and of any similar provisions of applicable Laws under any other jurisdiction (the “Bankruptcy Code”), rights and licenses to “intellectual property” (as defined in Section 101(35A) of the Bankruptcy Code). Each Party agrees that the other Party, as a licensee of rights and licenses under this Agreement, will retain and may fully exercise all of its rights and elections under the Bankruptcy Code. The Parties further agree that, in the event of
the commencement of a bankruptcy proceeding by or against a Party under the Bankruptcy Code or analogous provisions of applicable Law outside the U.S., the other Party will be entitled to a complete duplicate of, or complete access to (as appropriate), any intellectual property licensed to such other Party held by such first Party and its successors and assigns (including all embodiments thereof), which, if not already in such other Party’s possession, will be promptly delivered to it (a) upon any such commencement of a bankruptcy proceeding upon such other Party’s written request therefor, unless such first Party elects to continue to perform all of its obligations under this Agreement, or (b) if not delivered under clause (a), following the rejection of this Agreement by such first Party in the bankruptcy proceeding upon written request therefor by such other Party.

9.6. No Grant of Inconsistent Rights by Moderna. Moderna (and its Affiliates) shall not assign, transfer, convey or otherwise grant to any Person or otherwise encumber (including through lien, charge, security interest, mortgage, encumbrance or otherwise, but excluding liens in connection with financings) (a) any rights to any Moderna Technology (or any rights to any intellectual property that would otherwise be included in the Moderna Technology), in any manner that is inconsistent with or would interfere with the grant of the rights or licenses to Merck hereunder, or (b) any rights to any Collaboration mRNA Constructs, Product Candidates, Elected Candidates or Products (provided that Moderna shall grant to Merck the rights to the Collaboration mRNA Constructs, Product Candidates, Elected Candidates or Products as set forth herein), other than with respect to the right to receive royalty payments on the Net Sales of Products.

10. Ownership of Technology and Materials

10.1. Disclosure. Each Party will promptly disclose to the other Party in writing, and will cause its Affiliates and subcontractors to so disclose, the conception, creation or discovery of any inventions within the Collaboration Know-How.

10.2. Ownership of Certain Moderna Technology. Subject to the license grants to Merck under this Agreement, as between the Parties, Moderna will own and retain all right, title and interest in and to all [***], conceived, created or discovered during the performance of Collaboration Activities. Accordingly, Merck will promptly disclose to Moderna in writing, the conception, creation, or the discovery, of any [***] by or on behalf of Merck or its Affiliates. Merck, for itself and on behalf of its Affiliates, hereby assigns (and to the extent such assignment can only be made in the future hereby agrees to assign), to Moderna all its right, title and interest in and to any [***] conceived, created or discovered during the performance of Collaboration Activities. Merck will cooperate, and will cause the foregoing persons and entities to cooperate, with Moderna to effectuate and perfect the foregoing ownership, including by promptly executing and recording assignments and other documents consistent with such ownership.

10.3. [***] License. To the extent that Merck solely conceives, creates or discovers any Moderna Collaboration Platform Technology or Moderna Formulation Technology that is assigned to Moderna pursuant to Section 10.2, Moderna hereby grants to Merck [***], worldwide license under [***] to research, develop, manufacture, use, commercialize, offer for sale, sell, distribute, import or export [***].
10.4. Ownership of [***]. Subject to the license grants to Moderna under this Agreement, as between the Parties, Merck will own and retain all right, title and interest in and to all [***]. Accordingly, Moderna will promptly disclose to Merck in writing, the conception, creation or discovery of any [***] by or on behalf of Moderna or its Affiliates. Moderna, for itself and on behalf of its Affiliates, hereby assigns (and to the extent such assignment can only be made in the future hereby agrees to assign), to Merck all its right, title and interest in and to any [***] conceived, created or discovered during the course of performing Collaboration Activities. Moderna will cooperate, and will cause the foregoing persons and entities to cooperate, with Merck to effectuate and perfect the foregoing ownership, including by promptly executing and recording assignments and other documents consistent with such ownership. To the extent that Moderna conceives, creates or discovers any [***] (solely or jointly with Merck) that is assigned to Merck pursuant to this Section 10.4, Merck hereby grants to Moderna a non-exclusive, royalty free and fully paid-up, sublicensable, worldwide license under such assigned [***], subject to Section 11, to research, develop, manufacture, use, commercialize, offer for sale, sell, distribute, import or export any product (or component thereof).

10.5. Ownership of Other Technology. Except as set forth in Section 10.2 and Section 10.4, and subject to the license grants by one Party to the other under this Agreement, all Know-How and Patents conceived, created or discovered, by or on behalf of either Party or its Affiliates either alone or jointly with Third Party(ies), or by the Parties or their Affiliates jointly under or in connection with the this Agreement, whether or not conceived, created or discovered at a facility owned or controlled by such Party and whether or not patented or patentable, and any and all Patent and other intellectual property rights with respect thereto will be owned in accordance with inventorship and in accordance with applicable Law in the United States.

10.6. United States Law. The determination of whether Know-How and Patents are conceived, created or discovered by a Party for the purpose of allocating proprietary rights (including Patent, copyright or other intellectual property rights) therein, will, for purposes of this Agreement, be made in accordance with applicable Law in the United States. In the event that United States Law does not apply to the conception, creation or discovery of any Know-How or Patents hereunder, each Party will, and does hereby, assign, and will cause its Affiliates to so assign, to the other Party, without additional compensation, such right, title and interest in and to any Know-How and Patents as well as any intellectual property rights with respect thereto, as is necessary to fully effect ownership as would have been determined under U.S. Law.

10.7. Exploitation of Joint Technology. Subject to Section 10.2 and Section 10.4 and to the license grants in this Agreement, the Parties will each own an equal, undivided interest in any and all Joint Technology. Each Party will exercise its ownership rights in and to such Joint Technology, including the right to license and sublicense or otherwise to Exploit, transfer or encumber its ownership interest, without an accounting or obligation to, or consent required from, the other Party, but subject to Section 11 and the license grants under this Agreement. At the reasonable written request of a Party, the other Party will in writing grant such consents and confirm that no such accounting is required to effect the foregoing regarding Joint Technology. Each Party will, and does hereby, assign, and will cause its Affiliates and subcontractors to so assign, to the other Party, without additional compensation, such right, title and interest in and to any Joint Technology as well as any intellectual property rights with respect thereto, as is necessary to fully effect the joint ownership provided for in the first sentence of this Section 10.7.
10.8. **No Implied Rights.** No license, sublicense or other right is or will be created or granted hereunder by implication, estoppel or otherwise. Any licenses, sublicenses or rights will be granted only as expressly provided in this Agreement. Neither Party nor any of its Affiliates will use or practice any Know-How or Patents licensed or provided to such Party or any of its Affiliates outside the scope of or otherwise not in compliance with the rights and licenses granted to such Party and its Affiliates under this Agreement.

11. **Exclusivity.**

11.1. **Target Exclusivity.**

(a) **R&D Term.** During the R&D Term, Moderna will not, [***].

(b) **After R&D Term.** From and after the end of the R&D Term, Moderna will not, [***].

11.2. **Collaboration mRNA Construct, Product Candidate, Elected Candidate and Product Exclusivity.** Moderna will not, [***].

11.3. **Collaboration Field Exclusivity.**

(a) **R&D Term.** Subject to [***], during the R&D Term, Moderna will not, and will cause each of its Affiliates not to, either itself, or together with any Third Party, [***].

(b) **Non-Restricted Activities.** Notwithstanding anything in Section 11.3(a) to the contrary, the provisions of Section 11.3(a) do not restrict Moderna or its Affiliates or licensees from:

(i) performing Moderna’s obligations pursuant to this Agreement or any Supply Agreement;

(ii) [***];

(iii) conducting such assays or other research as reasonably necessary to maintain compliance with Section 11.3(a);

(iv) granting the rights and licenses set forth in, and performing obligations under, any Existing Partner Agreement regarding [***] but in all cases subject to the other provisions of this Section 11; [***];

(v) granting any Third Party [***]

(vi) [***]

11.4. [***]

(a) [***]

(b) [***]
11.5. [***]
   (a) [***]
   (b) [***]
   (c) [***]

11.6. [***]

11.7. [***]
   (a) [***]
   (b) [***]
   (c) [***]

11.8. Exception for Business Combination.

   (a) Notwithstanding Sections [***], if (a) a Business Combination occurs with respect to Moderna or its Affiliate with a Third Party or (b) Moderna or its Affiliate acquires a Third Party (by merger, consolidation or otherwise) so that such Third Party becomes an Affiliate over which Moderna or its Affiliate has control (as defined in Section 1.4), or (c) Moderna or its Affiliate acquires all or substantially all of the assets of a Third Party (including any subsidiaries or divisions thereof) (each of (a), (b) and (c), a "Moderna Acquisition"), and, in each case, the Third Party (or any of such Third Party’s Affiliates or any successors or assigns of such Third Party or such Third Party’s Affiliates, other than Moderna and its Affiliates as of the Moderna Acquisition) already has, or the acquired assets contain, as applicable, a program that existed prior to, or was substantially in the process of being implemented prior to such Moderna Acquisition and is in fact implemented shortly after such Moderna Acquisition, the Moderna Acquisition that would otherwise violate any of Sections [***] (a "Moderna Business Program"), then [***]; provided that [***].
(b) In addition, in the event a Business Combination occurs with respect to Moderna or an Affiliate that does work hereunder or is in possession of Merck’s Confidential Information (including [***]), with a Third Party, then with respect to such acquiring Third Party (or any Affiliates of such acquiring Third Party prior to the consummation of Business Combination (collectively with such acquiring Third Party, a “Third Party Acquiror”), but excluding, for clarity, Moderna and the Moderna Affiliates prior to the consummation of such Business Combination) and after such Business Combination such Third Party Acquiror initiates a program that was not substantially in the process of being implemented prior to such Business Combination (each, a “New Program”):

(i) the provisions of [***] shall not apply to such Third Party Acquiror with respect to such New Program provided that [***]

(ii) the provisions of [***] shall not apply to such Third Party Acquiror with respect to such New Program provided that [***].

(c) In addition to the other provisions of this Section 11.8, Merck shall have the right to [***].

11.9. Merck Exclusivity.

(a) R&D Term. During the R&D Term, Merck will not, and will cause each of its Affiliates not to, either itself, or together with any Third Party, [***].

(b) Post R&D Period. [***], during the Post-R&D Period, Merck will not, [***].

(c) Notwithstanding Section 11.9(a) and Section 11.9(b), if (a) a Business Combination occurs with respect to Merck or its Affiliate with a Third Party or (b) Merck or its Affiliate acquires a Third Party (by merger, consolidation or otherwise) so that such Third Party becomes an Affiliate over which Merck or its Affiliate has control (as defined in Section 1.4), or (c) Merck or its Affiliate acquires all or substantially all of the assets of a Third Party (including any subsidiaries or divisions thereof) (each of (a), (b) and (c), a “Merck Acquisition”), and, in each case, the Third Party (or any of such Third Party’s Affiliates or any successors or assigns of such Third Party or such Third Party’s Affiliates, other than Merck and its Affiliates as of the Merck Acquisition) already has, or the acquired assets contain, as applicable, a program that existed prior to, or was planned prior to and is demonstrably to be implemented shortly after, the Merck Acquisition that would otherwise violate Section 11.9(a) or Section 11.9(b) (a “Merck Business Program”), then [***]; provided that [***].

12. Confidentiality.

12.1. Confidential Information.

(a) Confidential Information. Each Party (“Disclosing Party”) may have disclosed or will disclose to the other Party (“Receiving Party”), and Receiving Party may acquire during the course and conduct of activities under this Agreement, certain proprietary or confidential information of Disclosing Party. The term “Confidential Information” means (i) all proprietary tangible samples of, and confidential information about, Materials and (ii) all confidential ideas
and information of any kind, whether in written, oral, graphical, machine-readable or other form, whether or not marked as confidential or proprietary, which are transferred, disclosed or made available to Receiving Party by Disclosing Party or at the request of Receiving Party. Without limiting the foregoing, all confidential information about (1) [***], (2) [***], and (3) Joint Technology will be treated as Confidential Information of both Parties.

(b) Restrictions. During the Term and for [***] thereafter, Receiving Party will, and will cause its Affiliates and their respective officers, directors, employees and agents to, keep all Disclosing Party’s Confidential Information in confidence with the same degree of care with which Receiving Party holds its own confidential information (though no less than reasonable care). Receiving Party will not use, and will cause its Affiliates and their respective officers, directors, employees and agents not to use, Disclosing Party’s Confidential Information except for in connection with the performance of its obligations and exercise of its rights under this Agreement. Receiving Party has the right to disclose Disclosing Party’s Confidential Information without Disclosing Party’s prior written consent (such consent not to be unreasonably withheld, delayed or conditioned), to the extent and only to the extent reasonably necessary or useful, to Receiving Party’s Affiliates and their employees, subcontractors, Sublicensees, consultants or agents who have a need to know such Confidential Information in order to perform its obligations and exercise its rights under this Agreement and who are required to comply with restrictions on use and disclosure similarly restrictive as those in this Section 12.1(b). Receiving Party will use [***] to cause those entities and persons to comply with such restrictions on use and disclosure. Notwithstanding the foregoing sentence, Receiving Party assumes responsibility for those entities and persons maintaining Disclosing Party’s Confidential Information in confidence and using same only for the purposes described herein.

(c) Exceptions. Receiving Party’s obligation of nondisclosure and the limitations upon the right to use the Disclosing Party’s Confidential Information set forth in Section 12.1(b) will not apply to the extent that Receiving Party can demonstrate that the Disclosing Party’s Confidential Information: (i) was known to Receiving Party or any of its Affiliates prior to the time of disclosure; (ii) is or becomes public knowledge through no fault or omission of Receiving Party or any of its Affiliates; (iii) is obtained by Receiving Party or any of its Affiliates from a Third Party under no obligation of confidentiality to Disclosing Party; or (iv) has been independently developed by employees, subcontractors, consultants or agents of Receiving Party or any of its Affiliates without the aid, application or use of Disclosing Party’s Confidential Information, as evidenced by contemporaneous written records. Notwithstanding the foregoing, (A) any Confidential Information will not be deemed to be within the foregoing exceptions merely because such information is embraced by more general information in the public domain or in the possession of the Receiving Party or any of its Affiliates, and (B) any combination of features will not be deemed to be within the foregoing exceptions merely because individual features are in the public domain or in the possession of the Receiving Party or any of its Affiliates, but only if the combination itself and its principle of operation are in the public domain or in the possession of the Receiving Party or any of its Affiliates.
(d) Permitted Disclosures. Receiving Party may disclose Disclosing Party’s Confidential Information to the extent (and only to the extent) such disclosure is reasonably necessary in the following instances:

(i) in order to comply with applicable Law or with a legal or administrative proceeding;

(ii) in connection with (a) prosecuting or defending litigation or for Prosecuting or (b) the Prosecution and Maintenance of Patents in accordance with this Agreement;

(iii) in connection with exercising any rights or other licenses under this Agreement, including with respect to any Joint Technology;

(iv) in the case of Merck to [***]; and

(v) in the case of Moderna, to [***].

In the case of a disclosure pursuant to (A) Sections [***], where reasonably possible, Receiving Party will notify Disclosing Party of Receiving Party’s intent to make any disclosure pursuant thereto sufficiently prior to making such disclosure so as [***], and (B) with respect to Sections [***], each of those named people and entities are required to comply with restrictions on use and disclosure [***].

12.2. Publications. The Parties may desire to publish in scientific journals and present at scientific conferences the results of the Collaboration Activities, subject to the following process. Notwithstanding anything to the contrary herein, either Party may propose publication of the results of the Collaboration Activities following scientific review by the ISC (if in force); provided, that no such publication will be made without written approval by Moderna and Merck. After receipt of the proposed publication by both Merck and Moderna, such written approval or disapproval will be provided within [***] days. Both Parties understand that a reasonable commercial strategy may require delay of publication of information or filing of Patent applications, therefore the Parties agree to review and consider delay of publication and filing of patent applications under certain circumstances for a reasonably limited period of. Once publications have been reviewed by each Party and have been approved for publication, the same publications do not have to be provided again to the other Party for review for a later submission for publication. Expedited reviews for abstracts or poster presentations may be arranged if mutually agreeable to the Parties. Each Party will acknowledge the other Party’s technical, non-financial contributions in any such publication. Notwithstanding the foregoing, Merck shall have the sole right to publish with respect to Elected Candidates and Products, provided any such publication does not include any Confidential Information of Moderna.

12.3. Terms of this Agreement; Publicity.

(a) Restrictions. The Parties agree that the terms of this Agreement will be treated as Confidential Information of both Parties, and thus may be disclosed only as permitted by Section 12.1(d). Each Party will also be permitted to disclose the terms of this Agreement and any Supply Agreement (including the exhibits hereto and thereto), in each case under appropriate confidentiality provisions, on a need to know basis, to a Party’s (and its Affiliates’) existing investors and unit holders and to any [***], provided that (1) the disclosing Party agrees to redact information that it reasonably believes is not relevant to the proposed transaction, and (2) [***]. Except as required by Law, each Party agrees not to issue any press release or public statement disclosing information relating to this Agreement, the transactions contemplated hereby or any of the terms hereof without the prior written consent of the other Party (such consent not to be unreasonably withheld, delayed or conditioned), or as such consent may be obtained in accordance with Section 12.3(c), or as permitted by Section 12.3(d).
(b) **Securities Filings.** Law. Each Party acknowledges and agrees that the other Party may submit this Agreement (including for clarity, the Exhibits and Schedules hereto) to the United States Securities and Exchange Commission (the “SEC”) or any other securities exchange and if a Party does submit this Agreement to the SEC or any other securities exchange, such Party agrees to consult with the other Party with respect to the preparation and submission of, a confidential treatment request for this Agreement. If a Party is required by Law to make a disclosure of the terms of this Agreement in a filing with or other submission to the SEC or any other securities exchange or otherwise to comply with Law, and (i) such Party has provided copies of the disclosure to the other Party as far in advance of such filing or other disclosure as is reasonably practicable under the circumstances, (ii) such Party has promptly notified the other Party in writing of such requirement and any respective timing constraints, and (iii) such Party has given the other Party a reasonable time under the circumstances from the date of notice by such Party of the required disclosure to comment upon, request confidential treatment or approve such disclosure, then such Party will have the right to make such public disclosure at the time and in the manner reasonably determined by its counsel to be required by Law.

(c) **Press Releases.** Neither Party may issue any press release or make any other public announcement or statement concerning this Agreement, the transactions contemplated hereby or the terms hereof, without the prior written approval of the other Party, except as may be required by applicable Law. In the event either Party (the “Issuing Party”) desires to issue a press release or other public statement disclosing information relating to this Agreement, the transactions contemplated hereby or the terms hereof, the Issuing Party will provide the other Party (the “Reviewing Party”) with a copy of the proposed press release or public statement (the “Release”) and seek the Reviewing Party’s prior written consent. The Issuing Party will specify with each such Release, taking into account the urgency of the matter being disclosed, a reasonable period of time within which the Reviewing Party may provide any comments on such Release and if the Reviewing Party fails to provide any comments during the response period called for by the Issuing Party, the Reviewing Party will be deemed to have not consented to the issuance of such Release. If the Reviewing Party provides any comments, the Parties will consult on such Release and work in good faith to prepare a mutually acceptable Release. Either Party may subsequently publicly disclose any information previously contained in any Release so consented to.

(d) **Joint Press Release.** The Parties agree to issue the joint press release in Exhibit H promptly following the Effective Date.

12.4. **Relationship to the Confidentiality Agreement.** This Agreement supersedes the Confidentiality Agreement; provided, that all “Confidential Information” disclosed or received by the Parties thereunder will be deemed “Confidential Information” hereunder and will be subject to the terms and conditions of this Agreement.
13. Patent Prosecution, Maintenance and Enforcement


(a) Moderna [***] Patents.

(i) Subject to [***], Moderna will have the sole right, but not the obligation, using counsel of its choosing, to Prosecute and Maintain all Moderna [***] Patents throughout the Territory.

(ii) Moderna will be solely responsible for the Patent Costs incurred by Moderna in connection with this Section 13.1(a).

(b) Moderna [***] Patents and Moderna [***] Patents.

(i) [***]

(ii) [***]

(iii) [***]

(c) Moderna [***] Patents and Moderna [***] Patents.

(i) [***]

(ii) [***]

(iii) [***]

(d) Moderna [***] Patents.

(i) [***]

(ii) [***]

(iii) [***]

(e) Cooperation. The non-prosecuting Party will, and will cause its Affiliates to, reasonably assist and cooperate with the prosecuting Party in connection with Prosecuting and Maintaining under this Section 13.1.

13.2. Patent Extensions. With respect to any election for patent term restoration or extension, supplemental protection certificate or any of their equivalents, (a) Merck will have the sole right to make any such decision relating to the [***]; and (b) Moderna will have the right to make any such decision relating to the Moderna [***] Patents and Moderna [***] Patents. Upon the request by a Party, such other Party through will reasonably cooperate in the implementation of such requesting Party’s decisions under this Section 13.2.
13.3. **Patent Listings.** With respect to any filings made to Regulatory Authorities with respect to the Moderna Patents for any Elected Candidate or Product, including as required or allowed in connection with in the United States, the FDA's Orange Book, if applicable, or outside the United States, other international equivalents, Merck will have the sole right to make all decisions regarding such filings as Merck deems appropriate. Upon the request by Merck, Moderna will reasonably cooperate in the implementation of Merck’s decisions regarding the filing and listing pursuant to this Section 13.3.

13.4. **Joint Patents.** With respect to any Joint Patents included in the [***] or Moderna [***] Patents, the provisions of Sections [***] shall apply to the Prosecution and Maintenance of such Joint Patents to the extent such Joint Patent is included as either a Moderna [***] Patent or Moderna [***] Patents, as applicable. With respect to all other Joint Patents, the Parties shall mutually agree upon the responsibility for the Prosecution and Maintenance of such Joint Patents and the Patent Costs therefor.

13.5. **Third Party Rights.** Notwithstanding the foregoing provisions of this Section 13, each Party’s rights and obligations under this Section 13 with respect to any Moderna [***] Patent or Moderna [***] Patent licensed to Moderna or its Affiliate pursuant to a Moderna Collaboration In-License will be subject to the Third Party rights and obligations under such Moderna Collaboration In-License [***]; provided, however, that, to the extent that Moderna has [***].

13.6. [***]

13.7. **Patent Enforcement and Defense.**

(a) **Notice.** Each Party will promptly notify the other Party, in writing, upon learning of any actual or suspected Competitive Infringement of [***] by a Third Party, [***], and will, along with such notice, provide any evidence in its possession pertaining thereto.

(b) [***] and Competitive Infringement.

(i) As between the Parties, [***].

(ii) [***]

(c) **Defense.** As between the Parties, [***].

(d) **Withdrawal, Cooperation and Participation.** With respect to any infringement or defensive action identified above in this Section 13.7.

(i) If the controlling Party ceases to pursue or withdraws from such action, it will promptly notify the other Party (in sufficient time to enable the other Party to meet any deadlines by which any action must be taken to preserve any rights in such infringement or defensive action) and such other Party may substitute itself for the withdrawing Party and proceed under the terms and conditions of this Section 13.7.

(ii) The non-controlling Party will cooperate with the Party controlling any such action (as may be reasonably requested by the controlling Party), including [***]. The Party controlling any such action will keep the non-controlling Party updated with respect to any such action, including providing copies of all documents received or filed in connection with any such action.
(iii) Each Party will have the right to participate or otherwise be involved in any such action controlled by the other Party, in each case at the non-controlling Party’s sole cost and expense. If a Party elects to so participate or be involved, the controlling Party will provide the non-controlling Party and its counsel with an opportunity to consult with the controlling Party and its counsel regarding the prosecution of such action (including reviewing the contents of any correspondence, legal papers or other documents related thereto), and the controlling Party will take into account reasonable requests of the non-controlling Party regarding such enforcement or defense.

(iv) Damages. Unless otherwise agreed by the Parties, all monies recovered upon the final judgment or settlement of any action described in [*] will be [*].

(v) Third Party Rights. To the extent that a Third Party licensor under a Moderna Collaboration In-License has retained any right to [***], Moderna will use Commercially Reasonable Efforts to cause such Third Party licensor to take the actions specified by this Section 13.7 in a manner consistent with the Moderna Collaboration In-License applicable thereto, but Moderna will not be deemed to be in breach of its obligations under this Section 13.7 if, after using such Commercially Reasonable Efforts, it is unable to comply with such obligations because of actions taken or not taken by such Third Party licensor.

14. Representations and Warranties; Limitations of Liability; Indemnification; Covenants.

14.1. Representations and Warranties of Each Party. Each Party represents and warrants to the other as of the Effective Date that:

(a) Such Party is duly organized, validly existing and in good standing under the laws of the jurisdiction in which it is organized.

(b) Such Party (i) has the legal right and power to enter into this Agreement, to extend the rights granted or to be granted to the other in this Agreement, and to fully perform its obligations hereunder, including to grant the licenses set forth herein, and (ii) has taken all requisite action on its part to authorize the execution and delivery of this Agreement and the performance of its obligations hereunder. This Agreement has been duly executed and delivered on behalf of such Party, and constitutes a legal, valid and binding obligation, enforceable against such Party in accordance with its terms, except as may be limited by bankruptcy, insolvency, reorganization or other laws affecting creditors’ rights generally and by general equitable principles.

(c) Neither such Party nor its Affiliates has been debarred or is subject to debarment. Neither it nor its Affiliates will use in any capacity, in connection with the services to be performed under this Agreement, any person who has been debarred pursuant to Section 306 of the FFDCA, or who is the subject of a conviction described in such section. In addition, neither it nor its Affiliates has used in any capacity, in connection with any Development activities with respect to [*]
the mRNA Technology, mRNA Construct or any Polypeptide included hereunder carried out prior to the Effective Date, any person who has been debarred or was the subject of a conviction described in Section 306. Such Party agrees to inform the other Party in writing immediately if it or any person who is performing services under this Agreement is debarred or is the subject of a conviction described in Section 306, or if any action, suit, claim, investigation or legal or administrative proceeding is pending or, to the best of such Party’s or its Affiliates’ Knowledge, is threatened, relating to the debarment or conviction of such Party or any person performing services under this Agreement, or if such Party becomes aware that it or any person performing Development activities with respect to an mRNA Construct, Polypeptide, Product Candidate, Elected Candidate or Product included hereunder carried out prior to the Effective Date was debarred or was the subject of a conviction described in Section 306.

(d) All necessary consents, approvals and authorizations of all governmental authorities and other Persons required to be obtained by such Party to enter into, or perform its obligations under, this Agreement have been obtained.

(e) The execution and delivery of this Agreement and the performance of such Party’s obligations hereunder (i) will not conflict with or violate any requirement of applicable Law or orders of governmental bodies, (ii) do not conflict with, or constitute a default under, any contractual obligation of such Party and (iii) do not conflict with or violate any provision of the corporate charter, by-laws or other organizational documents of such Party.

14.2. Additional Representations of Moderna. Moderna represents and warrants to Merck that as of the Effective Date:

(a) there are no [***] and to Moderna’s Knowledge, no [***] relating to the Moderna Patents and/or Moderna Know-How;

(b) Schedule 1.123 sets forth a true, correct and complete list of Moderna Patents and such schedule contains all application numbers and filing dates, registration numbers and dates, jurisdictions and owners. [***]

(c) to Moderna’s Knowledge (i) all Patents within the Moderna Patents have been procured or are being procured from the respective patent offices in accordance with applicable Law, and (ii) the issued Patents within the Moderna Patents are [***];

(d) it (and its Affiliates) has not prior to the Effective Date (i) assigned, transferred or conveyed its right, title and/or interest in Moderna Patents or Moderna Know-How, or (ii) otherwise granted any rights to any Third Parties that would, in the case of clauses (i) and/or (ii), conflict with the rights granted to Merck hereunder, and, to Moderna’s Knowledge, there is no unauthorized use, infringement or misappropriation of any Moderna Patent or Moderna Know-How;

(e) it or its Affiliate is the sole and exclusive owner of the [***] which are as at the Effective Date free and clear of any liens, charges and encumbrances (excluding those entered into the ordinary course of financing its business), and no other Person has as at the Effective Date any claim of ownership whatsoever with respect to the [***];
14.3. Disclaimers. Without limiting the respective rights and obligations of the Parties expressly set forth herein, each Party specifically disclaims any guarantee that the Collaboration Activities or any Product Candidate will be successful, in whole or in part. EXCEPT AS OTHERWISE EXPRESSLY PROVIDED IN THIS AGREEMENT, THE PARTIES MAKE NO REPRESENTATIONS AND EXTEND NO WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED (AND EACH PARTY HEREBY EXPRESSLY DISCLAIMS ANY AND ALL REPRESENTATIONS AND WARRANTIES NOT EXPRESSLY PROVIDED IN THIS AGREEMENT), INCLUDING WITH RESPECT TO ANY PATENTS OR KNOW-HOW, mRNA CONSTRUCTS, PRODUCT CANDIDATES, MATERIALS, OR mRNA PRODUCTS, INCLUDING WARRANTIES OF VALIDITY OR ENFORCEABILITY OF ANY PATENTS, TITLE, QUALITY, MERCHANTABILITY, FITNESS FOR A PARTICULAR USE OR PURPOSE, PERFORMANCE, AND NONINFRINGEMENT OF ANY THIRD PARTY PATENTS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

14.4. No Consequential Damages. NOTWITHSTANDING ANYTHING IN THIS AGREEMENT, EXCEPT FOR DAMAGES DUE TO THE FRAUD OR WILFUL MISCONDUCT OR GROSS NEGLIGENCE OF THE LIABLE PARTY, NEITHER PARTY WILL BE LIABLE TO THE OTHER OR ANY THIRD PARTY WITH RESPECT TO ANY SUBJECT MATTER OF THIS AGREEMENT FOR ANY INDIRECT, PUNITIVE, SPECIAL OR CONSEQUENTIAL DAMAGES, EVEN IF SUCH PARTY HAS BEEN INFORMED OR SHOULD HAVE KNOWN OF THE POSSIBILITY OF SUCH DAMAGES; PROVIDED, THAT THIS SECTION 14.4 WILL NOT APPLY TO THE PARTIES’ INDEMNIFICATION RIGHTS AND OBLIGATIONS UNDER SECTION 14.5.

14.5. Indemnification.

(a) Indemnification by Merck. Merck will indemnify Moderna, its Affiliates and their respective directors, officers, employees and agents, and their respective successors, heirs and assigns (collectively, “Moderna Indemnitees”), and defend and save each of them harmless, from and against any and all losses, damages, liabilities, costs and expenses (including reasonable
attorneys’ fees and expenses) (collectively, “Losses”) in connection with any and all suits, investigations, claims or demands of Third Parties (collectively, “Third Party Claims”) arising from or occurring as a result of: [***], except in each case for those Losses and Third Party Claims for which Moderna has an obligation to indemnify Merck pursuant to Section 14.5(b) (or would have had such Third Party Claim been made against Merck under this Agreement), as to which Losses each Party will indemnify the other to the extent of their respective liability; provided, that Merck will not be obligated to indemnify Moderna Indemnitees for any Losses or Third Party Claims to the extent that such Losses or Third Party Claims arise as a result of gross negligence or willful misconduct on the part of a Moderna Indemnitee or breach of this Agreement by Moderna.

(b) Indemnification by Moderna. Moderna will indemnify Merck, its Affiliates and their respective directors, officers, employees and agents, and their respective successors, heirs and assigns (collectively, “Merck Indemnitees”), and defend and save each of them harmless, from and against any and all Losses in connection with any and all Third Party Claims arising from or occurring as a result of: [***], except in each case for those Losses and Third Party Claims for which Merck has an obligation to indemnify Moderna pursuant to Section 14.5(a)(i) or 14.5(a)(ii) (or would have had such Third Party Claim been made against Moderna under this Agreement), as to which Losses each Party will indemnify the other to the extent of their respective liability for the Losses; provided, that Moderna will not be obligated to indemnify Merck Indemnitees for any Losses or Third Party Claims to the extent that such Losses or Third Party Claims arise as a result of gross negligence or willful misconduct on the part of a Merck Indemnitee or breach of this Agreement by Merck.

(c) Notice of Claim. All indemnification claims provided for in Section 14.5(a) and 14.5(b) will be made solely by such Party to this Agreement (the “Indemnified Party”). The Indemnified Party will promptly notify the indemnifying Party (an “Indemnification Claim Notice”) of any Losses or the discovery of any fact upon which the Indemnified Party intends to base a request for indemnification under Section 14.5(a) or 14.5(b), but in no event will the indemnifying Party be liable for any Losses that result from any delay in providing such notice. Each Indemnification Claim Notice must contain a description of the claim and the nature and estimated amount of such Loss (to the extent that the nature and amount of such Loss is known at such time). The Indemnified Party will furnish promptly to the indemnifying Party copies of all papers and official documents received in respect of any Losses and Third Party Claims. Notwithstanding the foregoing, any delay or failure to provide any notices or copies pursuant to this Section 14.5(c) shall not constitute a waiver or release of, or otherwise limit, the Indemnified Party’s rights to indemnification under this Section 14.5, except to the extent that such delay or failure materially prejudices the indemnifying Party’s ability to defend against the relevant claims.

(d) Defense, Settlement, Cooperation and Expenses.

(i) Control of Defense. At its option, the indemnifying Party may assume the defense of any Third Party Claim by giving written notice to the Indemnified Party within [***] days after the indemnifying Party’s receipt of an Indemnification Claim Notice. The assumption of the defense of a Third Party Claim by the indemnifying Party will not be construed as an acknowledgment that the indemnifying Party is liable to indemnify the Indemnified Party in respect of the Third Party Claim, nor will it constitute a waiver by the indemnifying Party of any defenses it may assert against the Indemnified Party’s claim for indemnification. Upon assuming
the defense of a Third Party Claim, the indemnifying Party may appoint as lead counsel in the defense of the Third Party Claim any legal counsel selected by
the indemnifying Party (the indemnifying Party will consult with the Indemnified Party with respect to a possible conflict of interest of such counsel retained
by the indemnifying Party). In the event the indemnifying Party assumes the defense of a Third Party Claim, the Indemnified Party will immediately deliver
to the indemnifying Party all original notices and documents (including court papers) received by the Indemnified Party in connection with the Third Party
Claim. Should the indemnifying Party assume the defense of a Third Party Claim, except as provided in Section 14.5(d)(i), the indemnifying Party will not
be liable to the Indemnified Party for any legal costs or expenses subsequently incurred by such Indemnified Party in connection with the analysis, defense or
settlement of the Third Party Claim. [***]

(ii) Right to Participate in Defense. Without limiting Section 14.5(d)(i), any Indemnified Party will be entitled to participate in, but not control,
the defense of such Third Party Claim and to employ counsel of its choice for such purpose; provided, that such employment will be at the Indemnified
Party’s own cost and expense unless [***].

(iii) Settlement. With respect to any Third Party Claims that relate solely to the payment of money damages in connection with a Third Party
Claim and that will not result in the Indemnified Party’s becoming subject to injunctive or other relief or otherwise adversely affecting the business of the
Indemnified Party in any manner, and as to which the indemnifying Party will have acknowledged in writing the obligation to indemnify the Indemnified
Party hereunder, the indemnifying Party will have the sole right to agree to the entry of any judgment, enter into any settlement or otherwise dispose of such
Loss, on such terms as the indemnifying Party, in its sole discretion, will deem appropriate. With respect to all other Losses in connection with Third Party
Claims, where the indemnifying Party has assumed the defense of the Third Party Claim in accordance with Section 14.5(d)(i), the indemnifying Party will
have authority to agree to the entry of any judgment, enter into any settlement or otherwise dispose of such Loss provided it obtains the prior written consent
of the Indemnified Party (such consent not to be unreasonably withheld, delayed or conditioned). The indemnifying Party will not be liable for any
settlement or other disposition of a Loss by an Indemnified Party that is reached without the prior written consent of the indemnifying Party. Regardless of
whether the indemnifying Party chooses to defend or prosecute any Third Party Claim, no Indemnified Party will admit any liability with respect to or settle,
compromise or discharge, any Third Party Claim without the prior written consent of the indemnifying Party, such consent not to be unreasonably withheld,
delayed or conditioned.

(iv) Cooperation. If the indemnifying Party chooses to defend or prosecute any Third Party Claim, the Indemnified Party will, and will cause
each other Indemnified Party to, cooperate in the defense or prosecution thereof and will furnish such records, information and testimony, provide such
witnesses and attend such conferences, discovery proceedings, hearings, trials and appeals as may be reasonably requested in connection therewith. Such
cooperation will include access during normal business hours afforded to indemnifying Party to, and reasonable retention by the Indemnified Party of,
records and information that are reasonably relevant to such Third Party Claim, and making Indemnified Parties and other employees and agents available on
a mutually convenient basis to provide additional information and explanation of any material provided hereunder, and the indemnifying Party will
reimburse the Indemnified Party for all its reasonable out-of-pocket costs and expenses in connection therewith.

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(v) Costs and Expenses. Except as provided above in this Section 14.5(d), the reasonable and verifiable costs and expenses, including attorneys' fees and expenses, incurred by the Indemnified Party in connection with any claim will be reimbursed on a Calendar Quarter basis by the indemnifying Party, without prejudice to the indemnifying Party’s right to contest the Indemnified Party’s right to indemnification and subject to refund in the event the indemnifying Party is ultimately held not to be obligated to indemnify the Indemnified Party.

14.6. Insurance. Each Party will maintain at its sole cost and expense, an adequate liability insurance or self-insurance program (including product liability insurance) to protect against potential liabilities and risk arising out of activities to be performed under this Agreement, and any agreement related hereto and upon such terms (including coverages, deductible limits and self-insured retentions) as are customary in the U.S. pharmaceutical industry, or, if such activities are conducted outside the U.S., as are customary in such country, for the activities to be conducted by such Party under this Agreement. The coverage limits set forth herein will not create any limitation on a Party’s liability to the other under this Agreement. Each Party shall provide the other Party with written evidence of such insurance upon request. Each Party shall provide the other Party with written notice at least [***] days prior to the cancellation, non-renewal or material change in such insurance or self-insurance which materially adversely affects the rights of the other Party hereunder.

14.7. Covenants of Moderna. Moderna hereby covenants that:

(a) [***]

(b) [***]

14.8. Additional Covenants. [***]

15. Term and Termination.

15.1. Term. This Agreement shall commence as of the Effective Date and, unless sooner terminated in accordance with the terms hereof or by mutual written consent, shall continue on a Product-by-Product and country-by-country basis until the end of the Royalty Term with respect to such Product in such country (the “Term”). On a country-by-country and Product-by-Product basis, upon the expiration of the Royalty Term for such Product in such country the licenses granted to Merck shall become fully-paid, perpetual and irrevocable for such Product in such country.

15.2. Termination by Moderna for Breach. Moderna will have the right to terminate this Agreement in full in the event of a material breach by Merck of this Agreement, provided, that to the extent that any such material breach is limited to a particular R&D Program, Product Candidate, Elected Candidate, Product or country, Moderna will have the right to terminate this Agreement only with respect to such R&D Program, Product Candidate, Elected Candidate, Product or country to which such material breach primarily relates. Notwithstanding the foregoing, any such termination under this Section 15.2 will not be effective if such material breach has been cured within [***] days after written notice thereof is given by Moderna to Merck specifying the nature of the alleged material breach (or, if such default cannot be cured within such [***]-day period, such longer period as reasonably required to cure such material breach; provided, that Merck commences actions to cure such default within such [***]-day period and thereafter diligently continues such actions); provided, that to the extent such material breach involves the failure to make an undisputed payment when due, such material breach must be cured within [***] days after written notice thereof is given by Moderna to Merck.
15.3. Termination by Merck.

(a) **Breach.** Merck will have the right to terminate this Agreement in full in the event of a material breach by Moderna of this Agreement; provided, that to the extent that any such material breach is limited to a particular R&D Program, Product Candidate, Elected Candidate, Product or country, Merck will have the right to terminate this Agreement only with respect to such R&D Program, Product Candidate, Elected Candidate, Product or country to which such material breach primarily relates. Notwithstanding the foregoing, any such termination under this Section 15.3(a) will not be effective if such material breach has been cured within [***] days after written notice thereof is given by Merck to Moderna specifying the nature of the alleged material breach (or, if such default cannot be cured within such [***]-day period, such longer period as reasonably required to cure such material breach; provided, that Moderna commences actions to cure such default within such [***]-day period and thereafter diligently continues such actions). [***]

(b) **Discretionary Termination.**

(i) Merck will have the right to terminate this Agreement in its entirety or with respect to an Product Candidate, Elected Candidate, or Product upon [***] days after delivery of written notice to Moderna if Merck concludes due to scientific, technical, regulatory or commercial reasons, including [***].

(ii) Merck will have the right to terminate this Agreement for any reason in its entirety or with respect to a Product Candidate, Elected Candidate and associated Product upon [***] days after delivery of written notice to Moderna.

15.4. **Terminated Rights.** In the event this Agreement is terminated with respect only to particular R&D Programs, Product Candidates, Elected Candidates or Products (and is not terminated in full), such terminated R&D Programs, Product Candidates, Elected Candidates and associated Products are referred to herein as the “**Terminated Rights**”, and the rights and obligations of the Parties as to the remaining R&D Programs, Product Candidates, Elected Candidates and associated Products in which termination has not yet occurred shall be unaffected by such termination.

15.5. **Effects of Termination by Moderna for Merck Material Breach.** Upon termination of this Agreement in full or with respect to any Terminated Rights by Moderna pursuant to Section 15.2:

(a) all rights and licenses granted by Moderna to Merck in Section 9.1 with respect to the Terminated Rights will terminate, and Merck and its Affiliates will cease all use of Moderna Technology hereunder and all Development of and Commercialization of such Terminated Rights. Subject to the remainder of this Section 15.5, all rights and licenses granted by Merck to Moderna in Section 9.2 with respect to the Terminated Rights will terminate and Moderna and its Affiliates will cease all use of the applicable Merck Technology.
(b) any R&D Targets and R&D Polyproteins therefor, Product Candidates, Elected Candidates, Collaboration mRNA Constructs and Products with respect to the Terminated Rights will become, respectively, Discontinued Targets, and Discontinued mRNA Constructs.

(c) Merck will responsibly wind-down, in accordance with accepted pharmaceutical industry norms and ethical practices, any on-going clinical studies with respect to the Terminated Rights in which patient dosing has commenced or, if requested by Moderna, Merck will transfer responsibility for such clinical study to Moderna. Merck will be responsible for any costs associated with such wind-down.

(d) to the extent permitted by applicable Law, owned (in whole or in part) by Merck or its Affiliates or Sublicensees relating exclusively to the Terminated Rights (but excluding any Combination Product), as such items exist as of the effective date of such termination (including [*] will be assigned to Moderna, and Merck will provide to Moderna one (1) copy of the foregoing and all [*] in any such items. In the event of failure to obtain assignment, Merck hereby consents and grants to Moderna the [*].

(e) Merck hereby grants to Moderna, and Moderna shall automatically have, a worldwide, [*], royalty-free and fully paid-up, exclusive license, with the right to grant sublicenses through multiple tiers, under the [*] owned by Merck or any of its Affiliates as of the date of such termination and [*] the Terminated Rights, effective only as of and after the effective date of such termination, for Developing and Commercializing such Terminated Rights (but excluding [*]) but solely as such Terminated Rights were being Developed or Commercialized by Merck as of the effective date of such termination.

15.6. Effects of Termination by Merck for Discretionary Reasons or for Moderna Breach. Upon termination of this Agreement by Merck pursuant to Section 15.3(a) in full or with respect to any Terminated Rights:

(a) all rights and licenses granted by Moderna to Merck in Section 9.1 with respect to the Terminated Rights will terminate, and Merck and its Affiliates will cease all use of Moderna Technology hereunder and all Development and Commercialization of such Terminated Rights. All rights and licenses granted by Merck to Moderna in Section 9.2 with respect to the Terminated Rights will terminate and Moderna and its Affiliates will cease all use of the applicable Merck Technology.

(b) any R&D Programs, R&D Targets and R&D Polyproteins therefor, Product Candidates, Elected Candidates, Collaboration mRNA Constructs and Products with respect to the Terminated Rights will become, respectively, Discontinued Programs, Discontinued Targets and Discontinued mRNA Constructs.

(c) Merck will responsibly wind-down, [*], any on-going clinical studies with respect to the Terminated Rights in which patient dosing has commenced or, if requested by Moderna, Merck will transfer responsibility for such clinical study to Moderna; provided that Moderna shall not have the right to request a transfer of such clinical study if the termination is pursuant to Section 15.3(b)(i)(A). Merck will be responsible for any costs associated with such wind-down; provided that if the termination is pursuant to Section 15.3(a), Moderna shall be responsible for such costs.
(d) Merck will covenant not to, alone or in cooperation with any Third Party, sue or to bring any cause of action against Moderna, its Affiliates, or any sublicensees of the foregoing for any type of infringement or misappropriation under the Merck Technology owned by Merck or its Affiliates for the development, manufacture, use, commercialization, offer for sale, sale, distribution, import or export of any of the Terminated Rights (but excluding any Combination Product).

(e) The Parties hereby acknowledge and agree that in the event that Merck delivers notice of termination to Moderna pursuant to Section 15.3(a), but prior to the effective date of such termination, a Milestone Payment under Table 1 in Section 8.4 becomes payable in accordance with Section 8.4, then, notwithstanding the provisions of Section 8.4 or anything to the contrary contained herein, Merck shall not be required to pay any such Milestone Payment to Moderna.

15.7. Alternative to Termination. Notwithstanding the foregoing, in the event this Agreement (or any particular Terminated Right) may otherwise be validly terminated by Merck pursuant to Section 15.3(a), then in lieu of such termination, Merck may elect, at its option, to [***] but otherwise to continue this Agreement in force with respect to such Terminated Right.

15.8. Return of Confidential Information. Except as otherwise necessary to continue exercising any ongoing licenses under this Agreement, upon expiration or termination of this Agreement, the Parties will return (or destroy or erase, as directed by the other Party) all data, files, records and other materials containing or comprising the other Party’s Confidential Information with respect to the Terminated Rights. Notwithstanding the foregoing, (i) in respect of physical embodiments of information, the Parties will be permitted to retain one copy of such data, files, records, and other materials for non-commercial archival purposes, and (ii) in respect of any information stored electronically or in other non-physical media, it will be sufficient for such Party to procure that access to such information is restricted to non-commercial archiving purposes only.

15.9. Survival. In addition to the consequences of expiration or termination set forth in Section 15.4, the following provisions will survive termination or expiration of this Agreement: [***]. Termination or expiration of this Agreement will not relieve the Parties of any liability or obligation which accrued hereunder prior to the effective date of such termination or expiration nor preclude either Party from pursuing all rights and remedies it may have hereunder or at law or in equity with respect to any breach of this Agreement. All other rights and obligations will terminate upon expiration of this Agreement.


16.1. Dispute Resolution.

(a) Disputes. Disputes of any nature arising under, relating to, or in connection with this Agreement (“Disputes”) will be resolved pursuant to this Section 16.1.
(b) Dispute Escalation. In the event of a Dispute between the Parties, the Parties will first attempt to resolve such dispute by negotiation and consultation between themselves or the JSC. In the event that such dispute is not resolved on an informal basis within [***] days from receipt of the written notice of a Dispute, any Party may, by written notice to the other, have such dispute referred to the Executive Officers (or their designees, which designee is required to have decision-making authority on behalf of such Party), who will attempt to resolve such Dispute by negotiation and consultation for a [***] day period following receipt of such written notice.

(c) Full Arbitration. In the event the Parties have not resolved such Dispute within [***] days of receipt of the written notice referring such Dispute to the Executive Officers, either Party may at any time after such [***]-day period submit such Dispute to be finally settled by arbitration administered in accordance with the procedural rules of the American Arbitration Association ("AAA") in effect at the time of submission, as modified by this Section 16.1(c). The arbitration will be governed by the Laws of the state of New York. The arbitration will be heard and determined by three (3) arbitrators who are retired judges or attorneys with at least [***] of relevant experience in the pharmaceutical and biotechnology industry, each of whom will be impartial and independent. Each Party will appoint one arbitrator and the third arbitrator will be selected by the two Party-appointed arbitrators, or, failing agreement within [***] days following appointment of the second arbitrator, by AAA. Such arbitration will take place in [***]. The arbitration award so given will be a final and binding determination of the dispute, will be fully enforceable in any court of competent jurisdiction, and will not include any damages expressly prohibited by Section 14.4. Fees, costs and expenses of arbitration are to be divided by the Parties in the following manner: Merck will pay for the arbitrator it chooses, Moderna will pay for the arbitrator it chooses, and the Parties will share payment for the third arbitrator. Except in a proceeding to enforce the results of the arbitration or as otherwise required by law, neither Party nor any arbitrator may disclose the existence, content or results of any arbitration hereunder without the prior written consent of both Parties (each such consent not to be unreasonably withheld, delayed or conditioned).

(d) Injunctive Relief. Notwithstanding the dispute resolution procedures set forth in this Section 16.1, in the event of an actual or threatened breach of this Agreement, the aggrieved Party may seek provisional equitable relief (including restraining orders, specific performance or other injunctive relief), without first submitting to any dispute resolution procedures hereunder.

(e) Tolling. The Parties agree that all applicable statutes of limitation and time-based defenses (such as estoppel and laches) will be tolled while the dispute resolution procedures set forth in this Section 16.1 are pending, and the Parties will cooperate in taking all actions reasonably necessary to achieve such a result. [***]

16.2. Cumulative Remedies and Irreparable Harm. All rights and remedies of the Parties hereunder will be cumulative and in addition to all other rights and remedies provided hereunder or available by agreement, at law or otherwise. Each Party acknowledges and agrees that breach of any of the terms or conditions of this Agreement may cause irreparable harm and damage to the other and that such damage may not be ascertainable in money damages and that as a result thereof the non-breaching Party would be entitled to seek on an interim basis from a court and on a permanent basis from an arbitral tribunal equitable or injunctive relief restraining any breach or future violation of the terms contained herein by the breaching Party without the necessity of proving actual damages or posting bond. Such right to equitable relief is in addition to whatever remedies either Party may be entitled to as a matter of law or equity, including money damages.
16.3. **Business Combination.** Notwithstanding anything to the contrary herein, in the event of an acquisition of a Party by a Significant Third Party as part of a Business Combination, then for purposes of this Agreement, [***]. “Significant Third Party” means a Third Party [***].

16.4. **Relationship of Parties.** Nothing in this Agreement is intended or will be deemed to constitute a partnership, agency, employer-employee or joint venture relationship between the Parties. No Party will incur any debts or make any commitments for the other, except to the extent, if at all, specifically provided herein. There are no express or implied third party beneficiaries hereunder.

16.5. **Compliance with Law.** Each Party will perform or cause to be performed any and all of its obligations or the exercise of any and all of its rights hereunder in good scientific manner and in compliance with all applicable Law.

16.6. **Force Majeure.** Neither Party will be liable to the other for failure of or delay in performing obligations set forth in this Agreement, and neither will be deemed in breach of such obligations, if such failure or delay is due to natural disasters or any causes reasonably beyond the control of such Party; provided, that the Party affected will promptly notify the other of the force majeure condition and will exert reasonable efforts to eliminate, cure or overcome any such causes and to resume performance of its obligations as soon as possible.

16.7. **Governing Law.** This Agreement will be governed by and construed in accordance with the Laws of the state of New York, without respect to its conflict of laws rules or principles that might otherwise refer construction or interpretation of this Agreement to the substantive Law of another jurisdiction; provided, that any dispute relating to the scope, validity, enforceability or infringement of any Patents will be governed by, and construed and enforced in accordance with, the substantive Laws of the jurisdiction in which such Patents apply. The Parties agree to exclude the application to this Agreement of the United Nations Convention on Contracts for the International Sale of Goods.

16.8. **Counterparts; Facsimiles.** This Agreement may be executed in one or more counterparts, each of which will be deemed an original, and all of which together will be deemed to be one and the same instrument. Facsimile or PDF execution and delivery of this Agreement by either Party will constitute a legal, valid and binding execution and delivery of this Agreement by such Party.

16.9. **Headings.** All headings in this Agreement are for convenience only and will not affect the meaning of any provision hereof.

16.10. **Waiver of Rule of Construction.** Each Party has had the opportunity to consult with counsel in connection with the review, drafting and negotiation of this Agreement. Accordingly, the rule of construction that any ambiguity in this Agreement will be construed against the drafting party will not apply.

16.11. **Interpretation.** Whenever any provision of this Agreement uses the term “including” (or “includes”), such term will be deemed to mean “including without limitation” (or “includes without limitations”). “Herein,” “hereby,” “hereunder,” “hereof” and other equivalent words refer to this Agreement as an entirety and not solely to the particular portion of this
Agreement in which any such word is used. Except where the context otherwise requires, whenever used, the singular will include the plural, the plural the singular, the use of any gender will be applicable to all genders and the word “or” is used in the inclusive sense (and/or). Unless otherwise provided, all references to Sections, Schedules and Exhibits in this Agreement are to Sections, Schedules and Exhibits of this Agreement. References to any Sections include Sections and subsections that are part of the related Section (e.g., a section numbered “Section 2.1” would be part of “Section 2”, and references to “Section 2.1” would also refer to material contained in the subsection described as “Section 2.1(a)”). Citations to a statute or regulation will be deemed to mean such statute or regulation and any amendment or supplement thereto or any replacement thereof.

16.12. **Binding Effect.** This Agreement will inure to the benefit of and be binding upon the Parties, their Affiliates, and their respective lawful successors and assigns.

16.13. **Assignment.**

(a) This Agreement may not be assigned by either Party, nor may either Party delegate its obligations or otherwise transfer any licenses granted herein or other rights created by this Agreement, except as expressly permitted hereunder, without the prior written consent of the other Party, which consent will not be unreasonably withheld, delayed or conditioned; provided, that either Party may assign this Agreement to an Affiliate (provided that the Party assigning to an Affiliate will remain fully liable for any acts or omissions, including financial liabilities, of such Affiliate) or to such Party’s successor in connection with the merger, consolidation, sale of all or substantially all of its assets or that portion of its business pertaining to the subject matter of this Agreement, or any Business Combination of such Party. The rights and obligations of the Parties under this Agreement will be binding upon and inure to the benefit of the successors and permitted assigns of the Parties, and the name of a Party appearing herein will be deemed to include the name of such Party’s successors and permitted assigns to the extent necessary to carry out the intent of this Section 16.13.

(b) In the event Moderna or any Affiliate of Moderna that does work hereunder or is in possession of Confidential Information of Merck (including Moderna LLC) undergoes as a Business Combination, Moderna shall [***].

16.14. **Extension to Affiliates.** Each Party shall have the right to extend the rights, licenses, immunities and obligations granted or imposed in this Agreement to one or more of its Affiliates, and in the case of Moderna, Moderna acknowledges that it will use its wholly-owned Affiliate Valera LLC to perform certain Collaboration Activities hereunder. All applicable terms and provisions of this Agreement shall apply to any such Affiliate to which this Agreement has been extended to the same extent as such terms and provisions apply to such Party. Each Party shall remain fully liable for any acts or omissions, including financial liabilities, of such Affiliates. To the extent that this Agreement imposes obligations on any Affiliates of a Party, such Party agrees to cause its Affiliates to perform such obligations.
16.15. Notices. All notices, requests, demands and other communications required or permitted to be given pursuant to this Agreement will be in writing and will be deemed to have been duly given upon the date of receipt if delivered by hand, recognized international overnight courier, confirmed facsimile transmission, or registered or certified mail, return receipt requested, postage prepaid to the following addresses or facsimile numbers:

If to Moderna:
Moderna Therapeutics, Inc.
200 Technology Square
Cambridge, MA 02139
Attention: Chief Executive Officer

With a copy to:
Moderna Therapeutics, Inc.
200 Technology Square
Cambridge, MA 02139
Attention: General Counsel

If to Merck:
Merck Sharp & Dohme Corp.
One Merck Drive
P.O. Box 100, WS3A-65
Whitehouse Station, NJ 08889-0100
Attention: Office of Secretary
Facsimile No.: (908)735-1246

With a copy to:
Merck Sharp & Dohme Corp.
One Merck Drive
P.O. Box 100
Whitehouse Station, NJ 08889-0100
Attention: Vice-President, Business Development and Licensing, Merck Research Laboratories
Facsimile No.: (908)735-1204

Either Party may change its designated address and facsimile number by notice to the other Party in the manner provided in this Section 16.14.

16.16. Amendment and Waiver. This Agreement may be amended, supplemented, or otherwise modified only by means of a written instrument signed by both Parties; provided, that any unilateral undertaking or waiver made by one Party in favor of the other will be enforceable if undertaken in a writing signed by the Party to be charged with the undertaking or waiver. Any waiver of any rights or failure to act in a specific instance will relate only to such instance and will not be construed as an agreement to waive any rights or fail to act in any other instance, whether or not similar.

16.17. Severability. In the event that any provision of this Agreement will, for any reason, be held to be invalid or unenforceable in any respect, and if the rights or obligations of either Party under this Agreement will not be materially and adversely affected thereby, (a) such provisions will be given no effect by the Parties and will not form part of this Agreement, (b) all other provisions of this Agreement will remain in full force and effect, and (c) the Parties will negotiate in good faith to modify this Agreement to preserve (to the extent possible) their original intent.
16.18. **Entire Agreement.** This Agreement is the sole agreement with respect to the subject matter and supersedes all other agreements and understandings between the Parties with respect to same (including the Confidentiality Agreement).

[Remainder of this Page Intentionally Left Blank]
IN WITNESS WHEREOF, the Parties have caused this Master Collaboration and License Agreement to be executed by their respective duly authorized officers as of the Effective Date.

**MODERN THERAPEUTICS, INC.**

By: /s/ Stéphane Bancel
    (Signature)
Name: Stéphane Bancel
Title: President and CEO

**MERCK SHARP & DOHME CORP.**

By: /s/ Iain D. Dukes
    (Signature)
Name: Iain D. Dukes
Title: SVP, Business Development and Licensing
EXHIBIT A

General Supply Terms

Exhibit A — 1
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Exhibit B-2 — 1
**EXHIBIT C**

**Merck Exclusive Targets**

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Exhibit C — 3
[***] INDICATES MATERIAL THAT HAS BEEN OMITTED AND FOR WHICH CONFIDENTIAL TREATMENT HAS BEEN REQUESTED. ALL SUCH OMITTED MATERIAL HAS BEEN FILED WITH THE SECURITIES AND EXCHANGE COMMISSION PURSUANT TO RULE 406 PROMULGATED UNDER THE SECURITIES ACT OF 1933, AS AMENDED

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Exhibit C — 4
[***] INDICATES MATERIAL THAT HAS BEEN OMITTED AND FOR WHICH CONFIDENTIAL TREATMENT HAS BEEN REQUESTED. ALL SUCH OMITTED MATERIAL HAS BEEN FILED WITH THE SECURITIES AND EXCHANGE COMMISSION PURSUANT TO RULE 406 PROMULGATED UNDER THE SECURITIES ACT OF 1933, AS AMENDED

EXHIBIT D

Existing Partner Fields

Exhibit D — 1
Exhibit E

Expedited Dispute Resolution Procedure

Exhibit E — 1
Exhibit F — 1
EXHIBIT G

Permitted Subcontractors

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Exhibit G — 3
Press Release

Moderna Announces License and Collaboration Agreement with Merck to Develop Messenger RNA-based Antiviral Vaccines and Passive Immunity Therapies

CAMBRIDGE, Mass., January 13, 2015 – Moderna Therapeutics today announced a license and collaboration agreement with Merck, known as MSD outside the United States and Canada, through a subsidiary, for the discovery and development of vaccines and passive immunity treatments against viral diseases using modified messenger RNA (mRNA). Moderna is a pioneer in the development of mRNA Therapeutics™ across a range of therapeutic applications. Moderna’s work in the collaboration will be led by Valera, its venture focused on the development of mRNA vaccines and therapeutics to fight infectious disease.

The vaccines work of Valera builds on a body of preclinical research at Moderna showing the ability of modified mRNA to express viral antigens in vivo and to induce robust immune responses. Valera’s therapeutic passive immunity programs will expand on Moderna’s research using mRNA to express antibodies that bind to viral and other targets. The robust data in these programs across a range of preclinical infectious disease models, together with the inherent, rapid turn-around time in creating novel mRNA constructs, provide Valera with a potentially powerful and versatile new platform for the creation of a broad array of vaccines and passive immunity therapies.

“Given the tremendous potential for messenger RNA Therapeutics across a wide range of therapeutic applications, establishing long-term strategic relationships with world leaders in their fields will accelerate our ability to bring mRNA products to patients in need,” said Stéphane Bancel, president and CEO of Moderna. “Merck’s worldwide leadership in vaccines and anti-infective treatments make them an ideal collaborator for us, particularly given their strong commitment to innovation and new approaches to prevent and treat serious viral diseases. We are excited to work in collaboration to move these promising programs forward for patients.”

“By combining Merck’s strength in vaccine and antiviral therapeutic development with Moderna’s mRNA therapeutics technology we are well positioned to develop differentiated candidates with the potential to provide meaningful benefit to patients,” said Dr. Roger M. Perlmutter, President, Merck Research Laboratories. “We look forward to working with the scientific and technical teams at Moderna.”

Exhibit H — 1
The three-year research collaboration (with the possibility of a one-year extension) is focused on the development of new mRNA-based treatments and vaccines against four undisclosed viruses. Under the terms of the agreement, Merck will make an upfront cash payment to Moderna of $50 million to give Merck the ability to utilize the granted licenses to commercialize five product candidates, and will make a $50 million equity investment in Moderna as an addition to the $450 million financing previously announced on January 5, 2015. Moderna will be eligible for undisclosed per-product development and commercial milestones under the license as well as tiered royalties on commercial sales. Merck will lead the discovery and development of candidates and commercialization of any products resulting from this license and collaboration agreement, while Moderna will design and synthesize the messenger RNA product candidates directed against selected targets.

Moderna’s mRNA Therapeutics™ platform builds on the discovery that modified mRNA can direct the body’s cellular machinery to produce nearly any protein of interest, from native proteins to antibodies and other entirely novel protein constructs with therapeutic activity inside and outside of cells. In addition to the license and collaboration announced today with Merck, Moderna has ongoing strategic agreements with Alexion Pharmaceuticals in the area of rare diseases, AstraZeneca in cardiovascular disease and some areas of oncology and DARPA (the Defense Advanced Research Projects Agency) in biodefense.

About Valera, a Moderna Venture

Valera, the second venture company formed by Moderna, is focused exclusively on the advancement of vaccines and therapeutics for the prevention and treatment of infectious diseases. Valera is leveraging Moderna’s messenger RNA Therapeutics™ platform, an entirely new in vivo drug technology that produces human proteins, antibodies and entirely novel protein constructs inside patient cells, which are in turn secreted or active intracellularly. For more information please visit www.modernatx.com/ventures.
About Moderna Therapeutics

Moderna is pioneering messenger RNA Therapeutics™, an entirely new in vivo drug technology that produces human proteins, antibodies and entirely novel protein constructs inside patient cells, which are in turn secreted or active intracellularly. This breakthrough platform addresses currently undruggable targets and offers a superior alternative to existing drug modalities for a wide range of disease conditions. The company plans to develop and commercialize its innovative mRNA drugs through a combination of strategic relationships as well as new formed ventures, including Onkaido LLC, focused oncology drug development, and Valera LLC, focused on infectious disease. Founded by Flagship VentureLabs, Cambridge-based Moderna is privately held and currently has strategic agreements with AstraZeneca and Alexion Pharmaceuticals. [www.modernatx.com](http://www.modernatx.com).

For information contact:
Maria Favorito, Feinstein Kean Healthcare
617-761-6720, maria.favorito@fkhealth.com

Exhibit H — 3
EXHIBIT I

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Exhibit I — 1
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Schedule 1.123 — 2
### Schedule 1.123 — 3  

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Schedule 1.137
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Modern [***] In-Licenses

Schedule 1.138
SCHEDULE 1.144

Moderna Internal Virology Programs

Schedule 1.144
FIRST AMENDMENT TO
COLLABORATION AND LICENSE AGREEMENT

This First Amendment to Collaboration and License Agreement (this “First Amendment”) dated as of January 8, 2016 (the “First Amendment Effective Date”), is made by and between Moderna Therapeutics, Inc., a corporation organized and existing under the laws of Delaware (“Moderna”), and Merck Sharp & Dohme Corp., a corporation organized and existing under the laws of New Jersey (“Merck”). Each of Moderna and Merck may be referred to herein as a “Party” or together as the “Parties”.

WHEREAS, the Parties hereto are parties to that certain Collaboration and License Agreement dated January 12, 2015 (the “Collaboration Agreement”) under which the Parties agreed to collaborate together to discover and Develop therapeutic and vaccine products using mRNA Constructs, with the goal of identifying or creating Collaboration mRNA Constructs that are suitable for Development and Commercialization by Merck; and

WHEREAS, the Parties desire to amend the Collaboration Agreement in accordance with the terms set forth in this First Amendment.

NOW, THEREFORE, in consideration of the mutual covenants set forth in this First Amendment, and other good and valuable consideration, the amount and sufficiency of which are hereby acknowledged, the Parties hereby agree as follows:

1. Definitions. All terms used in this First Amendment and not otherwise defined herein shall have the same meanings ascribed to such terms in the Collaboration Agreement.

2. Sections 1.21, 1.24 and 1.170 of the Collaboration Agreement are hereby amended by deleting any reference to [***] therein and replacing with “VZV”.

3. Section 1.169 of the Collaboration Agreement is hereby deleted in its entirety and is replaced with the following:

   “VZV” means the varicella zoster virus, including all subtypes and strains thereof.

4. The table in Section 8.5 (Royalties) of the Collaboration Agreement is hereby deleted in its entirety and is replaced with the following new table:

The following royalty rates [***] apply with respect to any Product (on a Product-by-Product basis) arising from an R&D Program for which the R&D Program Pathogen is [***]:

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<th>Annual Net Sales of each Product in a Calendar Year</th>
<th>Royalty Rate</th>
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The following royalty rates [***] apply with respect to any Product (on a Product-by-Product basis) arising from an R&D Program for which the R&D Program Pathogen is [***] for each Calendar Year immediately following [***]

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<th>Annual Net Sales of each Product in a Calendar Year</th>
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5. [***]:

6. [***]:

7. [***]:

8. Exhibit C (Merck Exclusive Targets) of the Collaboration Agreement is hereby amended by deleting each reference to [***] and replacing with the following:

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9. **Target Replacement Payment.** Within [***] after the First Amendment Effective Date and receipt of an invoice from Moderna, Merck will pay to Moderna a one-time payment of US $10,000,000, which payment will be non-refundable, non-creditable, not subject to set-off, and not be reduced by any withholding or similar taxes.

10. **General Terms.** This First Amendment modifies the Collaboration Agreement only to the extent expressly described herein and does not modify the Collaboration Agreement (including any attachments and exhibits thereto) in any other manner. This First Amendment will be construed in accordance with and governed by the laws of the State of New York without giving effect to principles of conflict of laws. This First Amendment may be executed in one or more counterparts, each of which will be deemed an original, and all of which together will be deemed to be one and the same instrument. Facsimile or PDF execution and delivery of this First Amendment by either Party will constitute a legal, valid and binding execution and delivery of this First Amendment by such Party.

    [Remainder of page intentionally left blank.]
IN WITNESS WHEREOF, the Parties have caused this First Amendment to be executed by their respective duly authorized officers as of the First Amendment Effective Date.

MODERNA THERAPEUTICS, INC.

By: /s/ Stéphane Bancel  
   (Signature)  
Name: Stéphane Bancel  
Title: CEO

MERCK SHARP & DOHME CORP.

By: /s/ Benjamin Thomer  
   (Signature)  
Name: Benjamin Thomer  
Title: VP BD&L
SECOND AMENDMENT TO
COLLABORATION AND LICENSE AGREEMENT

This Second Amendment to Collaboration and License Agreement (this “Second Amendment”), dated as of June 28, 2016 (the “Second Amendment Effective Date”), is made by and between Moderna Therapeutics, Inc., a corporation organized and existing under the laws of Delaware ("Moderna"), and Merck Sharp & Dohme Corp., a corporation organized and existing under the laws of New Jersey ("Merck"). Each of Moderna and Merck may be referred to herein as a "Party" or together as the “Parties”.

WHEREAS, Merck and Moderna are parties to that certain Collaboration and License Agreement dated January 12, 2015 (as amended on January 8, 2016, the “Agreement”), under which they agreed to collaborate to discover and Develop therapeutic and vaccine products using mRNA Constructs, with the goal of identifying or creating Collaboration mRNA Constructs that are suitable for Development and Commercialization by Merck;

WHEREAS, the Parties have agreed to amend the Agreement with respect to the establishment of TPPs and the nomination of Product Candidates during the R&D Term, all in accordance with the terms set forth in this Second Amendment; and

WHEREAS, the Parties have further agreed to amend the Agreement with respect to supply of non-cGMP Moderna mRNA API for GLP Toxicology Studies.

NOW, THEREFORE, in consideration of the mutual covenants set forth in this Second Amendment, and other good and valuable consideration, the Parties agree as follows:

Defined Terms. Capitalized terms used but not defined herein shall have the respective meanings ascribed to such terms in the Collaboration Agreement.

Amendment.

2.1 Section 1.191 of the Agreement (definition of “Product Candidate”) is hereby deleted in its entirety and is replaced with the following:

“Product Candidate” means, [***].

2.2 The following new Section 2.8(d) is hereby added to the Agreement:

“2.8(d) Product Candidate Nomination During the R&D Term. On an R&D Program-by-R&D Program basis, from time to time during the R&D Term, Merck may elect to establish a Product Candidate [***] as a part of such R&D Program by issuing a written notice to Moderna. Each such notice under this Section 2.8(d) will identify [***]. For clarity, each Product Candidate established hereunder must contain at least one Collaboration mRNA Construct [***], and [***], and the Collaboration mRNA Construct(s) [***] are included in the Product Candidate Pool for such TPP. If upon the expiration of the R&D Term, such Product Candidate is not included in a TPP, the Collaboration mRNA Constructs in such Product Candidate will become Discontinued mRNA Constructs (to the extent such mRNA Constructs are not within any Product Candidate Pool).”
2.3 The heading for Section 2.9 of the Agreement is hereby deleted in its entirety and is replaced with the following:

“2.9. Target Product Profile; Product Candidate Designation During the Post-R&D Period.”

2.4 Section 2.9(b) of the Agreement is hereby deleted in its entirety and is replaced with the following new Section 2.9(b):

(b) **Target Product Profile Designation.** On a R&D Program-by-R&D Program basis, Merck may elect by written notice to Moderna to establish one or more TPPs for such R&D Program (each, a “TPP Notice”), provided that no more than five (5) TPPs (in the aggregate) may be established hereunder. Each TPP Notice must be issued prior to the expiration of the R&D Term and will identify the [***].

2.5 Section 2.9(d) of the Agreement is hereby deleted in its entirety and is replaced with the following new Section 2.9(d):

“(d) **Post-R&D Period Product Candidate Notice.** On a TPP-by-TPP basis from time to time during the Post-R&D Period, Merck may elect to establish a Product Candidate comprised by Collaboration mRNA Constructs from the associated Product Candidate Pool by issuing a written notice to Moderna (a “Product Candidate Notice”). Each such Product Candidate Notice must be issued prior to the expiration of the Post-R&D Period, and will identify [***].

2.6 Section 2.9(e) of the Agreement is hereby deleted in its entirety and is replaced with the following new Section 2.9(e):

“(e) **Designation of Patents.** At the time (i) a TPP is established for a Product Candidate that has been nominated pursuant to Section 2.8(d), or (ii) a Product Candidate is established pursuant to this Section 2.9, the Parties shall mutually agree upon which [***] such Product Candidates; provided that if the Parties are not able to agree upon which category of Patents a particular patent falls into, such disagreement shall be resolved in accordance with the dispute resolution procedure set forth in [***].”

2.7 Section 2.10(a) of the Agreement is hereby deleted in its entirety and is replaced with the following new Section 2.10(a):

“(a) **Elected Candidate Notice.** Prior to the expiration of the Collaboration Term, Merck may designate a Product Candidate as an “Elected Candidate” hereunder by providing Moderna with written notice of the same (an “Elected Candidate Notice”); provided that Merck may make no more than five (5) such designations, in the aggregate, hereunder (the “Elected Candidate Cap”). If
Merck issues an Elected Candidate Notice during the R&D Term, but Merck has not, prior to the issuance of such Elected Candidate Notice, established a TPP with respect to such Elected Candidate, then along with such Elected Candidate Notice, Merck will provide Moderna with a TPP Notice with respect to such Elected Candidate. Upon Moderna’s receipt of the Elected Candidate Notice (and TPP Notice, if applicable), such designated Product Candidate will be an Elected Candidate. For the avoidance of doubt, a separate Elected Candidate Notice is required for each of the five (5) possible designations of Elected Candidates, and following the designation of the fifth (5th) Elected Candidate, Merck shall no longer have the right to designate any additional Elected Candidates hereunder:“

2.8 [***]

2.9 The following new Section 8.4(c)(iv) is hereby added to the Agreement:

2.10 The following new Section 4.1(c) is hereby added to the Agreement:

“4.1(c) Non-cGMP Moderna mRNA API Supply for GLP Toxicology Studies. Notwithstanding the foregoing, non-cGMP Moderna mRNA API for GLP Toxicology Studies will be supplied [***].”

General Terms. This Second Amendment modifies the Agreement only to the extent expressly described herein and does not modify the Agreement in any other manner. This Second Amendment will be governed by and construed in accordance with the Laws of the state of New York, without respect to its conflict of laws rules or principles that might otherwise refer construction or interpretation of this Agreement to the substantive Law of another jurisdiction.

[Remainder of this Page Intentionally Left Blank]
IN WITNESS WHEREOF, the Parties have caused this Second Amendment to be executed by their respective duly authorized officers as of the Second Amendment Effective Date.

MODERN THERAPEUTICS, INC.

By: /s/ Stéphane Bancel  
(Signature)  
Name: Stéphane Bancel  
Title: CEO

MERCK SHARP & DOHME CORP.

By: /s/ Benjamin Thomer  
(Signature)  
Name: Benjamin Thomer  
Title: VP BD&L
THIRD AMENDMENT TO COLLABORATION AND LICENSE AGREEMENT

This Third Amendment to Collaboration and License Agreement (this “Third Amendment”), dated as of June 28, 2016 (the “Third Amendment Effective Date”), is made by and between Moderna Therapeutics, Inc., a corporation organized and existing under the laws of Delaware (“Moderna”), and Merck Sharp & Dohme Corp., a corporation organized and existing under the laws of New Jersey (“Merck”). Each of Moderna and Merck may be referred to herein as a “Party” or together as the “Parties”.

WHEREAS, Merck and Moderna are parties to that certain Collaboration and License Agreement dated January 12, 2015 (as amended on January 8, 2016, the “Agreement”), under which they agreed to collaborate to discover and Develop therapeutic and vaccine products using mRNA Constructs, with the goal of identifying or creating Collaboration mRNA Constructs that are suitable for Development and Commercialization by Merck;

WHEREAS, pursuant to the Agreement, the Parties have been conducting an R&D Program for the Development of a Vaccine Product for RSV (the “RSV R&D Program”);

WHEREAS, the Parties are preparing to initiate a Phase I Clinical Study with respect to the Collaboration mRNA Construct in the RSV R&D Program as specified in the Statements of Work, which will be elected as a Product Candidate prior to commencement of the Phase I Clinical Study (the “RSV Collaboration mRNA Construct”);

WHEREAS, the Parties have agreed that, during the Moderna RSV Lead Period (as defined below), Moderna shall act as the regulatory lead in connection with the filing of an IND and performance of an associated Phase I Clinical Study in Australia for the RSV Collaboration mRNA Construct on the terms and conditions set forth herein; and

WHEREAS, the Parties now desire to amend the Agreement in accordance with the terms set forth in this Third Amendment.

NOW, THEREFORE, in consideration of the mutual covenants set forth in this Third Amendment, and other good and valuable consideration, the Parties agree as follows:

1. Defined Terms. The following terms and their correlatives will have the meanings set forth below in this Section 1. Capitalized terms used but not defined herein shall have the respective meanings ascribed to such terms in the Agreement.

1.1. “Amended RSV R&D Plan” means the R&D Plan (which includes a detailed budget therefor) attached hereto as Appendix A, as may be further updated by the Parties in accordance with Section 2.1 to this Third Amendment.

1.2. “Executive Officer” means, for Moderna, [***], Chief Executive Officer, and for Merck, [***], Senior Vice President Research. Either Party may change its Executive Officer upon written notice to the other Party, provided that such replacement individual has decision-making authority on behalf of such Party in respect of this Third Amendment.

1
1.3. “Moderna Lead Period” means the period beginning on [***].
1.4. “Moderna RSV Lead Activities” means [***]. The Moderna RSV Lead Activities will be considered Collaboration Activities.
1.5. “RSV Drug Product” means [***].
1.6. “RSV IND” means the [***].
1.7. “RSV Phase I Study” means a Phase I Clinical Study of RSV Drug Product to be conducted by Moderna in Australia as set forth in the Amended RSV R&D Plan.
1.8. “Statements of Work” mean the statements of work between the Parties attached to this Third Amendment in Appendix B entitled [***] and any additional statements of work agreed to by Merck and Moderna related to the RSV Collaboration mRNA Construct identified in the Amended RSV R&D Plan.
1.9. “TGA” means the Australian Therapeutic Goods Administration.

2. Amendment

2.1. Amended RSV R&D Plan. The R&D Plan for the RSV R&D Program existing immediately prior to the Third Amendment Effective Date is hereby replaced in its entirety with the Amended RSV R&D Plan. Notwithstanding anything in Sections 2 or 3.2 or elsewhere in the Agreement to the contrary, any modifications or amendments to the Amended RSV R&D Plan that relate to the Moderna RSV Lead Activities will be submitted to the JSC for review and approval. [***]. Any dispute within the JSC with respect to such proposed modification or amendment to the Amended RSV R&D Plan [***] that is not settled by the Parties within [***] days following submission to the JSC for review shall be referred to the Executive Officers (or their designees, which designee is required to have decision-making authority on behalf of such Party), who will attempt in good faith to resolve such dispute by negotiation and consultation for a [***] day period following such referral. If, despite such efforts, agreement cannot be reached by the Executive Officers within such [***] day period, then the approval of such modification or amendment to the Amended RSV R&D Plan shall be determined by [***].

2.2. RSV Regulatory Lead. Notwithstanding anything in Section 5 or elsewhere in the Agreement to the contrary, but subject to Sections 2.3 and 2.4 of this Third Amendment, the Parties acknowledge and agree that during the Moderna Lead Period, Moderna will have primary responsibility for preparing and maintaining all Regulatory Filings with respect to the RSV IND and RSV Phase I Study, and conducting the RSV Phase I Study, in each case in accordance with this Third Amendment and the Amended RSV R&D Plan. Each Party shall be responsible for performing the activities allocated to such Party under the Amended RSV R&D Plan, which activities will be considered Collaboration Activities.

2.3. RSV IND Filing. Moderna will be responsible for preparing and submitting the RSV IND, and the RSV IND will be the property of Moderna and held in the name of Moderna; provided, however, prior to making such submission with the TGA (or any other applicable Regulatory Authority), Moderna shall submit to the JSC a draft of the RSV IND and any
correspondence pertaining to such RSV IND to be submitted therewith to the TGA (or any other applicable Regulatory Authority). Through the JSC, Moderna will consult with Merck with respect to such submission [***]. Any dispute within the JSC with respect to such proposed submission that is not settled by the Parties within [***] days following submission to the JSC for review shall be referred to the Executive Officers (or their designees, which designee is required to have decision-making authority on behalf of such Party), who will attempt in good faith to resolve such dispute by negotiation and consultation for a [***] day period following such referral. If, despite such efforts, agreement cannot be reached by the Executive Officers within such [***] day period, then [***].

2.4. Regulatory Communications and Meetings. Notwithstanding anything in Section 5 or elsewhere in the Agreement to the contrary, the Parties agree that during the Moderna Lead Period, Moderna will have primary responsibility for conducting communications with the TGA (and any other applicable Regulatory Authorities) that pertain to the RSV IND or relate to the performance of the RSV Phase I Study or otherwise relate to the Moderna RSV Lead Activities, including [***]. The Parties (through the JSC) will discuss the strategy and shall endeavor to mutually agree upon the objectives for any such meeting or conference call. If it is not possible to provide the JSC advance notice of any such meeting or conference call, Moderna shall thereafter provide Merck with a reasonably detailed summary of such meeting or conference call. Moderna shall promptly furnish Merck with copies of all correspondence or material Moderna provides to or receives from the TGA (or any other applicable Regulatory Authority), including [***]. To the extent there is a disagreement between Merck and Moderna within the JSC regarding [***] after each Party reasonably and in good faith considers the other Party’s comments on such matter, such disagreement shall be referred to the Executive Officers (or their designees, which designee is required to have decision-making authority on behalf of such Party), who will attempt in good faith to resolve such dispute by negotiation and consultation for a [***] day period following such referral. If, despite such efforts, agreement cannot be reached by the Executive Officers within such [***] day period, [***].

2.5. RSV Drug Product Manufacture. Notwithstanding anything in Sections 4 or 7, Exhibit A or elsewhere in the Agreement to the contrary, the Parties agree as follows:

(a) Moderna or its Affiliate shall Manufacture (or have Manufactured), in accordance with the specifications and other requirements set forth in the Amended RSV R&D Plan and the applicable Statements of Work, all RSV Drug Product (including all Moderna mRNA API incorporated therein) to be used by or on behalf of Moderna in conducting the Moderna RSV Lead Activities. Merck agrees to pay Moderna for the Manufacture of RSV Drug Product in accordance with the amounts and schedules set forth in the Amended RSV R&D Plan and applicable Statement of Work. Moderna shall invoice Merck in accordance with the Amended RSV R&D Plan and applicable Statement of Work and Merck shall pay the undisputed portion of such invoice within [***] days of receipt of same. [***]

(b) Moderna acknowledges and agrees that Moderna is responsible for ensuring that the RSV Drug Product is suitable for use in connection with the RSV Phase I Study and otherwise for use in the performance of the Moderna RSV Lead Activities. Any RSV Drug Product (including [***]) that Moderna supplies to itself shall (i) be Manufactured, stored and delivered in conformance with all applicable Law and cGMPs, (ii) be Manufactured in facilities
that are in compliance with applicable Law at the time of such Manufacture (including applicable inspection requirements of FDA and other Regulatory Authorities), (iii) not be adulterated or misbranded under the FFDCA, (iv) be in good, usable and merchantable condition and fit for its intended purpose, and (v) meet such specifications, quality standards and requirements as set forth in the Amended RSV R&D Plan and applicable Statements of Work. If Moderna mRNA API contained within the RSV Drug Product Manufactured by or on behalf of Moderna does not conform to the specifications, quality standards and requirements set forth in the Amended RSV R&D Plan and applicable Statements of Work, Moderna will, [***]. If RSV Drug Product Manufactured by or on behalf of Moderna using Moderna mRNA API that conformed to the foregoing specifications, quality standards and requirements at the time of such Manufacture, does not conform to the applicable specifications, quality standards and requirements set forth in the Amended RSV R&D Plan due to an error or deficiency with respect to [***], Moderna will, [***], provided that [***]; provided, however, that [***]. Any dispute within the JSC with respect to [***] shall be referred to the Executive Officers (or their designees, which designee is required to have decision-making authority on behalf of such Party), who will attempt in good faith to resolve such dispute by negotiation and consultation. If, despite such efforts, agreement cannot be reached by the Executive Officers, such matter shall be handled in accordance with [***] of the Agreement. [***]

(c) The Parties acknowledge and agree that the Manufacture of RSV Drug Product as set forth in the Amended RSV R&D Plan requires a license under Third Party Patents under an [***]. Moderna agrees to [***] to obtain a license under such Patents with respect to Moderna’s Manufacture of such RSV Drug Product and performance of Moderna RSV Lead Activities. In the event that Moderna successfully obtains such a license, such license will be a Moderna Collaboration In-License under the Agreement and Moderna will provide a copy of the applicable license agreement to Merck (subject to confidentiality obligations and reasonable redaction). [***]

(d) [***]

(e) Merck may decide to use non-cGMP Moderna mRNA API for GLP Toxicology Studies and in such case, the supply of such non-cGMP Moderna mRNA API for such GLP Toxicology Studies shall be in accordance with Section 4.1 of the Agreement.

2.6. Costs for Performing the Moderna RSV Lead Activities. Notwithstanding anything in Section 8 or elsewhere in the Agreement to the contrary, the Parties agree that Merck will reimburse Moderna for all Out-of-Pocket Costs and FTE Costs incurred by Moderna and its Affiliates directly in connection with the performance of Moderna RSV Lead Activities (other than with respect to costs associated with the Manufacture of RSV Drug Product, which are addressed above), in accordance with the budget, including amounts and schedules, set forth in the Amended RSV R&D Plan, on a Calendar Quarter-by-Calendar Quarter basis, provided that to the extent such Out-of-Pocket Costs and FTE Costs, in the aggregate, exceed [***] of the budgeted costs, then such excess Out-of-Pocket Costs and FTE Costs shall be eligible for [***]. Any changes to the budget set forth in the Amended RSV R&D Plan, including amounts in connection with the performance of activities that are not included in the Amended RSV R&D Plan or that are not specifically included in the budget set forth therein, shall require review and approval by the JSC, which approval may come in any written form [***]. Moderna will send a reasonably
detailed invoice to Merck for each Calendar Quarter, which invoice will include [***] during such Calendar Quarter. All of the foregoing shall be auditable by Merck pursuant to Section 8.6(c) of the Agreement. Merck agrees to pay undisputed amounts in each such invoice within [***] days of Merck’s receipt thereof.

2.7. Termination of the Moderna Lead Period.

(a) The Moderna Lead Period will automatically terminate upon completion of the Moderna RSV Lead Activities set forth in the Amended RSV R&D Plan.

(b) [***]

2.8. Results of Termination.

(a) Upon any termination of the RSV Lead Period pursuant to Section 2.7 of this Third Amendment, Moderna will responsibly wind-down, in accordance with accepted pharmaceutical industry norms and ethical practices, all in-progress Moderna RSV Lead Activities (including the [***]), or if requested by Merck and permitted by applicable Law, Moderna will transfer responsibility for the RSV Phase I Study to Merck, in which case Merck will pay all costs incurred to complete the RSV Phase I Study should such studies be completed. [***]. Moderna will be entitled to receive payment from Merck for all Out-of-Pocket Costs and FTE Costs incurred by Moderna and its Affiliates directly in connection with [***].

(b) Promptly upon termination of the RSV Lead Period, Moderna shall assign and transfer to Merck (or its designee) the RSV IND and all associated Regulatory Filings. Upon assignment to Merck, Moderna shall [***]. Thereafter, (i) Merck or its designee shall be the owner of the RSV IND and all associated Regulatory Filings, (ii) Merck shall have the sole responsibility for all regulatory activities with respect to the RSV Collaboration mRNA Constructs, and (iii) Merck shall be the sole point of contact with Regulatory Authorities in all matters relating to the RSV Collaboration mRNA Constructs. Moderna shall have the right to prepare, at Moderna’s cost, and retain a copy of any and all Regulatory Filings transferred to Merck pursuant to this Section 2.8(b).

2.9. Miscellaneous.

(a) In the event that Moderna is delayed in performing the Moderna RSV Lead Activities for a period of [***] or more days, except [***], including delays caused by [***], the R&D Term for the RSV R&D Program will be extended by a period equal to such delay, provided that Merck has notified Moderna once Merck becomes aware of such alleged delay.

(b) [***]

3. General Terms. This Third Amendment modifies the Agreement only to the extent expressly described herein and does not modify the Agreement in any other manner. This Third Amendment will be governed by and construed in accordance with the Laws of the state of New York, without respect to its conflict of laws rules or principles that might otherwise refer construction or interpretation of this Agreement to the substantive Law of another jurisdiction.
IN WITNESS WHEREOF, the Parties have caused this Third Amendment to be executed by their respective duly authorized officers as of the Third Amendment Effective Date.

MODERNA THERAPEUTICS, INC.

By: /s/ Stéphane Bancel
   (Signature)
Name: Stéphane Bancel
Title: CEO

MERCK SHARP & DOHME CORP.

By: /s/ Benjamin Thorner
   (Signature)
Name: Benjamin Thornor
Title: VP BD&L
Appendix A

Amended RSV R&D Plan
FOURTH AMENDMENT TO
MASTER COLLABORATION AND LICENSE AGREEMENT

This Fourth Amendment to Master Collaboration and License Agreement (this "Amendment"), dated as of June 28, 2016 (the "Amendment Effective Date"), is made by and between Moderna Therapeutics, Inc., a corporation organized and existing under the laws of Delaware ("Moderna"), and Merck Sharp & Dohme Corp., a corporation organized and existing under the laws of New Jersey ("Merck"). Each of Moderna and Merck may be referred to herein as a "Party" or together as the "Parties".

WHEREAS, Merck and Moderna are parties to that certain Master Collaboration and License Agreement, dated January 12, 2015 (as amended and in effect from time to time, the "Agreement"), under which they agreed to collaborate to discover and Develop therapeutic and vaccine products using mRNA Constructs, with the goal of identifying or creating Collaboration mRNA Constructs that are suitable for Development and Commercialization by Merck;

WHEREAS, [***]; and

WHEREAS, [***].

WHEREAS, the Parties now desire to amend the Agreement in accordance with the terms set forth in this Amendment.

NOW, THEREFORE, in consideration of the mutual covenants set forth in this Amendment, and other good and valuable consideration, the Parties agree as follows:

1. Defined Terms. Capitalized terms used but not defined herein shall have the respective meanings ascribed to such terms in the Agreement.

2. Amendment. [***]

3. General Terms. This Amendment modifies the Agreement only to the extent expressly described herein and does not modify the Agreement in any other manner. This Amendment will be governed by and construed in accordance with the Laws of the state of New York, without respect to its conflict of laws rules or principles that might otherwise refer construction or interpretation of this Agreement to the substantive Law of another jurisdiction.

[Remainder of this Page Intentionally Left Blank]
IN WITNESS WHEREOF, the Parties have caused this Amendment to be executed by their respective duly authorized officers as of the Amendment Effective Date.

MODERNA THERAPEUTICS, INC.

By: /s/ Stéphane Bancel
    (Signature)
Name: Stéphane Bancel
Title: Chief Executive Officer

MERCK SHARP & DOHME CORP.

By: /s/ Benjamin Thorner
    (Signature)
Name: Benjamin Thorner
Title: VP BD&L
Amended and Restated
mRNA Cancer Vaccine Collaboration and License Agreement
by and between
MODERNA TX, INC.
and
MERCK SHARP & DOHME CORP.
April 17, 2018
List of Exhibits and Schedules

Exhibit A-1: POC Plan for PCV Program
Exhibit A-2: POC Plan for KRAS Program
Exhibit A-3: Research Plan for [***]
Exhibit B: Financial Definitions
Exhibit C: Relative Commercial Value
Exhibit D: Exercise of Merck Participation Election – Profit & Loss Share
Exhibit E: Economic Effects of Merck Non-Participation and Merck Cessation of Collaboration Activities
Exhibit F: In-Licenses
Exhibit G: Confidential CMC Document Review Procedures
Exhibit H: Moderna Technology Transfer
Exhibit I: Form Press Release
Exhibit J: Patent Prosecution and Maintenance; Patent Enforcement
Exhibit K: Supply Terms
Exhibit L: Subcontractors and Sublicensing
Exhibit L-1: Permitted Subcontractors
Exhibit L-2: Certain Sublicensing/Subcontracting Examples
Exhibit M: Terms for PCV Clinical Supply Agreement and SAV Clinical Supply Agreement
Exhibit N: Supply Terms for Merck Internal SAV Programs
Schedule 1.235: Moderna Background Patents
Schedule 1.253: Moderna Pre-Existing In-Licenses
Schedule 3.4(c)(ii): Initial KRAS Transition Plan
Schedule 6.1(d)(iv): Required Manufacturing Items
This Amended and Restated mRNA Cancer Vaccine Collaboration and License Agreement (this “Agreement”), dated as of April 17, 2018 (the "Amended Effective Date"), is made by and between ModernaTX, Inc., a corporation organized and existing under the laws of Delaware ("Moderna"), and Merck Sharp & Dohme Corp., a corporation organized and existing under the laws of New Jersey ("Merck"). Each of Moderna and Merck may be referred to herein as a “Party” or together as the “Parties”.

WHEREAS, Moderna and its Affiliates have developed expertise and technology useful for the research, development, manufacture, or commercialization of pharmaceutical products that function using mRNA;

WHEREAS, Merck is a pharmaceutical company focused on researching, developing, manufacturing and commercializing innovative therapeutic products;

WHEREAS, Merck and Moderna previously entered into that certain PCV Collaboration and License Agreement dated as of June 28, 2016, as amended (the "Original Agreement" and such date, the "Effective Date") pursuant to which the Parties established a broad research and development collaboration pursuant to which Moderna would Research and Develop Collaboration PCV Products through proof of concept, and Merck would thereafter have the right to continue with Moderna in the Research, Development, Manufacture and Commercialization of Collaboration PCV Products; and

WHEREAS, the Parties now desire to amend and restate the Original Agreement in its entirety and replace the Original Agreement with this Agreement, to, among other things, expand the scope of the Collaboration to include SAVs in addition to PCVs.

NOW, THEREFORE, in consideration of the mutual covenants contained herein, and for other good and valuable consideration, the amount and sufficiency of which are hereby acknowledged, the Parties hereby agree as follows:

1. DEFINITIONS

The following terms and their correlatives will have the following meanings:

1.1 “2015 Collaboration Agreement” means that certain Master Collaboration and License Agreement, by and between Moderna and Merck, dated as of January 12, 2015, as amended or restated from time to time.

1.2 “2016 CSA” means that certain Pre-Clinical and Clinical Supply Agreement, by and between Moderna and Merck, dated on or about June 27, 2016, as amended or restated from time to time.
1.3 “AAA” has the meaning set forth in Section 15.1(c).

1.4 “Act” means, as applicable, the United States Federal Food, Drug and Cosmetic Act, 21 U.S.C. §§ 301 et seq., and/or the Public Health Service Act, 42 U.S.C. §§ 262 et seq., as such may be amended from time to time, together with any rules, regulations and requirements promulgated thereunder (including all additions, supplements, extensions, and modifications thereto).

1.5 “Additional Converted Program Research Activities” has the meaning set forth in Section 3.1(e)(ii)(1).

1.6 “Additional Moderna PCV POC Term Study” has the meaning set forth in Section 3.3(d).

1.7 “Additional Research Plan” means a written plan setting forth the Collaboration Activities of the Parties with respect to any Additional Research Program and the budget therefor that is approved by both of the Parties.

1.8 “Additional Research Program” has the meaning set forth in Section 4.1(b).

1.9 “Additional Regulatory Costs” has the meaning set forth in the Financial Definitions Exhibit.

1.10 “Additional Study” means any Clinical Study (including any Phase IV Clinical Study) proposed by a Party pursuant to Section 4.4(a)(i) to be conducted during the Merck Participation Term for a given Program to Develop any Collaboration Product from such Program as a monotherapy or in combination with one or more Other Components beyond any Clinical Study(ies) contemplated by the then-current Joint Development Plan and Budget for the applicable Program.

1.11 “Additional Study Proposal” has the meaning set forth in Section 4.4(a)(i).

1.12 “Adverse Event” per the International Conference on Harmonization (ICH), means any untoward medical occurrence in a patient or clinical investigation subject administered a pharmaceutical product and which does not necessarily have to have a causal relationship with this treatment. An Adverse Event can therefore be any unfavorable and unintended sign (including an abnormal laboratory finding, for example), symptom, or disease temporally associated with the use of a medicinal product, whether or not considered related to such medicinal product.

1.13 “Affiliate” of a Person means any other Person which (directly or indirectly) is controlled by, controls or is under common control with such Person. A Person will be deemed to “control” another Person if it: (a) with respect to such other Person that is a corporation, owns, directly or indirectly, beneficially or legally, more than fifty percent (50%) of the outstanding voting securities or capital stock (or such lesser percentage which is the maximum allowed to be owned by such Person in a particular jurisdiction) of such other Person, or, with respect to such other Person that is not a corporation, has other comparable ownership interest; or (b) has the power, whether pursuant to contract, ownership of securities or otherwise, to direct the management and policies of such other Person.
1.14 "Agent Technology" means the Moderna Agent Technology and the Merck Agent Technology.

1.15 "Agreement" has the meaning set forth in the Recitals.

1.16 "Allowable Commercialization Costs" has the meaning set forth in the Financial Definitions Exhibit.

1.17 "Allowable Development Costs" has the meaning set forth in the Financial Definitions Exhibit.

1.18 "Amended Anticipated PCV POC Budget" means Two Hundred Forty-Three Million Dollars ($243,000,000), or such other amount as the Parties may mutually agree in the POC Plan for the PCV Program.

1.19 "Amended Effective Date" has the meaning set forth in the Recitals.

1.20 "Antitrust Clearance Date" has the meaning set forth in Section 14.1.

1.21 [***]

1.22 “Bankruptcy Code” has the meaning set forth in Section 10.5.

1.23 “Batch Records” means, with respect to a batch of product Manufactured, (a) batch records (including all attachments thereto), including pre-filtration Bioburden results, per process environmental monitoring reports, differential pressure alarm reports, CIP/SIP data, in-process CTU temperature charts, reports and details of major investigations, and reports and details of product related change controls, in English, and (b) any investigation or deviation reports (and details thereof) related to such product, in English, and (c) a release assay qualification summary report and a pre-campaign cleaning report, in English; in each case, for such batch.

1.24 “Business Combination” means, with respect to a Party (or its Affiliate), any of the following events: (a) any Third Party (or group of Third Parties acting in concert) acquires (including by way of a tender or exchange offer or issuance by such Party (or its Affiliate)), directly or indirectly, beneficial ownership or a right to acquire beneficial ownership of shares of such Party (or its Affiliate) representing more than fifty percent (50%) of the voting shares (where voting refers to being entitled to vote for the election of directors) then outstanding of such Party (or its Affiliate); (b) such Party (or its Affiliate) consolidates with or merges into another corporation or entity which is a Third Party, or any corporation or entity which is a Third Party consolidates with or merges into such Party (or its Affiliate), in either event, pursuant to a transaction in which more than fifty percent (50%) of the voting shares of the acquiring or resulting entity outstanding immediately after such consolidation or merger is not held by the holders of the outstanding voting shares of such Party (or its Affiliate) immediately preceding such consolidation or merger; or (c) such Party (or its Affiliate) sells, transfers, leases or otherwise disposes of all or substantially all of the assets to which this Agreement relates to a Third Party.
1.25 “Business Day” means any day other than a Saturday or Sunday on which banking institutions in New York, NY are open for business.

1.26 “Calendar Quarter” means the respective periods of three (3) consecutive calendar months ending on March 31, June 30, September 30 and December 31; provided, however, that (a) the first Calendar Quarter of this Agreement shall commence on the Effective Date and end at the end of the Calendar Quarter in which the Effective Date occurs and (b) the last Calendar Quarter of this Agreement shall commence at the commencement of such Calendar Quarter and end on the expiration of the Term.

1.27 “Calendar Year” means each twelve (12) month period beginning on January 1st; provided, however, that (a) the first Calendar Year of this Agreement shall commence on the Effective Date and end on December 31 of the same year and (b) the last Calendar Year of this Agreement shall commence on January 1 of the Calendar Year in which this Agreement expires and end on the expiration of the Term.

1.28 “Cash Losses” has the meaning set forth in the Financial Definitions Exhibit.

1.29 “Cash Profits” has the meaning set forth in the Financial Definitions Exhibit.

1.30 “Cash Profits or Losses” has the meaning set forth in the Financial Definitions Exhibit.

1.31 [***]

1.32 “Cessation Transition Plan” has the meaning set forth in Section 10.10(b).

1.33 “cGMP” means the then-current good manufacturing practices, standards, guidelines and regulations promulgated and published by FDA, EMA or any other applicable Regulatory Authorities having jurisdiction over the Manufacture, Development or Commercialization of any product (and any precursor steps), as applicable, relating to the testing, manufacturing, processing, packaging, holding or distribution of drug substances and finished drugs including any standards, guidelines and regulations as promulgated by, as applicable: (a) the FDA under and in accordance with the U.S. Federal Food, Drug and Cosmetic Act and Title 21, Parts 210 and 211 of the U.S. Code of Federal Regulations, (b) the EMA and the EU Commission under European Directive 2003/94/EC, and/or (c) the ICH Harmonised Tripartite Good Manufacturing Practice Guide For Active Pharmaceutical Ingredients (ICH Q7), as such standards, guidelines and regulations may be amended from time to time.

1.34 “Clinical Data” means all information with respect to a Collaboration Product made, collected or otherwise generated under or in connection with Clinical Studies for such Collaboration Product undertaken under the applicable POC Plan or Development Plan(s), including any data, reports and results with respect thereto.
1.35 “Clinical Initiation Criteria” means, with respect to a given Joint SAV Program (other than the KRAS Program), the criteria that are agreed upon by the Parties as part of, and set forth in, the POC Plan for such Joint SAV Program, which may be changed from time to time by written agreement of the Parties and which, among other data and information, will be used by the Parties to determine the suitability of an SAV for (a) the filing of an IND for such SAV and (b) the conduct of Phase I Clinical Studies with such SAV under such Joint SAV Program. The Clinical Initiation Criteria shall include criteria based upon [***].

1.36 “Clinical Quality Agreement” means a quality agreement entered into between the Parties with respect to the Manufacture of Collaboration Product for Development purposes during the Collaboration Term for the applicable Program, including pursuant to Section 6.2(d), 6.2(e) or Exhibit K.

1.37 “Clinical Study” means a clinical study (including a Post-Marketing Study or Phase IV Clinical Study) in humans the purpose of which is to obtain information regarding the product, including information relating to the safety, tolerability, pharmacological activity, pharmacokinetics, dose ranging or efficacy of the product, as applicable.

1.38 [***]

1.39 “CMC” means Chemistry and Manufacturing Controls, which includes (a) Manufacturing process development records for products, (b) all chemistry, Manufacturing and control procedures necessary for Manufacture of products, and (c) sourcing and testing of all raw materials and components used in the Manufacture of products.

1.40 “Co-Promotion” means those detailing and promotional activities (including performing sales calls) with respect to a Collaboration Product undertaken by or on behalf of either Party to encourage appropriate prescribing of such Collaboration Product in the U.S. in accordance with Section 8 and any Co-Promotion Agreement. When used as a verb, “to Co-Promote” means to engage in Co-Promotion, and “Co-Promoted” has a corresponding meaning.

1.41 “Co-Promotion Agreement” has the meaning set forth in Section 8.5(b).

1.42 “Code” has the meaning set forth in Section 5.4.

1.43 “Collaboration” means each of the programs for the Research, Development, Manufacture and Commercialization of mRNA Cancer Vaccines (including Collaboration Products) that is engaged in by or on behalf of one or more of the Parties under this Agreement during the applicable Collaboration Term.

1.44 “Collaboration Activities” means the activities conducted by or on behalf of one or more of the Parties or its Affiliates as part of the Collaboration.

1.45 [***]

1.46 “Collaboration Know-How” means [***].

1.47 [***]
1.50 “Collaboration Patents” means any and all Patents that claim or cover any of the Collaboration Know-How.

1.51 “Collaboration PCV Manufacturing Facility” means, with respect to the PCV Program, the Manufacturing facilities, or portion thereof, established by or on behalf of Moderna [***] for the PCV Program that is intended to be used for the Manufacture of Collaboration PCV Products for the PCV Program during the Collaboration Term for the PCV Program in accordance with this Agreement.

1.52 “Collaboration PCV Product” means, with respect to the PCV Program, any [***]. At either Party’s request, the Parties will mutually identify the then-existing Collaboration PCV Products. [***] For the avoidance of doubt, Collaboration PCV Products shall exclude Collaboration SAV Products; provided, however, that a Collaboration PCV Product for [***].

1.53 “Collaboration Product” means any Collaboration PCV Product or Collaboration SAV Product, as applicable.

1.54 “Collaboration SAV Manufacturing Facility” means, with respect to a given Joint SAV Program, the Manufacturing facilities, or portion thereof, that are intended to be used for the Manufacture of Collaboration SAV Products for such Joint SAV Program during the Collaboration Term for such Joint SAV Program in accordance with this Agreement.

1.55 “Collaboration SAV Product” means, with respect to a given Joint SAV Program, any [***]. For the avoidance of doubt, Collaboration SAV Products shall exclude Collaboration PCV Products.

1.56 “Collaboration Shared Neoepitope(s)” means, with respect to a given SAV Program, [***].

1.57 “Collaboration Technology” means, [***].

1.58 “Collaboration Term” means, with respect to a given Program, the Internal SAV Program Term (if any), the POC Term, the Merck Participation Election Period, and, if Merck exercises the Merck Participation Election, the Merck Participation Term, in each case for such Program.

1.59 “Combination Product” means:

(a) a single pharmaceutical formulation [***] containing, as its active ingredients, both (i) a Collaboration Product or Financial PCV or Financial SAV, on the one hand, and (ii) one or more Other Component(s), on the other hand, or
(b) a combination therapy comprised of (i) a Collaboration Product or Financial PCV or Financial SAV, on one hand, and (ii) one or more Other Component(s), on the other hand, either when (1) priced and sold in a single package containing such multiple products, or (2) packaged separately but sold together for a single price,

in each case, including all dosage forms, formulations, presentations, and package configurations. Drug delivery vehicles, adjuvants and excipients will not be deemed to be "active ingredients", except in the case where such delivery vehicle, adjuvant or excipient is recognized by the FDA as an active ingredient in accordance with 21 C.F.R. 210.3(b)(7).

1.60 "Commencement" means, together with all correlative meanings, [***] in a Clinical Study.

1.61 [***]

1.62 "Commercial Grant" means a grant by a Selling Party of a license or sublicense of the Merck Technology or Moderna Technology to a Third Party to Commercialize (which may also include Manufacture and Development to support any such Commercialization) any one or more Collaboration Products or Financial PCVs or Financial SAVs within one or more countries.

1.63 "Commercial Liabilities" has the meaning set forth in the Financial Definitions Exhibit.

1.64 "Commercial Quality Agreement" has the meaning set forth in Section 6.3(b).

1.65 "Commercial Supply Agreement" has the meaning set forth in Section 6.3(b).

1.66 "Commercialization" means any and all activities related to the import, export, transportation, storage, marketing, detailing, promotion, distribution, sale or other disposition and/or other approved use of a product in a country or region in the Territory, including: (a) strategic marketing, sales force detailing (including Co-Promotion), advertising, Medical Affairs, reimbursement and market access activities and market and product support; and (b) all customer support, Distribution Matters, invoicing and sales activities. When used as a verb, “to Commercialize” and “Commercializing” means to engage in Commercialization, and “Commercialized” has a corresponding meaning. For clarity, Commercialization excludes any Research, Development or Manufacturing activities.

1.67 "Commercialization Activities" means, on a Collaboration Product-by-Collaboration Product basis, all global Commercialization activities undertaken with respect to such Collaboration Product.

1.68 "Commercially Reasonable Efforts" means with respect to the efforts to be expended by a Party with respect to any objective, [***].

1.69 "Committee" means the POC Committee, [***], Joint Steering Committee, Joint Development Committee, Joint Manufacturing Committee or Joint Commercialization Committee, or any other subcommittee, as applicable.
1.70 “Competitive Infringement” has the meaning set forth in Exhibit J.

1.71 “Competitive PCV Product” means [***].

1.72 “Competitive SAV Product” means [***].

1.73 “Confidential CMC Data” means, with respect to a product, all [***] CMC-related data and information for such product.

1.74 “Confidential CMC Documents” has the meaning set forth in Exhibit G.

1.75 “Confidential Information” has the meaning set forth in Section 12.1(a).

1.76 “Contracting Party” has the meaning set forth in Exhibit F.

1.77 “Control” or “Controlled” means, with respect to any Know-How, Patent or other intellectual property right, the possession (whether by ownership, license or sublicense, other than by a license, sublicense or other right granted (but not assignment) pursuant to this Agreement) by a Party (or its Affiliate) of the ability to assign or grant to the other Party the licenses, sublicenses or rights to access and use such Know-How, Patent or other intellectual property right as provided for in this Agreement, without violating the terms of any agreement or other arrangement with any Third Party in existence as of the time such Party would be required hereunder to grant such license, sublicense, or rights of access and use. Know-How, Patents or other intellectual property rights that are licensed to a Party or its Affiliates or jointly owned by a Party or its Affiliates, on the one hand, and a Third Party, on the other hand, in each case pursuant to an In-License are not “Controlled” by such Party or its Affiliates for purposes of this Agreement unless and only after such agreement is included hereunder as an Included In-License pursuant to Exhibit F.

1.78 “Cost of Goods Sold” has the meaning set forth in the Financial Definitions Exhibit.

1.79 “Credit Against Profits Mechanism” has the meaning set forth in Exhibit D.

1.80 “CTA” means an application to a Regulatory Authority for purposes of requesting the ability to start or continue a Clinical Study, which CTA may consist of, or include, an IND.

1.81 “Development” means any and all clinical drug development activities, Clinical Studies, statistical analysis and report writing, the preparation and submission of Regulatory Filings, regulatory affairs with respect to the foregoing and all other activities necessary or reasonably useful or otherwise requested or required by a Regulatory Authority as a condition or in support of obtaining or maintaining a Regulatory Approval for a product, and “Develop”, “Developed” and “Developing” will have corresponding meanings. For clarity, Development excludes any Research, Commercialization or Manufacturing activities.

1.82 “Development Costs” has the meaning set forth in the Financial Definitions Exhibit.
1.83 “Development Plan(s)” means, with respect to a Program, collectively, the Joint Development Plan and Budget and any Independent Additional Study Development Plan(s) for such Program.

1.84 “Development Transition Plan” has the meaning set forth in Section 4.3(b).

1.85 “DOJ” has the meaning set forth in Section 14.1.

1.86 “Directed” means [***].

1.87 “Direct Manufacturing Costs” shall be calculated consistent with GAAP and include [***].

1.88 “Direct Marketing Expenses” has the meaning set forth in the Financial Definitions Exhibit.

1.89 “Disclosing Party” has the meaning set forth in Section 12.1(a).

1.90 “Dispute Proposal” has the meaning set forth in Section 15.1(c).

1.91 “Disputes” has the meaning set forth in Section 15.1(a).

1.92 “Distribution Expenses” has the meaning set forth in the Financial Definitions Exhibit.

1.93 “Distribution Matters” means all issues and decisions regarding the distribution of products, including decisions as to whether and with which wholesalers and distributors, if any, to contract, and the terms of contracts with such wholesalers and distributors.

1.94 “Distributor” means a Third Party [***].

1.95 “DMF” means any drug master file, biologics master file (types 2, 3, 4, and 5) or For Further Manufacturing Use (FFMU) BLA, as applicable, filed with the FDA, and any equivalent filing in other countries or regulatory jurisdictions, including active substance master files submitted to the EMA.

1.96 “Effective Date” has the meaning set forth in the Recitals.

1.97 “EMA” means the Regulatory Authority known as the European Medicines Agency and any successor agency thereto.

1.98 “Equity Agreement” means the Series H Preferred Stock Purchase Agreement, dated as of the Amended Effective Date, by and among Moderna Therapeutics, Inc. and the investors listed therein.

1.99 “ex-U.S. Antitrust Filing” has the meaning set forth in Section 15.19.

1.100 “Exclusions Lists” has the meaning set forth in Section 1.403.
1.101 “Executive Officer” means, for Moderna, [***], and for Merck, [***]. Either Party may change its Executive Officer upon written notice to the other Party, provided that such replacement individual has decision-making authority on behalf of such Party in respect of this Agreement.

1.102 “Expert” means a person with no less than [***] of pharmaceutical industry experience and expertise having occupied at least one senior position within a large pharmaceutical company relating to commercialization and/or licensing but excluding any current or former employee or consultant of either Party or its Affiliates. Such person shall be fluent in the English language.

1.103 “Expert Committee” has the meaning set forth in Exhibit C.

1.104 “FDA” means the United States Food and Drug Administration and any successor agency thereto.

1.105 [***]

1.106 [***]

1.107 “Financial Definitions Exhibit” means Exhibit B.

1.108 “Financial PCV” has the meaning set forth in the Financial Definitions Exhibit.

1.109 “Financial SAV” has the meaning set forth in the Financial Definitions Exhibit.

1.110 “First Commercial Sale” means, with respect to any Collaboration Product or a Financial PCV or Financial SAV in a country, the first commercial sale by a Selling Party to a Third Party on arm’s length terms for end use or consumption of such Collaboration Product or a Financial PCV or Financial SAV, as the case may be, in such country after all required Regulatory Approvals for commercial sale of the applicable Collaboration Product or a Financial PCV or Financial SAV have been obtained in such country. Sales prior to receipt of Regulatory Approval for such Collaboration Product or a Financial PCV or Financial SAV, such as so-called “treatment IND sales”, “named patient sales”, and “compassionate use sales” shall not be construed as a First Commercial Sale.

1.111 “FTC” has the meaning set forth in Section 14.1.

1.112 “FTE” means the equivalent of a full-time scientific or technical person’s work time over a twelve (12) month period (including normal vacation, sick days and holidays) devoted to, and directly related to, conducting activities under this Agreement, based on [***] person-hours or greater per year. In the event that an individual devotes less than such full time to conducting activities under this Agreement during such twelve (12) month period, then for purposes of this Agreement, such individual shall only count as a portion of an FTE which shall be determined by dividing the number of full days during the applicable twelve (12) month period devoted to, and directly related to, conducting activities under this Agreement by the total number of working days during such twelve (12) month period. No individual may be charged at greater than one (1) FTE in a given Calendar Year.
1.113 “FTE Costs” means, the actual FTEs employed by Moderna, Merck or their respective Affiliates or Sublicensees in the conduct of any activities under this Agreement multiplied by the FTE Rate, which represents [***].

1.114 “FTE Rate” means [***] per one (1) full FTE per full twelve (12) month Calendar Year; provided, that, starting [***], such rate shall adjust [***] of each Calendar Year by an amount equal to the change, if any, in [***]. Notwithstanding the foregoing, for any Calendar Year during the Term that is less than a full year, the above referenced rate shall be proportionately reduced to reflect such portion of such full Calendar Year.

1.115 “GAAP” means U.S. generally accepted accounting principles or International Financial Reporting Standards, consistently applied, as designated and used by the applicable Party.

1.116 “General PCV” means [***], but excluding any General SAV.

1.117 “General SAV” means [***], but excluding any General PCV.

1.118 “Global Commercialization Budget” has the meaning set forth in Section 8.4(b).

1.119 “Global Commercialization Plan” means, with respect to a Collaboration Product, a written plan that describes the plans for the Commercialization of such Collaboration Product in the Territory, including [***]. Each Global Commercialization Plan will be updated from time to time in accordance with Section 8.4(c).

1.120 “Good Clinical Practice” or “GCP” means the applicable then-current Good Clinical Practices as such term is defined from time to time by the FDA or other relevant Regulatory Authority having jurisdiction over the development, manufacture or sale of products pursuant to its regulations, guidelines or otherwise, as applicable.

1.121 “Good Laboratory Practice” or “GLP” means the applicable then-current standards for laboratory activities for pharmaceuticals (including biologicals) or vaccines, as applicable, as set forth in the Act, together with any similar standards of good laboratory practice as are required by any Regulatory Authority having jurisdiction over the applicable activity.

1.122 “Gross Profit” has the meaning set forth in the Financial Definitions Exhibit.


1.124 “HSR Filing” means any filing with the United States Federal Trade Commission and the Antitrust Division of the United States Department of Justice of a Notification and Report Form for Certain Mergers and Acquisitions (as that term is defined in the HSR Act) with respect to the subject matter of this Agreement, together with all required documentary attachments thereto.
1.125 “Human Materials” has the meaning set forth in Section 5.2.
1.126 “IAS Costs” has the meaning set forth in the Financial Definitions Exhibit.
1.127 “IAS Party” has the meaning set forth in Section 7.1(b).
1.128 [***]
1.129 [***]
1.130 [***]
1.131 “In-License” means a Moderna Pre-Existing In-License, Moderna New In-License or a Merck In-License.
1.132 “In-License Upfront Payment” has the meaning set forth in Section 2(a) of Exhibit F.
1.133 “Included In-License” means an Included Moderna In-License or an Included Merck In-License.
1.134 “Included In-License IP” means Patents and Know-How in-licensed by a Party from a Third Party pursuant to an Included In-License, including any extensions or expansions of the scope thereof.
1.135 “Included In-License Payments” means, with respect to a Contracting Party and an Included In-License, any amounts paid or payable during the Term by such Contracting Party under such Included In-License that are or were incurred by or on behalf of such Contracting Party or its Affiliates as a result of (a) [***], (b) the grant of [***], (c) the grant or exercise [***] or (d) [***], in each case ((a)-(d)), under and in accordance with the terms of this Agreement, but excluding in all cases [***]; provided, however, that the Parties will agree on [***].
1.136 “Included Merck In-License” has the meaning set forth in Section 1(c) of Exhibit F.
1.137 “Included Moderna In-License” means an Included Moderna New In-License, an Included Moderna Pre-Existing In-License or an Included Permitted In-License.
1.138 “Included Moderna New In-License” has the meaning set forth in Section 1(b)(ii) of Exhibit F.
1.139 “Included Moderna Pre-Existing In-License” has the meaning set forth in Section 1(a) of Exhibit F.
1.140 “Included Permitted In-License” has the meaning set forth in Section 1(d) of Exhibit F.
1.145 “IND” means an Investigational New Drug Application filed with the FDA pursuant to 21 C.F.R. §312 before the commencement of human clinical trials involving a product, including all amendments and supplements to such application, or any equivalent filing with any Regulatory Authority outside the United States.

1.146 “IND-Enabling Studies” means, for a given SAV Program, the non-clinical pharmacology studies (including pharmacokinetic and toxicology studies) identified in the POC Plan for such SAV Program that are intended to be performed prior to filing an IND/CTA with respect to the SAVs that are being Researched for such SAV Program under the POC Plan.

1.147 “Indemnification Claim Notice” has the meaning set forth in Section 13.6(c).

1.148 “Indemnified Party” has the meaning set forth in Section 13.6(c).

1.149 “Independent Additional Study” has the meaning set forth in Section 4.4(a)(ii).

1.150 “Independent Additional Study Development Plan” has the meaning set forth in Section 4.4(a)(ii).

1.151 “Indirect Manufacturing Costs” shall be calculated consistent with GAAP and include [***].

1.152 “Indirect Marketing Expenses” has the meaning set forth in the Financial Definitions Exhibit.

1.153 “Individualized Neoepitope(s)” has the meaning set forth in Section 13.6(c).

1.154 “Initial PCV POC Program Funding Amount” means Two Hundred Million Dollars ($200,000,000).

1.155 “Initiation” of a Program means, (i) with respect to the PCV Program, [***], (ii) with respect to the KRAS Program, [***]. (iii) with respect to any Internal SAV Program, [***] and (iv) with respect to any other Joint SAV Program, [***].

1.156 “Internal SAV Program” means the Research by a Party or its Affiliates of SAVs Directed against a given Target(s) under the Collaboration in accordance with an Internal SAV Program Plan for such Target(s), which the other Party [***] in accordance with Section 3.1(d)(i).

1.157 “Internal SAV Program Plan” means a written plan that has been prepared by the Party conducting an Internal SAV Program.

1.158 “Internal SAV Program Term” means, with respect to a given Internal SAV Program, the period commencing on [***].
1.159 “IP Committee” means the intellectual property advisory committee as more fully described in Paragraph 1.1 of Exhibit J.

1.160 “ISP Party” means the Party conducting a given Internal SAV Program pursuant to the applicable Internal SAV Program Plan.

1.161 “Issuing Party” has the meaning set forth in Section 12.3(c).

1.162 “Joint Commercialization Committee” or “JCC” has the meaning set forth in Section 2.7.

1.163 “Joint Development Committee” or “JDC” has the meaning set forth in Section 2.5.

1.164 “Joint Development Plan and Budget” has the meaning set forth in Section 4.3(c)(i).

1.165 “Joint Development Program” has the meaning set forth in Section 4.1(c).

1.166 “Joint Development Study” has the meaning set forth in Section 4.4(a)(i).

1.167 “Joint Know-How” means all Collaboration Know-How within [***] that is jointly owned by the Parties in accordance with Section 11.4.

1.168 “Joint Manufacturing Committee” or “JMC” has the meaning set forth in Section 2.6(a).

1.169 “Joint Patents” means all Collaboration Patents within [***] that are jointly owned by the Parties in accordance with Section 11.4.

1.170 “Joint SAV Program” means the collaborative Research, Development and Manufacture by the Parties or their respective Affiliates of SAVs (including Collaboration SAV Products) Directed against a given SAV Target(s) in accordance with the POC Plan for such SAV Target(s), and if Merck exercises the applicable Merck Participation Election and pays the Participation Election Payment, the further Research of SAVs (including Collaboration SAV Products) Directed against such SAV Target(s) in accordance with an Additional Research Plan, and the Development, Manufacture and Commercialization of Collaboration SAV Products Directed against such SAV Target(s) by or on behalf of one or more of the Parties under the Collaboration in accordance with this Agreement. [ ***]

1.171 “Joint Steering Committee” or “JSC” has the meaning set forth in Section 2.4.

1.172 “Joint Technology” means all Joint Know-How and Joint Patents.

1.173 “Keytruda” means Merck’s human pharmaceutical product Keytruda® (pembrolizumab).
1.174 “Know-How” means all non-public technical, scientific, and other know-how and information, trade secrets, knowledge, technology, means, methods, processes, practices, formulae, instructions, skills, techniques, procedures, experiences, ideas, designs, drawings, assembly procedures, Software, computer programs, apparatuses, specifications, data, results and materials, including: biological, chemical, vaccine-related, pharmacological, toxicological, pharmaceutical, physical and analytical, pre-clinical, clinical, safety, manufacturing and quality control data and information, including study designs and protocols, assays, and biological methodology, in all cases, whether or not copyrightable or patentable, in written, electronic or any other form now known or hereafter developed.

1.175 “Knowledge” means with respect to the matter in question, the knowledge of any [***].

1.176 “KRAS” means [***].

1.177 “KRAS POC Program” has the meaning set forth in Section 3.1(b).

1.178 “KRAS Program” means the Research, Development and Manufacture of SAVs (including Collaboration SAV Products) Directed against KRAS in accordance with the POC Plan for KRAS, and if Merck exercises the applicable Merck Participation Election and pays the applicable Participation Election Payment, the further Research of SAVs (including Collaboration SAV Products) Directed against KRAS in accordance with an Additional Research Plan, and the Development, Manufacture and Commercialization of Collaboration SAV Products Directed against KRAS by or on behalf of one or more of the Parties under the Collaboration in accordance with this Agreement.

1.179 “KRAS Transition Date” has the meaning set forth in Section 3.4(c)(ii).

1.180 “KRAS Transition Plan” has the meaning set forth in Section 3.4(c)(ii).

1.181 “Law” or “Laws” means all laws, statutes, enactments, acts of legislature, rules, regulations, orders, judgments, guidelines, policies, directions, directives, or ordinances having the effect of law of any federal, national, multinational, state, provincial, county, city or other political subdivision of any jurisdiction which are applicable to any of the Parties or their respective Affiliates in carrying out the activities hereunder or to which any of the Parties or their respective Affiliates in carrying out the activities hereunder are subject, including the Act and GLPs, GCPs and cGMPs.

1.182 “Lead Regulatory Party” means, for a given Program, the POC Lead Regulatory Party or the Merck Participation Term Lead Regulatory Party, as applicable.

1.183 [***]

1.184 [***]

1.185 [***]

1.186 “Losses” has the meaning set forth in Section 13.6(a).
1.187 “Manufacturing” means the production, manufacture, synthesis, processing, filling, formulating, finishing, packaging, labeling, shipping and holding of product or any intermediate thereof (including with respect to a PCV, receipt of patient samples, sequencing, identifying and analyzing tumor specific mutations (e.g., using sequencing or genomics tools)), process development, process qualification and validation, scale-up, commercial manufacture and analytic development, product characterization, stability testing, quality assurance and quality control. “Manufacturing” refers to both pre-clinical and clinical Manufacturing for Research and Development, and Manufacturing for Commercialization. “Manufacture” and “Manufactured” will have corresponding meanings. For clarity, “Manufacturing” excludes Research, Development or Commercialization activities.

1.188 “Manufacturing Capacity Forecast” has the meaning set forth in Section 6.2(g)(i).

1.189 “Manufacturing Costs” has the meaning set forth in the Financial Definitions Exhibit.

1.190 “Manufacturing Subcontractor” means, with respect to Merck, any Third Party that, as a contract manufacturer (for example, as of the Amended Effective Date, the Third Parties listed on Exhibit L-1) of Merck or any of its Affiliates, may Manufacture the applicable cGMP Collaboration Product in connection with a technology transfer pursuant to this Agreement or the PCV Clinical Supply Agreement, the SAV Clinical Supply Agreement, Commercial Supply Agreement, [***] (as applicable), which Third Party is designated by Merck and is reasonably acceptable to Moderna (and in all cases those listed on Exhibit L-1 are deemed acceptable); provided that Moderna may only determine that a Third Party selected by Merck to act as a contract manufacturer of Merck (or its Affiliate) is not reasonably acceptable [***] if (a) such Third Party manufacturer or its Affiliate is a biotech or pharmaceutical company [***] that Researches, Develops or Commercializes (i) [***] (for example, as of the Amended Effective Date, the Third Parties listed on Exhibit L-2), or (ii) [***] (for example, as of the Amended Effective Date, the Third Parties listed on Exhibit L-2), or (b) with respect to Third Party manufacturing in [***], Moderna has reasonable concerns [***] relating to [***].

1.191 “Material(s)” means any tangible chemical or biological material, including any compounds, DNA and RNA (modified and unmodified), mRNA Constructs, polypeptides, clones, cells, plasmids, lipids, vectors, receptors, any other nucleic acids, proteins, peptides and any expression product, progeny, derivative or other improvement thereto, along with any tangible chemical or biological material embodying any Know-How.

1.192 “Medical Affairs” means, with respect to a product, the performance of activities with respect to: continuing medical education therefor; development, publication and dissemination of publications; exhibiting and presenting at seminars and conventions; conducting health economic studies; conducting speakers programs; conducting appropriate activities involving opinion leaders; engaging medical science liaisons and conducting medical science liaison activities; disease education to health care professionals and consumers; conducting advisory board meetings or other consultant programs; and establishing clinical consumer and patient registries.

1.193 “Medical Affairs Costs” has the meaning set forth in the Financial Definitions Exhibit.
1.194 “Merck” has the meaning set forth in the Recitals.

1.195 “Merck Acquisition” has the meaning set forth in Section 10.8(d)(ii).

1.196 “Merck Acquisition Program” has the meaning set forth in Section 10.8(d)(ii).

1.197 “Merck Agent” means any [***] Controlled by Merck or its Affiliates (but not [***]).

1.198 “Merck Agent Technology” has the meaning set forth in Section 11.3.

1.199 “Merck Background Know-How” means, on a Program-by-Program basis, subject to Section 10.12, any and all Know-How Controlled by Merck or its Affiliates (a) as of the date of Initiation of such Program, or (b) as to which Merck or its Affiliates obtains Control during the Collaboration Term for such Program, in each case (a)-(b) that [***], excluding [***] Merck’s rights in any Collaboration Know-How.

1.200 “Merck Background Patents” means, on a Program-by-Program basis, subject to Section 10.12, those Patents that are Controlled by Merck or its Affiliates (a) as of the date of Initiation of such Program, or (b) as to which Merck or its Affiliates obtains Control during the Collaboration Term for such Program, in each case (a)-(b) that claim or cover the Merck Background Know-How for such Program, excluding in each case (a) and (b) Merck’s rights in any Collaboration Patents.

1.201 “Merck Background Technology” means Merck Background Know-How and Merck Background Patents.

1.202 “Merck Business Combination Program” has the meaning set forth in Section 10.8(d)(i).

1.203 “Merck Cessation Election” has the meaning set forth in Section 10.10.

1.204 [***]

1.205 [***]

1.206 “Merck General Patents” means Merck Background Patents, excluding [***].

1.207 “Merck In-License” has the meaning set forth in Section 1(c) of Exhibit F.

1.208 “Merck Indemnitees” has the meaning set forth in Section 13.6(b).

1.209 “Merck Internal SAV Program” means an Internal SAV Program being conducted by Merck or its Affiliates.

1.210 [***]

1.211 “Merck Non-Participation” has the meaning set forth in Section 3.7(a).
1.212 “Merck Participation Election” has the meaning set forth in Section 3.5(b).
1.213 “Merck Participation Election Date” means, with respect to the PCV Program or a given Joint SAV Program, [***].
1.214 “Merck Participation Election Notice” has the meaning set forth in Section 3.5(c).
1.215 “Merck Participation Election Period” means, with respect to the PCV Program or a given Joint SAV Program, the period commencing on the date of Initiation of such Program and ending upon the earliest of [***].
1.216 “Merck Participation Term” means, for the PCV Program or a given Joint SAV Program, the period commencing on the Merck Participation Election Date for such Program and ending upon [***].
1.217 “Merck Participation Term Lead Regulatory Party” means [***] with respect to the PCV Program or any Joint SAV Program, unless otherwise agreed to by the Parties in writing with respect to a given Program.
1.218 “Merck Patents” means the Merck General Patents and the [***].
1.219 [***]
1.220 “Merck Program Director” has the meaning set forth in Section 2.2.
1.221 [***]
1.222 [***]
1.223 “Merck Reimbursement Cap” has the meaning set forth in Exhibit E.
1.224 “Merck Representatives” has the meaning set forth in Exhibit G.
1.225 [***]
1.226 “Merck SAV Program Costs” means, [***].
1.227 [***]
1.228 “Merck Technology” means collectively, Merck Background Technology and Merck’s interest in Collaboration Technology.
1.229 “Moderna” has the meaning set forth in the Recitals.
1.230 [***]
1.231 [***]
1.232 "Moderna Agent" means any [***] Controlled by Moderna or its Affiliates (but not Collaboration Products).

1.233 "Moderna Agent Technology" has the meaning set forth in Section 11.2.

1.234 "Moderna Background Know-How" means, on a Program-by-Program basis, subject to Section 10.12, any and all Know-How Controlled by Moderna or any of its Affiliates (a) as of the date of Initiation of such Program, including [***], or (b) as to which Moderna or any of its Affiliates obtains Control during the Collaboration Term for such Program, in each case ((a)-(b)) that [***], excluding [***] Moderna’s rights in any Collaboration Know-How.

1.235 "Moderna Background Patents" means, on a Program-by-Program basis, subject to Section 10.12, those Patents that are Controlled by Moderna or any of its Affiliates [***] that claim or cover the Moderna Background Know-How for such Program, excluding [***] Moderna’s rights in any Collaboration Patents.

1.236 "Moderna Background Technology" means Moderna Background Know-How and Moderna Background Patents.

1.237 "Moderna Business Combination Program" has the meaning set forth in Section 10.7(e)(i).

1.238 "Moderna CMC Information" means, with respect to the PCV Program or a Joint SAV Program under this Agreement, the Confidential CMC Data of Moderna or its Affiliates with respect to a product that is Researched, Developed, Manufactured and/or Commercialized under the PCV Program or such Joint SAV Program.

1.239 [***]

1.240 [***]

1.241 [***]

1.242 "Moderna Commercialization Costs" has the meaning set forth in the Financial Definitions Exhibit.

1.243 "Moderna Costs Report" has the meaning set forth in Exhibit E.

1.244 "Moderna Development Costs" has the meaning set forth in the Financial Definitions Exhibit.

1.245 [***]

1.246 "Moderna General Patents" means [***].

1.247 "Moderna Indemnitees" has the meaning set forth in Section 13.6(a).

1.248 "Moderna Internal SAV Program" means an Internal SAV Program being conducted by Moderna or its Affiliates.
1.249 “Moderna New In-License” has the meaning set forth in Section 1(b)(i) of Exhibit F.

1.250 “Moderna Net Profits” has the meaning set forth in the Financial Definitions Exhibit.

1.251 [***]

1.252 “Moderna Patents” means the Moderna General Patents, [***] and the [***].

1.253 [***]

1.254 “Moderna Pre-Existing In-License” means, a license or other agreement between Moderna or its Affiliates and a Third Party in effect as of [***] pursuant to which a Third Party grants Moderna (or its Affiliates) a license under any Patents or Know-How that are necessary or reasonably useful for the Research, Development, Manufacture or Commercialization of mRNA Cancer Vaccines. The Moderna Pre-Existing In-License(s) shall be set forth on Schedule 1.254.

1.255 [***]

1.256 [***]

1.257 “Moderna Program Director” has the meaning set forth in Section 2.2.

1.258 [***]

1.259 [***]

1.260 [***]

1.261 [***]

1.262 [***]

1.263 [***]

1.264 “Moderna Technology” means collectively, Moderna Background Technology and Moderna’s interest in Collaboration Technology.

1.265 “mRNA-5671” means mRNA-5671 as described in the POC Plan for the KRAS Program.

1.266 “mRNA Cancer Vaccine” means any PCVs and/or SAVs, as applicable.

1.267 “mRNA Cancer Vaccine Technology” means any [***].

1.268 “mRNA Construct” means [***].
1.269 “mRNA-PCV Field” means Research, Development, Manufacture or Commercialization of any PCV.
1.270 “mRNA-SAV Field” means Research, Development, Manufacture or Commercialization of any SAV.
1.271 “mRNA Technology” means [***].
1.272 “NDA” means a new drug application or a biologics license application (a “BLA”), including all supplements and amendments thereto and all necessary documents, data, and other information concerning a product, required for Regulatory Approval of the product as a pharmaceutical product by the FDA or an equivalent application to the equivalent agency in any other country or group of countries (e.g. the marketing authorization application (MAA) in the EU).
1.273 “Net Residual Amount” means the difference between (a) the Upfront Payment and (b) the POC Program Costs for the PCV Program incurred as of the earlier of (i) [***], or (ii) [***].
1.274 “Net Sales” means the gross invoice price (not including [***]) of a Collaboration Product or Financial PCV or Financial SAV sold by a Selling Party to the first Third Party after deducting, if not previously deducted, from the amount invoiced or received:
   (a) [***]
   (b) [***]
   (c) [***]
   (d) [***]
   (e) [***]
   (f) [***]
   (g) [***]
wherein the foregoing actual deductions incurred in (a) through (g) shall be determined in a manner as [***], including such Financial PCV or Financial SAV or Collaboration Product, and for the sake of clarity, where any charge or allowance as described above in this Section 1.274 shall be counted once only. [***] With respect to a Financial PCV or Financial SAV or Collaboration Product that is sold as a Combination Product, Net Sales of such Financial PCV or Financial SAV or Collaboration Product shall be calculated in accordance with Exhibit C and shall not include the Relative Commercial Value of any Other Component of such Combination Product in accordance with Exhibit C.
1.275 “New In-License” means a Moderna New In-License or a Merck In-License.
1.276 “Non-Commercial Combination Activity” means [***].
1.277 “Non-IAS Party” has the meaning set forth in Section 7.1(b).
1.278 “Non-Participation PCV Net Profit Share” has the meaning set forth in Exhibit E.
1.279 “Non-Participation SAV Net Profit Share” has the meaning set forth in Exhibit E.
1.280 “Officials” has the meaning set forth in Section 5.5.
1.281 “Original Agreement” has the meaning set forth in the Recitals.
1.282 “Other Component” means any therapeutically or prophylactically active ingredients other than a PCV or SAV. For clarity, an Other Component may include one or more of the following: Merck Agent, Moderna Agent, Third Party Agent or [***].
1.283 “Other Operating Income/Expense” has the meaning set forth in the Financial Definitions Exhibit.
1.284 “Other SAV POC Program” has the meaning set forth in Section 3.1(c)(iv).
1.285 “Out-of-Pocket Costs” has the meaning set forth in the Financial Definitions Exhibit.
1.286 “P&L” has the meaning set forth in Exhibit D.
1.287 “Participation Election Payment” has the meaning set forth in Section 9.3(a)(ii).
1.288 “Parties” has the meaning set forth in the Recitals.
1.289 “Party” has the meaning set forth in the Recitals.
1.290 “Patent” means (a) a patent or a patent application, (b) any additions, priority applications, divisions, continuations, and continuations-in-part of any of the foregoing and (c) all patents issuing on any of the foregoing patent applications, together with all invention certificates, substitutions, reissues, reexaminations, registrations, supplementary protection certificates, confirmations, renewals and extensions of any of (a), (b) or (c), and foreign counterparts of any of the foregoing.
1.291 “Patent and Trademark Expenses” has the meaning set forth in the Financial Definitions Exhibit.
1.292 “Patent Costs” has the meaning set forth in the Financial Definitions Exhibit.
1.293 “Payment” has the meaning set forth in Section 5.5.
1.294 “PCV” means [***].
1.295 “PCV Cessation Net Profit Share” has the meaning set forth in Exhibit E.
1.296 “PCV Clinical Supply Agreement” has the meaning set forth in Section 6.2(d).
1.297 “PCV Participation Election Payment” has the meaning set forth in Section 9.3(a)(i).

1.298 “PCV POC Program” has the meaning set forth in Section 3.1(a).

1.299 “PCV POC Term” has the meaning set forth in Section 3.2(a).

1.300 “PCV Program” means the Research, Development and Manufacture of PCVs (including Collaboration PCV Products) in accordance with the POC Plan for PCVs, and if Merck exercises the applicable Merck Participation Election, the further Research of PCVs (including Collaboration PCV Products) in accordance with an Additional Research Plan, and the Development, Manufacture and Commercialization of Collaboration PCV Products by or on behalf of one or more of the Parties under the Collaboration in accordance with this Agreement. For clarity, the PCV Program shall be separate from each SAV Program.

1.301 [***].

1.302 “Permitted In-License” has the meaning set forth in Section 1(d) of Exhibit F.

1.303 [***]

1.304 “Person” means any individual, partnership, joint venture, limited liability company, corporation, firm, trust, association, unincorporated organization, governmental authority or agency, or any other entity not specifically listed herein.

1.305 “Pharmacovigilance Agreement” has the meaning set forth in Section 7.3.

1.306 “Phase I Clinical Study” shall mean a human clinical trial in any country that would satisfy the requirements of 21 CFR 312.21(a).

1.307 “Phase II Clinical Study” shall mean a human clinical trial in any country that would satisfy the requirements of 21 CFR 312.21(b).

1.308 “Phase III Clinical Study” shall mean a human clinical trial in any country that would satisfy the requirements of 21 CFR 312.21(c).

1.309 “Phase IV Clinical Study” means (i) any human clinical trial (other than a Phase I Clinical Study, Phase II Clinical Study or Phase III Clinical Study) in any country which is conducted on a product after Regulatory Approval of such product has been obtained from an appropriate Regulatory Authority, and includes clinical trials conducted voluntarily after Regulatory Approval for enhancing marketing or scientific knowledge of an approved indication or (ii) any REMS/RMP related study of a product after Regulatory Approval.

1.310 “Plans” means, with respect to a given Program, the Internal SAV Program Plan, the POC Plan, the Joint Development Plan and Budget and the Global Commercialization Plan for such Program.

1.311 [***]
1.312 

1.313 “POC Committee” has the meaning set forth in Section 2.3(a).

1.314 “POC Data Package” means, with respect to a given Program, the data package of data and information to be generated and collected under a POC Plan for such Program, which data package will in any event include: [***]; provided that with respect to an SAV POC Program, [***].

1.315 “POC Lead Regulatory Party” means, for a given POC Program, [***].

1.316 [***]

1.317 “POC Plan” has the meaning set forth in Section 3.3(a).

1.318 “POC Pharmacovigilance Agreement” has the meaning set forth in Section 3.4(m).

1.319 “POC Program” has the meaning set forth in Section 3.1(c)(iv).

1.320 “POC Program Costs for the PCV Program” means, with respect to the PCV Program, the internal costs (i.e., FTE Costs) and Out-of-Pocket Costs actually incurred by or on behalf Moderna (or its Affiliates) and that are [***] to the conduct of the POC Plan for the PCV Program, including:

(a) [***]
(b) [***]
(c) [***]
(d) [***]
(e) [***]
(f) [***]
(g) [***]

With respect to the foregoing, any internal costs shall be calculated based on the number of FTEs used to perform the applicable activity multiplied by the FTE Rate.

1.321 “POC Term” has the meaning set forth in Section 3.2(b).

1.322 “Post-Marketing Study” means a non-human pre-clinical study or human Clinical Study of a product initiated after receipt of Regulatory Approval for such product in a country or territory, which is required by the Regulatory Authority in such country or territory to maintain the Regulatory Approval for such product in such country or territory.
1.323 “Pre-Existing Restriction” means [***].

1.324 “Pre-GLP Tox Commitment Date” means, with respect to a given Internal SAV Program, the earlier of (a) the date of the ISP Party’s selection of a Lead SAV Candidate for such Internal SAV Program, or (b) the effective date of expiration or termination of the SAV Research Term.

1.325 “Pre-GLP Tox Data Package” means, with respect to a given Internal SAV Program, the data package of data and information to be generated and collected for such Internal SAV Program, which data package will in any event include [***].

1.326 “Pre-GLP Tox Election” has the meaning set forth in Section 3.1(d)(iv).

1.327 “Pre-GLP Tox Election Date” means, with respect to a given Internal SAV Program, the date of the Pre-GLP Tox Election Notice for such Internal SAV Program.

1.328 “Pre-GLP Tox Election Notice” has the meaning set forth in Section 3.1(d)(v).

1.329 “Pricing Matters” means all issues and decisions regarding (a) price, price terms and other contract terms with respect to Collaboration Product sales, including discounts, rebates, other price concessions and service fees to payors and purchasers and (b) reimbursement programs applicable to a Collaboration Product.

1.330 “Primary POC PCV Funding Amount” has the meaning set forth in Section 3.4(g)(i)(2).

1.331 “Product Specific Manufacturing Variances” has the meaning set forth in the Financial Definitions Exhibit.

1.332 “Profit & Loss Share” has the meaning set forth in Section 9.3(b).

1.333 “Profitability Date” has the meaning set forth in the Financial Definitions Exhibit.

1.334 “Program” means the PCV Program or any SAV Program (including the KRAS Program), as applicable.

1.335 “Program Directors” has the meaning set forth in Section 2.2.

1.336 “Promotional Materials” means all sales representative training materials and all written, printed, graphic, electronic, audio or video matter, including journal advertisements, sales visual aids, leave-behind items, formulary binders, reprints, direct mail, direct-to-consumer advertising, internet postings and sites and broadcast advertisements intended for use or used by or on behalf of either Party or their respective Affiliates in connection with any promotion of a Collaboration Product.

1.337 “Prosecution and Maintenance” means, with regard to a particular Patent or claim within a Patent, the preparation, filing, prosecution and maintenance of such Patent or claim, as well as re-examinations, reissues and the like with respect to such Patent or claim, together with the conduct of interferences, the defense of oppositions and other similar proceedings with respect to such Patent or claim. The term “Prosecute and Maintain” shall have a corresponding meaning.
1.338 “Providers” has the meaning set forth in Section 5.2.

1.339 “Qualification Standards” means the customary, reasonable standards and criteria to be applied [***].

1.340 “Quality Agreements” means the Clinical Quality Agreement(s) and the Commercial Quality Agreement(s).

1.341 [***]

1.342 “Receiving Party” has the meaning set forth in Section 12.1(a).

1.343 “Reconciliation Report” has the meaning set forth in Exhibit D.

1.344 “Registrational Study” means, with respect to the United States, a Clinical Study of a product on sufficient numbers of patients that is designed to establish that such product is safe and efficacious for its intended use, and to define warnings, precautions and adverse reactions that are associated with such product in the dosage range to be prescribed, and to support Regulatory Approval of such product or label expansion of such product, as described under 21 C.F.R. §312.21(c), or, with respect to a jurisdiction other than the United States, an equivalent clinical trial.

1.345 “Regulatory Approval” means, with respect to a country or extra-national territory, any and all approvals (including NDAs), licenses, registrations or authorizations of any Regulatory Authority necessary in order to commercially distribute, sell or market a product in such country or some or all of such extra-national territory, including any pricing or reimbursement approvals.

1.346 “Regulatory Authority” means any national (e.g., the FDA), supra-national (e.g., the EMA), regional, state or local regulatory agency, department, bureau, commission, council or other governmental entity, in any jurisdiction in the world, involved in the granting of Regulatory Approval or otherwise involved in regulating the Research, Development, Manufacture or Commercialization of a product.

1.347 “Regulatory Filing” means any submission to a Regulatory Authority, including all applications, registrations, licenses, authorizations and approvals (including Regulatory Approvals), together with any related correspondence and documentation submitted to or received from Regulatory Authorities (including minutes and official contact reports relating to any communications with any Regulatory Authority) and all supporting documents and all clinical studies and tests, relating to a product and all data contained in any of the foregoing, including all INDs, NDAs, CTAs, regulatory drug lists, advertising and promotion documents, Clinical Data, Adverse Event files and complaint files, and include any submission to a regulatory advisory board, marketing authorization application, and any supplement or amendment thereto.
1.348 “Relative Commercial Value” has the meaning set forth in Exhibit C.

1.349 “Release” has the meaning set forth in Section 12.3(c).

1.350 “Released Target” means [***].

1.351 [***]

1.352 “Research” means activities related to the design, discovery, identification, research, pre-clinical development, preclinical toxicology studies, profiling, characterization, improvement or optimization of a product. For clarity, “Research” excludes Development, Commercialization or Manufacturing activities. The term “Researched” has a corresponding meaning.

1.353 [***]

1.354 “Reviewing Party” has the meaning set forth in Section 12.3(c).

1.355 “Right of Reference” means the “right of reference” defined in 21 CFR 314.3(b), including, with respect to a Party, allowing the applicable Regulatory Authority in a country to have access to relevant information (by cross-reference, incorporation by reference or otherwise) contained in Regulatory Filings (and any data contained therein) filed with such Regulatory Authority with respect to such Party’s product, only to the extent necessary for the conduct of Research, Development, Manufacturing or Commercialization activities for such product in such country or as otherwise expressly permitted or required under this Agreement to enable the other Party to exercise its rights or perform its obligations hereunder.

1.356 “Safety Issue” means, with respect to a given Collaboration Product or Other Component used in combination with such Collaboration Product:

1.357 “SAV” means a messenger RNA-based therapeutic cancer vaccine intended to treat multiple patients and [***], including [***] but excluding PCVs.

1.358 “SAV Cessation Net Profit Share” has the meaning set forth in Exhibit E.

1.359 “SAV Clinical Supply Agreement” has the meaning set forth in Section 6.2(e).

1.360 “SAV IND Data Package” means, for a given Joint SAV Program (other than the KRAS Program), an information package regarding the SAVs for such Joint SAV Program that is submitted by Moderna to Merck following completion of the IND-Enabling Studies for the SAVs for such Joint SAV Program, which includes [***].

1.361 “SAV Participation Election Payment” has the meaning set forth in Section 9.3(a)(ii).

1.362 “SAV POC Program” has the meaning set forth in Section 3.1(c)(iv).

1.363 “SAV POC Term” has the meaning set forth in Section 3.2(b).
1.364 “SAV Program” means (a) a Joint SAV Program or (b) an Internal SAV Program. For clarity, a given SAV Program will be separate from each other SAV Program, and each SAV Program shall also be separate from the PCV Program. If agreed to by the Parties, a given SAV Program may include more than one Target.

1.365 “SAV Research Term” means the period from the Amended Effective Date until the earlier of [***].

1.366 [***]

1.367 “SAV Target” means (a) for the KRAS Program, KRAS, or (b) for any other Joint SAV Program, any Target(s) (other than KRAS) that the Parties mutually agree to include in such Joint SAV Program pursuant to the POC Plan for such Joint SAV Program.

1.368 “SAV Target Notice” has the meaning set forth in Section 3.1(c)(i).

1.369 “SEC” has the meaning set forth in Section 12.3(b).

1.370 “Selling Expenses” has the meaning set forth in the Financial Definitions Exhibit.

1.371 “Selling Party” means with respect to a Party, such Party and its Affiliates and Sublicensees, except as otherwise provided in Exhibit D or Exhibit E.

1.372 [***]

1.373 “Serious Adverse Event” or “SAE” means any untoward medical occurrence that at any dose: results in death, is life-threatening, requires inpatient hospitalization or prolongation of existing hospitalization, results in persistent or significant disability/incapacity or, is a congenital anomaly/birth defect. Medical and scientific judgment should be exercised in deciding whether expedited reporting is appropriate in other situations, such as important medical events that may not be immediately life-threatening or result in death or hospitalization but may jeopardize the patient or may require intervention to prevent one of the other outcomes listed in the definition above. These should also usually be considered serious. Examples of such events are intensive treatment in an emergency room or at home for allergic bronchospasm; blood dyscrasias or convulsions that do not result in hospitalization; or development of drug dependency or drug abuse or transmission of an infectious agent via a medicinal product.

1.374 “Shared Collaboration Costs” has the meaning set forth in the Financial Definitions Exhibit.

1.375 “Shared Commercialization and Related Manufacturing Costs” has the meaning set forth in the Financial Definitions Exhibit.

1.376 “Shared Costs Report” has the meaning set forth in Exhibit D.

1.377 “Shared Development and Related Manufacturing Costs” has the meaning set forth in the Financial Definitions Exhibit.

1.378 “Shared Neoepitope(s)” means [***].
“Shared Losses” has the meaning set forth in the Financial Definitions Exhibit.

“Shared Profits” has the meaning set forth in the Financial Definitions Exhibit.

“Shared Profits or Losses” has the meaning set forth in the Financial Definitions Exhibit.

“Significant Third Party” has the meaning set forth in Section 15.3.

“Software” means any and all computer programs, operating systems, applications, firmware, middleware, or software of any nature, whether operational, under development or inactive including all object code, source code, comment code, algorithms, tools, build, underlying components thereof, menu structures and arrangements, icons, operational instructions, scripts, commands, syntax, screen designs, reports, designs, concepts, technical manuals, test scripts, user manuals and other documentation therefor, whether in machine-readable form, programming language or any other language or symbols, and whether stored, encoded, recorded or written on disk, tape, film, memory device, paper or other media of any nature and all databases necessary or appropriate to operate any such computer programs, operating systems, applications, firmware, middleware, or software.

“[***]” means [***].

“Special Arbitration” has the meaning set forth in Section 15.1(c).

“Sublicense Income” means all consideration (including upfront payments, license fees, royalties and milestone payments) [***] by a Selling Party [***], net of out-of-pocket expenses of a Selling Party incurred in connection with such [***].

“Sublicensee” means any Person that is granted a sublicense as permitted by Section 10.3, either directly by a Party or indirectly by any other Sublicensee (including any Affiliate that is granted a sublicense hereunder but excluding, for clarity, any Distributors).

“Supply Agreement” means any supply agreement entered into by the Parties pursuant to Section 6 (including the PCV Clinical Supply Agreement, SAV Clinical Supply Agreement and any Commercial Supply Agreement). For clarity, the 2016 CSA is not a Supply Agreement.

“Supply Failure” means, with respect to the given PCV Clinical Supply Agreement, SAV Clinical Supply Agreement, Commercial Supply Agreement or Exhibit K, the meaning given to such term in such PCV Clinical Supply Agreement, SAV Clinical Supply Agreement, Commercial Supply Agreement or Exhibit K, as applicable, for an event or circumstance, [***].

“Target” means [***].

“Tax” and “Taxation” means any form of tax or taxation, levy, duty, charge or withholding (including any related fine, penalty, addition to tax, surcharge or interest) imposed by, or payable to, a governmental authority.
1.392 “Technical Failure” means with respect to a given Joint SAV Program, [***].

1.393 “Term” has the meaning set forth in Section 14.1.

1.394 “Territory” means worldwide.

1.395 “Testing Costs” has the meaning set forth in the Financial Definitions Exhibit.

1.396 “Third Party” means any Person other than Moderna, Merck and their respective Affiliates.

1.397 “Third Party Agent” means any clinical-stage compound or marketed product controlled by a Third Party (but not any [***]).

1.398 “Third Party Claims” has the meaning set forth in Section 13.6(a).

1.399 “Transparency Report” has the meaning set forth in Section 3.4(k)(vii).

1.400 “United States” or “U.S.” means the United States of America, including its territories and possessions, the District of Columbia and Puerto Rico.

1.401 “U.S. GAAP Standard Cost” has the meaning set forth in the Financial Definitions Exhibit.

1.402 “Upfront Payment” has the meaning set forth in Section 9.1.

1.403 “Violation” means, with respect to a Party, such Party or any of its officers or directors or any other personnel of such Party (or other permitted agents of such Party performing activities hereunder) has been: (a) convicted of any of the felonies identified among the exclusion authorities listed on the U.S. Department of Health and Human Services, Office of Inspector General (OIG) website, including 42 U.S.C. 1320a-7(a) (http://oig.hhs.gov/exclusions/authorities.asp); (b) identified in the OIG List of Excluded Individuals/Entities (LEIE) database (http://exclusions.oig.hhs.gov/) or listed as having an active exclusion in the System for Award Management (http://www.sam.gov); or (c) listed by any US Federal agency as being suspended, proposed for debarment, debarred, excluded or otherwise ineligible to participate in Federal procurement or non-procurement programs, including under 21 U.S.C. 335a (http://www.fda.gov/ora/compliance_ref/debar) (each of (a), (b) and (c) collectively the “Exclusions Lists”).

2. COLLABORATION OVERVIEW; GOVERNANCE

2.1 Overview of Collaboration. The Parties intend and have agreed to undertake the Collaboration under this Agreement with the primary goal to Research, Develop, Manufacture and Commercialize Collaboration Products in accordance with the Collaboration with the goal of expanding and enhancing the value of such Collaboration Products, consisting, in general, of the following major components:
(a) a broad program to be conducted during the POC Term for the PCV Program for the Research and Development of PCVs (including Collaboration PCV Products), pursuant to which Moderna will conduct Research and Development efforts with Merck’s participation with respect to such PCVs and establish Manufacturing capabilities for Collaboration PCV Products, as described in the POC Plan for the PCV Program and further detailed in Section 3;

(b) a broad program to be conducted during the POC Term for the KRAS Program, pursuant to which the Parties will conduct Research and Development efforts with respect to SAVs Directed against KRAS (including Collaboration SAV Products Directed against KRAS) and identify Manufacturing capacity for such Collaboration SAV Products, as described in the POC Plan for the KRAS Program and further detailed in Section 3;

(c) if during the SAV Research Term, the Parties do not agree to collaborate on one or more additional Targets, then a Party and its Affiliates may conduct an Internal SAV Program, pursuant to which such Party and its Affiliates may conduct Research efforts with respect to one or more SAVs Directed against such Target, as described in the Internal SAV Program Plan for such Internal SAV Program and further described in Section 3.1(d);

(d) if during the SAV Research Term, the Parties mutually agree to collaborate on one or more additional SAV Targets (other than KRAS) in accordance with Section 3.1(c), a broad program to be conducted during the POC Term for such Joint SAV Program, pursuant to which the Parties will conduct Research and Development efforts with respect to such SAVs Directed against such SAV Target (including Collaboration SAV Products Directed against such SAV Target) and identify Manufacturing capacity for such Collaboration SAV Products, as described in the POC Plan for such Joint SAV Program and further detailed in Section 3;

(e) for each given Program, Merck will have the right during the Merck Participation Election Period for such Program to exercise the Merck Participation Election for such Program to further participate with Moderna in the further Research, Development, Manufacture and Commercialization of mRNA Cancer Vaccines (including Collaboration Products) with respect to such Program, and to share equally the costs and benefits of, such Research, Development, Manufacture and Commercialization, subject to and in accordance with this Agreement;

(f) for each given Program, if Merck exercises the Merck Participation Election for such Program, then, subject to Merck paying the Participation Election Payment for such Program in accordance with Section 9.3(a), during the Merck Participation Term for such Program:

   (i) the Parties will conduct further Research and Development of mRNA Cancer Vaccines (including Collaboration Products) for such Program through Regulatory Approval, with the activities to be jointly funded by the Parties in accordance with the terms of this Agreement; provided, however, that [***];

   (ii) Merck shall have the sole right to Commercialize the Collaboration Products from such Program in the Territory (subject to Moderna’s right to engage in Co-Promotion activities in the United States under and in accordance with Sections 8.5 and 8.6 and any Co-Promotion Agreement(s));
(iii) the Parties will participate in profits or losses arising from the Commercialization of such Collaboration Products, all as detailed and pursuant to Section 9; and

(iv) each Party will grant appropriate cross-licenses to the other Party to Research, Develop, Manufacture and Commercialize such Collaboration Products pursuant to Section 10.

(g) ***.

(i) During the SAV Research Term, the Parties may review and discuss the available Clinical Data that is generated in the course of Developing Collaboration PCV Products to determine whether ***.

  1. If, during the SAV Research Term, ***, then the Parties may mutually agree to amend the applicable Plan to *** in accordance with the Plan for such SAV Program.

  2. If, during the SAV Research Term, ***, and the Parties wish to conduct Collaboration Activities for such ***, then the Parties may mutually agree to initiate a new SAV Program with respect to such *** in accordance with Section 3.1(c).

  3. ***

(ii) From time to time after the end of the SAV Research Term and during any remaining portion of the Collaboration Term for the PCV Program, the Parties may review and discuss the available Clinical Data that is generated in the course of Developing Collaboration PCV Products to determine whether ***. During the discussion referenced above, a Party shall disclose to the other Party if such Party (or any of its Affiliates) is engaged in a pre-existing bona fide active and sustained research, development or commercialization program (alone or with one or more Third Parties) on any *** based on ***.

  1. If, after the end of the SAV Research Term and during any remaining portion of the Collaboration Term for the PCV Program, a pre-existing bona fide active and sustained research, development or commercialization program with respect to an *** based on ***, then following the disclosure pursuant to clauses (ii) above in which the existence of such pre-existing program became known to both Parties, each Party shall ***.

  2. If, after the end of the SAV Research Term and during any remaining portion of the Collaboration Term for the PCV Program, such ***, then the Parties may mutually agree to amend the applicable Plan to incorporate the Research, Development, Manufacture and Commercialization of *** associated with *** in accordance with the Plan for such ***.

  3. If, after the end of the SAV Research Term and during any remaining portion of the Collaboration Term for the PCV Program, no such pre-existing program exists [***], at the written request of either Party, then any such ***s based on any such *** shall automatically be treated [***], for so long as one or both of the Parties [***].
For the avoidance of doubt, subject to this Section 2.1(g) and Sections 10.7 and 10.8, nothing in this Agreement shall limit either Party’s (or its Affiliates’) ability to research, develop, manufacture or commercialize any [***], or grant licenses or otherwise enter into agreements with one or more Third Parties for any of those activities.

2.2 Collaboration Management. Promptly after the Effective Date, each Party will appoint a person who will oversee day-to-day contact between the Parties for all matters related to the management of the Collaboration Activities in between meetings of the Committees and will have such other responsibilities as the Parties may agree in writing after the Effective Date. One person will be designated by Merck (the “Merck Program Director”) and one person will be designated by Moderna (the “Moderna Program Director”) and together they will be the “Program Directors”. Each Party may replace its Program Director at any time by notice in writing to the other Party. Any Program Director may designate a substitute to temporarily perform the functions of that Program Director by written notice to the other Party. Each Program Director also may serve as a representative of its respective Party on one or more Committees. The initial Program Directors will be:

For Moderna: [***]
For Merck: [***]

2.3 POC Committee.

(a) Formation and Membership. Pursuant to the Original Agreement, the Parties have established a joint committee to oversee the POC Programs (the “POC Committee”), comprised of [***] representatives of Moderna (or its Affiliate) and [***] representatives of Merck (or its Affiliate). Each POC Committee member will be a senior development leader or have similar experience and expertise as a senior development leader. Each Party may replace its representatives on the POC Committee at any time upon written notice to the other Party. With the consent of the other Party (such consent not to be unreasonably withheld, delayed or conditioned), each Party may invite non-voting employees and consultants to attend meetings of the POC Committee, subject to their agreement to be bound to the same extent as a permitted subcontractor under Section 10.4.

(b) Meetings. While in existence, the POC Committee will meet [***] (or more frequently as may be determined by the POC Committee) and may hold meetings in person or by audio or video conference as determined by the POC Committee, but at a minimum, [***] of such meetings each Calendar Year will be in person (which in-person meeting will be held at one of Moderna’s U.S. facilities, and the other held at Merck’s U.S. facilities). Meetings of the POC Committee will be effective only if at least [***] representative of each Party is present or participating. Each Party will be responsible for all of its own expenses of participating in the meetings. The Parties will endeavor to schedule meetings of the POC Committee at least [***] months in advance. The POC Committee will determine the POC Committee operating procedures, which shall in all cases be consistent with the terms of this Agreement, and will codify these operating procedures in the written minutes of the first meeting (or subsequent meetings as such procedures are updated). The POC Committee will prepare and circulate a meeting agenda prior to each such meeting. For the purposes of this Section 2, “agenda” will include any relevant background materials. The Parties will alternate in preparing written
minutes of such meeting, and the preparing Party will circulate such minutes within [***] days after such meeting. The Parties will agree on the minutes of each meeting promptly, but in no event later than the next meeting of the POC Committee. Each Party will designate one (1) of its [***] representatives who is empowered by such Party to make decisions regarding issues within the purview of the POC Committee as set forth below in Section 2.3(c) to act as the co-chair of each POC Committee. The co-chairs will be responsible for overseeing the activities of its POC Committee members consistent with the responsibilities set forth in Section 2.3(c).

(c) Responsibilities. The POC Committee will discuss the Parties' performance of Collaboration Activities under the Internal SAV Program Plans and POC Plans. The POC Committee may form project teams to oversee any day-to-day activities necessary to execute the POC Plans. Without limiting the generality of the foregoing, within such scope, the POC Committee will have the following responsibilities:

(i) discuss an ISP Party’s performance of any Internal SAV Program under an Internal SAV Program Plan;

(ii) review each Party’s performance of Collaboration Activities under the POC Plans;

(iii) review any proposed modifications or amendments to a given POC Plan (including the Data Sharing and Sample Testing Schedule included therein);

(iv) review and discuss any Additional Moderna PCV POC Term Studies conducted in accordance with Section 3.3(d);

(v) resolve any disputes related to the Additional Moderna PCV POC Term Study contemplated in Section 3.3(d);

(vi) prioritize and oversee execution of specific activities to be performed under each POC Plan;

(vii) review and discuss amendments to the KRAS Transition Plan (provided that any amendments to the KRAS Transition Plan must be mutually agreed to by the Parties in writing) and oversee the activities to be performed for the transition of the KRAS Program (including transfer of the IND) under the POC Plan and KRAS Transition Plan for the KRAS Program;

(viii) review data, reports or other information submitted by either Party with respect to Collaboration Activities under each Internal SAV Program Plan or POC Plan;

(ix) review and discuss any actual or potential Safety Issue or Technical Failure;

(x) review and discuss any Pre-GLP Tox Data Package for a given Internal SAV Program;
(xi) review and discuss any SAV IND Data Package for a given Joint SAV Program;

(xii) form such other subcommittees or project teams as the POC Committee may deem appropriate (including any project teams to oversee the day-to-day activities necessary to execute the POC Plans) and oversee the activities of any subcommittees or project teams formed by the POC Committee, including by receiving and reviewing reports and other information submitted by those subcommittees or project teams (if applicable); provided, that any such subcommittee or project team may make recommendations to the POC Committee but may not be delegated POC Committee decision-making authority;

(xiii) [***];

(xiv) coordinate and oversee the Manufacturing activities under a POC Plan with respect to PCVs (including Collaboration PCV Products) under the applicable Programs in the Territory, including CMC matters;

(xv) review and discuss Manufacturing activities under a POC Plan with respect to SAVs (including Collaboration SAV Products) under the applicable Joint SAV Program in the Territory, including CMC matters;

(xvi) discuss and resolve all disputes referred to the POC Committee by any subcommittee or project teams established by the POC Committee;

(xvii) review proposed publications regarding the results of the Collaboration Activities proposed to be published in accordance with Section 12.2; and

(xviii) attempt to resolve any disputes relating to this Agreement on an informal basis.

(d) Decision-making. The [***] POC Committee representatives of each Party will collectively have one (1) vote (i.e., all representatives of a Party vote as a single block). The POC Committee members will use diligent efforts to reach agreement on all matters. If, despite such efforts, agreement on a particular matter cannot be reached by the POC Committee within [***] days after the POC Committee first considers such matter (or such shorter time as may be reasonable in the circumstances), then upon the written request of a Party, such matter will be referred to the Executive Officers (or their designees, which designee is required to have decision-making authority on behalf of such Party), who will attempt in good faith to resolve such dispute by negotiation and consultation for a [***] day period following receipt of such written notice. If, despite such efforts, agreement on a particular matter cannot be reached by the Executive Officers within such [***] day period, then with respect to the applicable POC Program (i) if such matter relates to [***] such matter shall be determined by Moderna, in good faith and its sole discretion after due and reasonable consideration of Merck’s position, (ii) if such matter relates to [***], such matter shall be determined by Merck, in good faith and its sole discretion after due and reasonable consideration of Moderna’s position [***] (iv) for any other matter, such matter shall be resolved in accordance with the provisions of Section 15.1(c); provided that the Amended Anticipated PCV POC Budget (including any component thereof) may not be modified without the written consent of the Parties.
(c) POC Committee Term. The POC Committee will cease to exist upon the later of (i) the expiration or termination of all Merck Participation Election Periods or (ii) the expiration of the SAV Research Term.

2.4 Joint Steering Committee. Upon the first exercise of a Merck Participation Election, then within thirty (30) days after the Merck Participation Election Date, the Parties will establish a joint steering committee (the “Joint Steering Committee” or “JSC”). During the Merck Participation Term for a given Program, the JSC will oversee and facilitate Research activities under any Additional Research Program and the Development, Manufacturing and Commercialization of mRNA Cancer Vaccines (including Collaboration Products) for such Program. For clarity, the JSC will not have any responsibilities regarding, or oversight of, activities under the POC Plan for a given Program.

(a) Composition of the Joint Steering Committee. The Joint Steering Committee shall be comprised of [***] representatives of Merck and [***] representatives of Moderna. Each Party may change its representatives to the Joint Steering Committee from time to time in its sole discretion, effective upon notice to the other Party of such change. These representatives shall have appropriate technical credentials, experience and knowledge, and ongoing familiarity with the Collaboration Activities. With the consent of the other Party (such consent not to be unreasonably withheld, delayed or conditioned), each Party may invite non-voting employees and consultants to attend meetings of the Joint Steering Committee, subject to their agreement to be bound to the same extent as a permitted subcontractor under Section 10.4. The JSC may change its size from time to time by mutual consent of its members; provided that the JSC will consist at all times of an equal number of representatives of each of Merck and Moderna. Each Party will designate one of its representatives who is empowered by such Party to make decisions regarding issues within the purview of the Joint Steering Committee to act as the co-chair of the Joint Steering Committee. The co-chairs will be responsible for overseeing the activities of its Joint Steering Committee members consistent with the responsibilities set forth in this Section 2.4.

(b) Function and Powers of the Joint Steering Committee. During the Merck Participation Term for a given Program, the Joint Steering Committee shall have general strategic oversight of the Collaboration for such Program, and shall confer regarding the status of the Additional Research Plans and the Development Plans and the Research, Development, Manufacture and Commercialization of mRNA Cancer Vaccines (including Collaboration Products) for such Program. Without limiting the generality of the foregoing, the JSC shall have the following specific responsibilities during the Merck Participation Term for a given Program:

(i) review and discuss the Joint Development Plan and Budget for such Program and all amendments thereto, and approve any such amendments for the Joint Development Plan and Budget for the PCV Program and annual budget updates for the Joint Development Plan and Budget for any Program in accordance with Section 4.3(c)(ii), including to determine the resources and activities allocated by each Party thereto (which resources and activities will be set forth in the Joint Development Plan and Budget for such Program);

(ii) review and approve the Development Transition Plan for such Program;
(iii) review and comment on any Independent Additional Study Development Plan for such Program;

(iv) review and approve the Global Commercialization Plan, Global Commercialization Budget and global Commercialization strategy for such Program pursuant to Section 8.3;

(v) [***];

(vi) review, discuss and coordinate the Parties’ scientific presentation and publication strategy relating to the Collaboration Products in the Territory for such Program in accordance with Section 12.2;

(vii) [***]

(viii) review and approve any Additional Research Program(s) for such Program proposed by either Party;

(ix) oversee Research activities conducted pursuant to any Additional Research Plan for such Program;

(x) review and discuss any actual or potential Safety Issue with respect to any Collaboration Product or any Other Component used in a Combination Product;

(xi) provide guidance to the JDC, JMC or JCC and attempt to resolve issues for such Program presented to it by any other Committee; and

(xii) perform such other functions as may be expressly delegated to the JSC pursuant to this Agreement.

(c) Joint Steering Committee Decision-Making. Decisions of the Joint Steering Committee shall be made unanimously with each Party having one (1) vote (i.e., all representatives of a Party must vote as a single block). The Joint Steering Committee members will use diligent efforts to reach agreement on all matters. If, despite such efforts, agreement on a particular matter cannot be reached by the Joint Steering Committee within [***] days after the Joint Steering Committee first considers such matter (or such shorter time as may be reasonable in the circumstances), then upon the written request of a Party, such matter will be referred to the Executive Officers (or their designees, which designee is required to have decision-making authority on behalf of such Party), who will attempt in good faith to resolve such dispute by negotiation and consultation for a [***] day period following receipt of such written notice. If, despite such efforts, agreement on a particular matter cannot be reached by the Executive Officers within such [***] day period, then the matter shall be resolved in accordance with the provisions of Section 15.1(c); provided, that:

(i) [***], such matter shall be determined by Merck, in good faith and its sole discretion after due and reasonable consideration of Moderna’s position;
(ii) [***], such matter shall be determined by Moderna, in good faith and its sole discretion after due and reasonable consideration of Merck’s position;

(iii) [***], such matter shall be determined by Merck, in good faith and its sole discretion after due and reasonable consideration of Moderna’s position;

(iv) [***], then such matter shall be determined by Moderna, in good faith and its sole discretion after due and reasonable consideration of Merck’s position;

(v) [***], such matter shall be determined by Merck, in good faith and its sole discretion after due and reasonable consideration of Moderna’s position; provided, however, (A) decisions with respect to [***] shall be in accordance with [***] (B) with respect to the [***], Merck shall [***];

(vi) [***], such matter shall be determined by Merck, in good faith and its sole discretion after due and reasonable consideration of Moderna’s position; and

(vii) the budget within a Joint Development Plan and Budget for the applicable Program, Global Commercialization Budget or the budget within an Additional Research Plan may not be increased without the written consent of the Parties.

(d) Joint Steering Committee Meetings. The Joint Steering Committee shall meet in accordance with a schedule established by mutual written agreement of the Parties, but no less than [***] per Calendar Quarter, unless the Parties mutually agree in writing to a different frequency, with the location for such meetings alternating between Moderna and Merck facilities (or such other location as may be determined unanimously by the Joint Steering Committee members). Alternatively, the Joint Steering Committee may meet by means of teleconference, videoconference or other similar communications equipment. Each Party shall bear its own expenses related to the attendance of such meetings by its representatives.

(e) Joint Steering Committee Agendas. The co-chairs of the Joint Steering Committee shall be responsible for distributing an agenda for each Joint Steering Committee meeting at least [***] days in advance of such meeting. Each Party shall have the right to request that the chairs include any appropriate matter (i.e., additional topics) on the agenda, which requests shall be accommodated by the chairs.

(f) Joint Steering Committee Minutes. The co-chairs shall be responsible for generating and issuing reasonably detailed minutes of each Joint Steering Committee meeting that reflect material decisions made and action items identified at such meeting, and will circulate such minutes to the Joint Steering Committee representatives of each Party for review within [***] days after such meeting. Any corrections or comments to such minutes must be provided to the co-chair within [***] days after the draft minutes are issued, who shall then issue the approved (or, if no comments are provided within such [***] day period, deemed approved) minutes in final form to the Joint Steering Committee representatives of each Party.
2.5 Joint Development Committee or JDC. Upon the first exercise of a Merck Participation Election, then within [***] days after the Merck Participation Election Date, the Parties will establish a joint development committee (the "Joint Development Committee" or "JDC"). During the Merck Participation Term for a given Program, the JDC will oversee the conduct of the Development of Collaboration Products. For clarity, the JDC will not have any responsibilities regarding, or oversight of, activities under the POC Plan for a given Program.

(a) Composition of the JDC. The JDC shall comprise [***] representatives of Merck and [***] representatives of Moderna. Each Party may change its representatives to the JDC from time to time in its sole discretion, effective upon notice to the other Party of such change. These representatives shall have expertise and operational responsibilities for Development and/or registration of pharmaceutical products. With the consent of the other Party (such consent not to be unreasonably withheld, delayed or conditioned), each Party may invite non-voting employees and consultants to attend meetings of the JDC, subject to their agreement to be bound to the same extent as a permitted subcontractor under Section 10.4. The JDC may change its size from time to time by mutual consent of its members; provided that the JDC will consist at all times of an equal number of representatives of each of Merck and Moderna. The JDC shall be chaired by a representative of Merck. The chair shall have the responsibilities set forth in Section 2.5(e), but shall have no additional powers or rights beyond those held by the other JDC representatives.

(b) Function and Powers of the JDC. During the Merck Participation Term for a given Program, without limiting the generality of this Section 2.5, the JDC shall oversee and facilitate the conduct of the Development of Collaboration Products during the Merck Participation Term for such Program, including to:

(i) monitor and oversee the Development activities under the Development Plan, including timely sharing and discussion of any material results or events relating to such Development activities and discussion of any anticipated cost overruns;

(ii) oversee the conduct of and monitor progress of any Clinical Studies under the Joint Development Plan and Budget for such Program;

(iii) decide whether and when to initiate or discontinue any Clinical Study under the Joint Development Plan and Budget for such Program;

(iv) facilitate the flow of information between the Parties with respect to the Development of Collaboration Products for such Program;

(v) discuss and review the overall strategy regarding Regulatory Approval of Collaboration Products in the Territory for such Program;

(vi) provide a forum for discussion of any regulatory related activities and maintenance of INDs or CTAs for Collaboration Products and initial Regulatory Approvals for Collaboration Products for such Program;

(vii) review the Development Transition Plans for such Program;

(viii) coordinate with the JMC regarding enrollment for Clinical Studies for Collaboration Products, including the forecast for Manufacturing capacity and the applicable enrollment rate;
(i) discuss any Additional Study(ies) proposed by either Party for such Program; and

(x) until the formation of the JCC, discuss, when available to Merck, the applicable and relevant components of the initial Global Commercialization Plan for such Program; provided that for clarity, the JDC will not oversee the Commercialization activities with respect to Collaboration Products, and such Commercialization activities shall be under the purview of the JCC, as, and to the extent, applicable.

(c) Joint Development Committee Decision-Making. Decisions of the Joint Development Committee shall be made unanimously with each Party having one vote (i.e., all representatives of a Party must vote as a single block). In the event that the Joint Development Committee cannot or does not, after good faith efforts during a period of not more than [***] days, reach agreement on an issue that comes before the JDC and over which the JDC has oversight, then such matter shall be raised to the JSC for resolution in accordance with Section 2.4(c).

(d) JDC Meetings. The JDC shall meet in accordance with a schedule established by mutual written agreement of the Parties, but no less frequently than [***] per Calendar Quarter, with the location for such meetings alternating between Moderna and Merck facilities (or such other location as may be determined unanimously by the JDC members). Alternatively, the JDC may meet by means of teleconference, videoconference or other similar communications equipment. Each Party shall bear its own expenses related to the attendance of such meetings by its representatives.

(e) JDC Agendas. The chair of the JDC shall be responsible for distributing an agenda for each committee meeting at least [***] days in advance of such meeting. Each Party shall have the right to request the chair to include any matter on the agenda, which requests shall be accommodated by the chair.

(f) JDC Minutes. The chair shall be responsible for generating and issuing reasonably detailed minutes of each JDC meeting, which shall include a summary of any actions agreed at the meeting and will circulate such minutes to the JDC representatives of each Party for review within [***] days after such meeting. Any corrections or comments to such minutes must be provided to the chair within [***] days after the draft minutes are issued, who shall then issue the approved (or, if no comments are provided within such [***] day period, deemed approved) minutes in final form to the JDC representatives of each Party.

2.6 Joint Manufacturing Committee or JMC. Upon the exercise of the Merck Participation Election for the first Program, then within [***] days after the Merck Participation Election Date, subject to the oversight of, and without limiting the authority of, the Joint Steering Committee, the Parties will establish a committee to oversee and facilitate the Manufacturing of Collaboration Products for the Programs. For clarity, the JMC will not have any responsibilities regarding, or oversight of, activities under the POC Plan for a given Program.

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(a) Composition of the Joint Manufacturing Committee. The joint manufacturing committee (the “Joint Manufacturing Committee” or “JMC”) shall comprise [***] representatives of Merck and [***] representatives of Moderna. Each Party may change its representatives to the JMC from time to time in its sole discretion, effective upon notice to the other Party of such change. These representatives shall have appropriate technical credentials, experience and knowledge, and ongoing familiarity with Manufacturing activities. With the consent of the other Party (such consent not to be unreasonably withheld, delayed or conditioned), each Party may invite non-voting employees and consultants to attend meetings of the JMC, subject to their agreement to be bound to the same extent as a permitted subcontractor under Section 10.4. The JMC may change its size from time to time by mutual consent of its members; provided that the JMC will consist at all times of an equal number of representatives of each of Merck and Moderna. The JMC shall be chaired by a representative of [***]. The chair shall have the responsibilities set forth in Section 2.6(e) but shall have no additional powers or rights beyond those held by other JMC representatives.

(b) Function and Powers of the JMC. Without limiting the generality of this Section 2.6, the JMC shall oversee and facilitate the Manufacturing of Collaboration Products for a Program during the Merck Participation Term for such Program, including to:

(i) coordinate and oversee the Manufacturing activities under this Agreement with respect to Collaboration Products in the Territory in accordance with any Supply Agreement (as applicable), including CMC matters;

(ii) discuss and coordinate with the JDC to allocate appropriate amounts from the applicable budgets to Manufacturing activities;

(iii) [***]

(iv) coordinate with the JDC regarding enrollment for Clinical Studies for Collaboration Products under the applicable Programs, including [***] and the applicable enrollment rate;

(v) coordinate with the JCC regarding Manufacturing of Collaboration Products under the applicable Programs for Commercialization, including [***];

(vi) [***]; and

(vii) discuss, coordinate and plan for Manufacturing technology transfers as set forth in Section 6.2(f), a Supply Agreement, [***] (as applicable).

(c) Joint Manufacturing Committee Decision-Making. Decisions of the Joint Manufacturing Committee shall be made unanimously with each Party having one vote (i.e., all representatives of a Party must vote as a single block). In the event that the Joint Manufacturing Committee cannot or does not, after good faith efforts during a period of not more than [***] days, reach agreement on an issue that comes before the JMC and over which the JMC has oversight, then such matter shall be raised to the JSC for resolution in accordance with Section 2.4(c).

(d) JMC Meetings. The JMC shall meet [***], or more frequently as the Parties may agree, in accordance with a schedule established by mutual written agreement of the Parties, with the location for such meetings alternating between Moderna and Merck facilities (or such other location as may be determined unanimously by the JMC members). Alternatively, the JMC may meet by means of teleconference, videoconference or other similar communications equipment. Each Party shall bear its own expenses related to the attendance of such meetings by its representatives.
(e) JMC Agendas. The chair of the JMC shall be responsible for distributing an agenda for each JMC meeting at least [***] days in advance of such meeting. Each Party shall have the right to request the chair to include any appropriate matter on the agenda, which requests shall be accommodated by the chair. The chair shall be responsible for generating and issuing minutes, in accordance with Section 2.6(f), of each JMC meeting, which shall include a summary of any actions agreed at the meeting.

(f) JMC Minutes. The chair shall be responsible for generating and issuing reasonably detailed minutes of each JMC meeting, which shall include a summary of any actions agreed at the meeting and will circulate such minutes to the JMC representatives of each Party for review within [***] days after such meeting. Any corrections or comments to such minutes must be provided to the chair within [***] days after the draft minutes are issued, who shall then issue the approved (or, if no comments are provided within such [***] day period, deemed approved) minutes in final form to the JMC representatives of each Party.

2.7 Joint Commercialization Committee or JCC. Upon the first exercise of a Merck Participation Election, then within [***] days after the Merck Participation Election Date, subject to the oversight of, and without limiting the authority of, the Joint Steering Committee, the Parties hereby establish a joint commercialization committee (the “Joint Commercialization Committee” or “JCC”). During the Merck Participation Term for a given Program, the JCC will oversee and facilitate the Commercialization of Collaboration Products for such Program as follows:

(a) Composition of the JCC. The JCC shall comprise [***] representatives of Merck and [***] representatives of Moderna. Each Party may change its representatives to the JCC from time to time in its sole discretion, effective upon notice to the other Party of such change. These representatives shall have appropriate technical credentials, experience and knowledge, and ongoing familiarity with Commercialization activities. With the consent of the other Party (such consent not to be unreasonably withheld, delayed or conditioned), each Party may invite non-voting employees and consultants to attend meetings of the JCC, subject to their agreement to be bound to the same extent as a permitted subcontractor under Section 10.4. The JCC may change its size from time to time by mutual consent of its members; provided that the JCC will consist at all times of an equal number of representatives of each of Merck and Moderna. The JCC shall be chaired by a representative of [***]. The chair shall have the responsibilities set forth in Section 2.7(e) but shall have no additional powers or rights beyond those held by other JCC representatives.

(b) Function and Powers of the JCC. During the Merck Participation Term for a given Program, without limiting the generality of this Section 2.7, the JCC shall have the following specific responsibilities for such Program:

(i) review and comment on the global Commercialization strategy for such Program;
(ii) review and comment on the Global Commercialization Plan for such Program, including the Global Commercialization Budget;

(iii) as necessary, periodically request a review of the overall commercial strategy for such Program, and request Merck prepare and submit an updated global Commercialization strategy for such Program for review by the JCC;

(iv) discuss the Commercialization activities under the Global Commercialization Plan for such Program;

(v) facilitate the flow of information between the Parties with respect to the Commercialization of Collaboration Products for such Program;

(vi) review and discuss strategies with respect to Medical Affairs and Pricing Matters for Collaboration Products in the Territory for such Program to the extent not prohibited by applicable Law; and

(vii) [***], coordinating Co-Promotion in the U.S. in accordance with the terms and conditions of this Agreement and the Co-Promotion Agreement for such Program.

(c) Joint Commercialization Committee Decision-Making. Decisions of the Joint Commercialization Committee shall be made unanimously with each Party having one vote (i.e., all representatives of a Party must vote as a single block). In the event that the Joint Commercialization Committee cannot or does not, after good faith efforts during a period of not more than [***] days, reach agreement on an issue that comes before the JCC and over which the JCC has oversight, then such matter shall be raised to the JSC for resolution in accordance with Section 2.4(c).

(d) JCC Meetings. The JCC shall meet [***], provided that as of and after the beginning of the Calendar Year immediately preceding the anticipated First Commercial Sale of a Collaboration Product, the JCC shall meet [***] per Calendar Quarter, or more frequently as the Parties may agree, in accordance with a schedule established by mutual written agreement of the Parties, with the location for such meetings alternating between Moderna and Merck facilities (or such other location as may be determined unanimously by the JCC members). Alternatively, the JCC may meet by means of teleconference, videoconference or other similar communications equipment. Each Party shall bear its own expenses related to the attendance of such meetings by its representatives.

(e) JCC Agendas. The chair of the JCC shall be responsible for distributing an agenda for each JCC meeting at least [***] days in advance of such meeting. Each Party shall have the right to request the chair to include any matter on the agenda, which requests shall be accommodated by the chair.

(f) JCC Minutes. The chair shall be responsible for generating and issuing reasonably detailed minutes of each JCC meeting, which shall include a summary of any actions agreed at the meeting, and will circulate such minutes to the JCC representatives of each Party for review within [***] days after such meeting. Any corrections or comments to such minutes must be provided to the chair within [***] days after the draft minutes are issued, who shall then issue the approved (or, if no comments are provided within such [***] day period, deemed approved) minutes in final form to the JCC representatives of each Party.
2.8 **Authority.** Notwithstanding the foregoing, each Party will retain the rights, powers and discretion granted to it under this Agreement and no such rights, powers, or discretion will be delegated to or vested in the applicable Committee unless such delegation or vesting of rights is expressly provided for in this Agreement or the Parties expressly so agree in writing. No Committee will have the power to (a) amend, modify or waive compliance with this Agreement, (b) alter, increase or expand the Parties’ rights or obligations under this Agreement beyond those explicitly set forth in this Agreement, (c) determine that a Party has fulfilled any obligations under this Agreement or that a Party has breached any obligation under this Agreement, (d) make a decision that is expressly stated to require the Parties’ mutual agreement or a decision for which Merck or Moderna have final decision making authority, (e) change the Collaboration Activities in any manner that would alter the fundamental objectives of the Collaboration Activities as described herein, or (f) impose additional costs or expenses on either Party beyond those explicitly set forth in this Agreement. Any dispute between the Parties regarding the issues set forth in this Section 2.8 will be resolved pursuant to the procedures set forth in Section 15.1.

2.9 **Interactions Between the Committees and Personnel.** The Parties recognize that each Party possesses an internal structure (including various committees, teams and review boards) that may be involved in administering such Party’s activities under this Agreement. The JSC shall establish procedures to facilitate communications between the JSC and the relevant internal committee, team or board of each of the Parties in order to maximize the efficiency of the JSC and the performance of the Parties of their respective obligations under this Agreement.

2.10 **Amendment and Restatement.** The Parties hereby agree and acknowledge that this Agreement amends and restates the Original Agreement in its entirety and the Original Agreement is replaced with, and supersedes by, this Agreement; provided that, for the avoidance of doubt, any activities conducted under the Original Agreement shall be deemed to have been conducted under this Agreement.

3. **PROGRAMS AND MERCK PARTICIPATION ELECTIONS**

3.1 **Overview of Programs.**

(a) **PCV POC Program.** Subject to and in accordance with the terms of this Agreement, during the POC Term for the PCV Program, Moderna will undertake Research and Development and such other activities as set forth in the POC Plan for the PCV Program with the goal of Researching and Developing PCVs (including Collaboration PCV Products) through the conduct of preclinical studies and Clinical Studies with monotherapy PCVs (including Collaboration PCV Products) and Collaboration PCV Products in combination with Keytruda to create the POC Data Package for the PCV Program, all as more fully set forth in the POC Plan for the PCV Program (the “PCV POC Program”). For clarity, as of the Amended Effective Date, Moderna consents to [***] in accordance with the POC Plan for the PCV Program; provided, however, that notwithstanding the foregoing, [***].
(b) KRAS POC Program. Subject to and in accordance with the terms of this Agreement and the KRAS Transition Plan, during the POC Term for the KRAS Program, the Parties will undertake Research and Development and such other activities as set forth in the POC Plan for the KRAS Program with the goal of Researching and Developing SAVs (including Collaboration SAV Products) Directed against KRAS through the conduct of preclinical studies and Clinical Studies with monotherapy SAVs (including Collaboration SAV Products) Directed against KRAS and Collaboration SAV Products in combination with Keytruda to create the POC Data Package for the KRAS Program, all as more fully set forth in the POC Plan for the KRAS Program (the “KRAS POC Program”). For clarity, (i) the Parties acknowledge and agree that, as of the Amended Effective Date, [***], and (ii) Moderna consents to [***].

(c) Other SAV Programs.

(i) During the SAV Research Term, to the extent that either Party wishes to conduct Research and Development for SAVs Directed against a Target (or multiple Targets), other than KRAS, that is not the subject of a then existing SAV Program, then such Party shall provide written notice to the other Party of each proposed Target(s) to be included in a proposed SAV Program, which notice shall set forth [***] any Moderna Pre-Existing In-Licenses, Moderna New In-Licenses or Merck In-Licenses, as applicable, relating to such proposed Target(s) (an “SAV Target Notice”). Notwithstanding the foregoing, an SAV Target Notice may not include [***].

(ii) If the Parties mutually agree in writing to the inclusion of a proposed Target(s), [***], then (A) each such Target shall become an “SAV Target,” (B) the Parties shall conduct a “Joint SAV Program” for such SAV Target(s), and (C) the Parties shall promptly thereafter mutually prepare and approve in writing a POC Plan for a Joint SAV Program for such SAV Target(s). Such POC Plan for such Joint SAV Program shall contain such other information as set forth in and be consistent with Section 3.3(b). For the avoidance of doubt, the Parties may agree to multiple separate POC Plans for multiple Joint SAV Programs pursuant to this Section 3.1(c)(ii).

(iii) If the non-proposing Party does not approve the inclusion of a proposed Target in an SAV Target Notice, [***], it shall notify the proposing Party thereof in writing within [***] days of receipt of the applicable SAV Target Notice. During the SAV Research Term, if Moderna [***] declines in writing to participate in a program for a Target(s) that is proposed by Merck pursuant to an SAV Target Notice pursuant to Section 3.1(c)(i), then Merck may elect, upon written notice to Moderna within [***] after Moderna declines to participate in such program, to [***] (provided that [***]).

(iv) During the POC Term for a given Joint SAV Program, subject to and in accordance with the terms of this Agreement, the Parties will undertake Research and Development and such other activities as set forth in the applicable POC Plan for such Joint SAV Program (other than the KRAS Program, which is covered by the provisions of Section 3.1(b) above) with the goal of Researching and Developing SAVs (including Collaboration SAV Products) Directed against such SAV Target under such POC Plan through the conduct of preclinical studies and Clinical Studies with [***] SAVs (including Collaboration SAV Products) Directed against such SAV Target and, [***] (each, an “Other SAV POC Program”, and together with the KRAS POC Program, each an “SAV POC Program”). The PCV POC Program, KRAS POC Program and each Other SAV POC Program shall each be referred to herein as a “POC Program”.

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(d) **Internal SAV Programs**

(i) During the SAV Research Term, if a non-proposing Party reasonably declines in writing to participate in a program for a Target(s) that is proposed pursuant to an SAV Target Notice in accordance with Section 3.1(c)(iii), or fails to respond in writing to the proposing Party within [***] days of receipt of the applicable SAV Target Notice, then the proposing Party may elect, in its sole discretion, to provide written notice, within [***] days after the date that the non-proposing Party declines in writing to participate (or fails to respond, as applicable), to the non-proposing Party to conduct an Internal SAV Program for such proposed Target(s), and (A) upon the date of such written notice, the proposing Party shall conduct an “Internal SAV Program” for such Target(s) and shall be the “ISP Party” for such Internal SAV Program, (B) the ISP Party shall promptly thereafter (and in any event within [***] days) prepare in writing and provide to the non-ISP Party an Internal SAV Program Plan for such Internal SAV Program consistent with the SAV Target Notice, with the goal of Researching SAVs Directed against such Target(s) under the Internal SAV Program Plan through the selection of a Lead SAV Candidate, and (C) the Parties shall promptly discuss in good faith and agree upon the definition of [***] to be set forth in the Internal SAV Program Plan for such Internal SAV Program, [***].

(ii) The ISP Party for such Internal SAV Program, [***], will undertake Research and such other activities as set forth in the applicable Internal SAV Program Plan for such Internal SAV Program to generate information to prepare the Pre-GLP Tox Data Package for such Internal SAV Program. If Merck is the ISP Party for such Merck Internal SAV Program, Moderna will Manufacture and supply SAVs (including mRNA Constructs therefor) Directed against the applicable Target(s) for such Merck Internal SAV Program through the selection of a Lead SAV Candidate, and (C) the Parties shall promptly discuss in good faith and agree upon the definition of [***] to be set forth in the Internal SAV Program Plan for such Internal SAV Program, [***].

(iii) During the Internal SAV Program Term for a given Internal SAV Program, the Parties shall present and review, via the POC Committee, the status of the Research activities for such Internal SAV Program and the data generated thereunder. Upon [***], the ISP Party will promptly (and in any event within [***] days) prepare and provide to the non-ISP Party the Pre-GLP Tox Data Package for such Internal SAV Program. After the delivery of the Pre-GLP Tox Data Package and for the remainder of the Internal SAV Program Term for such Internal SAV Program, the ISP Party shall, as reasonably requested by the non-ISP Party, meet with the non-ISP Party to discuss such Pre-GLP Tox Data Package and any questions of the non-ISP Party with respect thereto, including providing the non-ISP Party with certain additional information as the non-ISP Party may reasonably request to assist with interpretation of such Pre-GLP Tox Data Package.
On an Internal SAV Program-by-Internal SAV Program basis, the ISP Party hereby grants to the non-ISP Party, during the Internal SAV Program Term for a given Internal SAV Program, the exclusive right, exercisable at the non-ISP Party’s sole discretion in accordance with Section 3.1(d)(v) below, to elect to continue, in collaboration with the ISP Party, the Research, Development, Manufacture and Commercialization of mRNA Cancer Vaccines (including Collaboration Products) for such Internal SAV Program (and the Target(s) thereunder) as a Joint SAV Program, and to exercise the licenses set forth in Section 10.1(a)(ii) or 10.2(a)(ii) (as applicable) with respect to such mRNA Cancer Vaccines (including Collaboration Products) for such Internal SAV Program as a Joint SAV Program, in each case, solely under the terms and conditions set forth in this Agreement (each such election, a “Pre-GLP Tox Election”). During the Internal SAV Program Term for a given Moderna Internal SAV Program, Merck may terminate its Pre-GLP Tox Election for such Moderna Internal SAV Program upon written notice to Moderna. In the event that Merck terminates its Pre-GLP Tox Election for a given Moderna Internal SAV Program, then the consequences set forth in Section 3.1(d)(vi) shall apply with respect to such Moderna Internal SAV Program (mutatis mutandis); provided, however, [***].

On an Internal SAV Program-by-Internal SAV Program basis, the non-ISP Party may elect to exercise the Pre-GLP Tox Election for a given Internal SAV Program by delivering to the ISP Party written notice of such exercise at any time during the Internal SAV Program Term for such Internal SAV Program (each, a “Pre-GLP Tox Election Notice”). Commencing on the Pre-GLP Tox Election Date for a given Internal SAV Program, (A) each Target(s) for such Internal SAV Program shall become an “SAV Target”, (B) such Internal SAV Program shall be converted into a “Joint SAV Program” and (C) the Parties shall engage in such Joint SAV Program for such SAV Target(s) in accordance with Section 3.1(c)(ii), including preparing a POC Plan for such Joint SAV Program as soon as reasonably practicable (and in any event within [***] days) after such Pre-GLP Tox Election Date.

For a given Moderna Internal SAV Program, if Moderna delivers a Pre-GLP Tox Data Package for such Moderna Internal SAV Program and Merck does not exercise the Pre-GLP Tox Election for such Moderna Internal SAV Program during the Internal SAV Program Term, then, upon written notice to Merck within [***] days after the Pre-GLP Tox Commitment Date for such Moderna Internal SAV Program, Moderna shall be entitled to [***]. Development, Manufacturing and Commercialization program for the Target(s) for such Moderna Internal SAV Program outside the Collaboration and without any further compensation to Merck, and (A) each such Target shall be deemed a Released Target and the Moderna Internal SAV Program shall be deemed terminated for purposes of this Agreement, (B) the licenses set forth in Section 10.1(d) may not be exercised by Merck with respect to such Released Target(s) and (C) the exclusivity provisions set forth in Sections 10.7(c) and 10.8(b) shall terminate with respect to the Released Target(s) and the provisions set forth in Sections 10.7(d)(iv) and 10.8(c)(iv) shall terminate with respect to the Collaboration Shared Neoepitope(s) under such Moderna Internal SAV Program, [***].

For a given Merck Internal SAV Program, if Merck delivers a Pre-GLP Tox Data Package for such Merck Internal SAV Program and Moderna does not exercise the Pre-GLP Tox Election for such Merck Internal SAV Program during the Internal SAV Program Term, then Merck may elect upon written notice to Moderna within [***] days after the
Pre-GLP Tox Commitment Date for such Merck Internal SAV Program to either (1) convert such Merck Internal SAV Program to a “Joint SAV Program” and each such Target to an “SAV Target”; provided that (x) Merck will be [***]; provided, however, that at the request of Merck, the Parties will [***], or (2) terminate such Merck Internal SAV Program upon written notice to Moderna, provided that if Merck elects to exercise its rights under this clause (2), then (A) each Target for such Merck Internal SAV Program [***], (B) the licenses set forth in [***], (C) in such case, [***] terminate with respect to such Merck Internal SAV Program [***], (D) any outstanding purchase orders for mRNA Constructs to be delivered by Moderna to Merck in accordance with the supply terms set forth in Exhibit N will terminate with respect to such Merck Internal SAV Program, and (E) Merck shall have no further rights under Exhibit J with respect to such Merck Internal SAV Program.

(e) Clinical Studies Under a POC Plan for a Joint SAV Program

(i) Selection of Collaboration Products for IND Enabling Studies

(1) For any given internal SAV Program that converts to a Joint SAV Program in accordance with Section 3.1(d), if either Party has reasonably identified [***], then, at the request of such Party, the Parties, via the POC Committee, will discuss whether to conduct such activities. If the Parties mutually agree that the conduct of such additional pre-clinical Research activities is reasonably likely to [***], the Parties will amend the applicable POC Plan to include such Research activities and any [***] (the “Additional Converted Program Research Activities”), and the Parties will reasonably agree as to which Party should conduct the Additional Converted Program Research Activities. If the Parties do not mutually agree to amend the POC Plan for such Joint SAV Program to include such Additional Converted Program Research Activities during the [***] following the POC Committee’s discussion, then (A) [***](B) a Party may, [***].

(2) During the POC Term for a given Joint SAV Program, the Parties shall discuss in good faith and mutually agree on the specific SAV(s) under such Joint SAV Program that will be the subject of the IND-Enabling Studies under the POC Plan for such Joint SAV Program. As of the Amended Effective Date, the Parties acknowledge and agree that (A) the IND-Enabling Studies for the KRAS Program have been completed [***], and (B) mRNA-5671 is a Collaboration SAV Product Directed against KRAS for the KRAS Program and will be the subject of Clinical Studies under the POC Plan for the KRAS Program.

(ii) Clinical Studies

(1) (I) From time to time prior to the completion of the IND-Enabling Studies for a given Joint SAV Program, the Parties may review, and may mutually agree to update, in good faith, the Clinical Initiation Criteria for such Joint SAV Program based on reasonable scientific rationale. Following completion of IND-Enabling Studies for a given Joint SAV Program, the Party that conducted such IND-Enabling Studies will promptly prepare and provide the other Party with the SAV IND Data Package for such Joint SAV Program. Within [***] days after the date of delivery of the SAV IND Data Package for such Joint SAV Program, the POC Committee will review and discuss the SAV IND Data Package for such Joint SAV Program, including determining if the Clinical Initiation Criteria has been met for such Joint SAV Program (provided if there is disagreement as to [***], such disagreement shall be referred to Section 15.1(c) for resolution (which the Parties agree shall be conducted within [***] days or such other period of time as agreed to by the Parties)).
Promptly (but in any event within [***] days following the determination as to whether the Clinical Initiation Criteria has been met for such Joint SAV Program (regardless of whether or not the Clinical Initiation Criteria were met), the Parties shall meet to discuss if the Parties desire to continue to progress such Joint SAV Program into Clinical Studies under the POC Plan. Subject to the provisions of this Section 3.1(e)(ii), the Parties must mutually agree to advance such Joint SAV Program into Clinical Studies under the POC Plan for such Joint SAV Program prior to commencing the first Clinical Study under the POC Plan; provided, however [***]. If the Parties mutually agree to advance such Joint SAV Program into Clinical Studies, then Merck shall use Commercially Reasonable Efforts to file an IND or CTA for such Program in accordance with the POC Plan as soon as reasonably practicable after the date of such agreement.

If, within [***] days following the meeting of the Parties pursuant to clause (II) above, the Parties do not mutually agree to advance such Joint SAV Program into Clinical Studies under the current POC Plan for such Joint SAV Program, then the Parties may continue for a period of [***] days to discuss in good faith alternatives to continue the Research and Development of SAVs (and Collaboration SAV Products) under such Joint SAV Program, which alternatives may include, if mutually agreed to by the Parties, [***]. If the Parties do not mutually agree to amendments to the then current POC Plan within such [***] day period or such longer time as mutually agreed to by the Parties, then the matter shall be referred to Section 15.1(c) for resolution (which the Parties agree shall be conducted within [***] or such other period of time as agreed to by the Parties).

Notwithstanding anything herein to the contrary, the Parties acknowledge and agree that this Section 3.1(e)(ii) shall not apply to the KRAS Program.

In the event that the Parties mutually agree in writing not to advance a given Joint SAV Program into Clinical Studies under the POC Plan for such Joint SAV Program, then the POC Term for such Joint SAV Program shall terminate [***] days after the Parties' decision in writing (which shall in any event be within [***] days after the date of delivery of the SAV IND Data Package) not to commence Clinical Studies for such Joint SAV Program.

In the event that an SAV IND Data Package is delivered to Merck and Moderna wishes to advance a given SAV for a Joint SAV Program under the POC Plan for such Joint SAV Program (as notified by Moderna to Merck in writing simultaneously with the delivery of the SAV IND Data Package), but Merck does not agree to advance such SAV into Clinical Studies under such POC Plan, then (A) [***], (B) [***], in each case ((A) and (B)), [***] after Merck’s decision in writing not to commence Clinical Studies for such Joint SAV Program. In the event that Merck does not agree in writing to commence Clinical Studies for such Joint SAV Program within [***].
(4) In the event that (A) an SAV IND Data Package is delivered to Merck, (B) as part of the POC Committee discussion pursuant to Section 3.1(c)(ii), Merck wishes to advance a given SAV for a Joint SAV Program into Clinical Studies under the POC Plan for such Joint SAV Program, (C) as part of the POC Committee discussion pursuant to Section 3.1(c)(ii), Moderna does not agree to advance such SAV into Clinical Studies under the POC Plan, and (D) Moderna determines in good faith that there is [***] and notifies Merck thereof during the POC Committee discussion pursuant to Section 3.1(c)(ii), then [***]

(5) In the event that (A) an SAV IND Data Package is delivered to Merck, (B) as part of the POC Committee discussion pursuant to Section 3.1(c)(ii), Merck wishes to advance a given Joint SAV Program into Clinical Studies under the POC Plan for such Joint SAV Program, (C) as part of the POC Committee discussion pursuant to Section 3.1(c)(ii), Moderna does not agree to advance a given Joint SAV Program into Clinical Studies under the POC Plan for such Joint SAV Program, and (D) Moderna [***], then Merck may [***] pursuant to this Section 3.1(c)(ii)(5), then the following shall apply:

a. Merck shall [***]
b. Moderna shall [***];
c. [***]
d. [***]
e. [***]

Notwithstanding anything herein to the contrary, the Parties acknowledge and agree that this Section 3.1(c)(ii) shall not apply to the KRAS Program.

(iii) Non-Commencement or Suspension of Clinical Studies for Safety Issue under POC Plan for a Joint SAV Program by Lead Regulatory Party. Notwithstanding anything to the contrary herein or in the applicable POC Plan for a given SAV POC Program, if the Lead Regulatory Party reasonably believes that there is a Safety Issue for such SAV POC Program, then the Lead Regulatory Party will immediately (and in any event within [***] Business Days after the date the Lead Regulatory Party determines there is a Safety Issue) provide written notice to the other Party of such Safety Issue for such Program, following which [***]. In all cases, the Lead Regulatory Party shall have the right to cease or suspend the conduct of a given Clinical Study for a given SAV POC Program if the Lead Regulatory Party reasonably believes there is a Safety Issue.

(iv) Suspension of SAV Program for Technical Failure. For a given SAV Program, the Parties may suspend the conduct of activities under such SAV Program upon mutual written agreement that there is a Technical Failure with respect to the SAVs for such SAV Program, subject to the consequences in Section 3.2(b).

3.2 POC Term.

(a) Subject to this Agreement, unless (i) earlier terminated by mutual written agreement of the Parties, or (ii) extended by mutual written agreement of the Parties, the term of the PCV POC Program will commence on the Effective Date and expire upon the earliest of [***] (“PCV POC Term”); [***].
Subject to this Agreement (including Section 3.2(c)), unless (i) earlier terminated by mutual written agreement of the Parties, or (ii) extended by mutual written agreement of the Parties, the term of a given SAV POC Program will commence on the date of Initiation of such Joint SAV Program (provided that for clarity, with respect to the KRAS Program, the term shall commence on the Amended Effective Date) and expire upon the earliest of (***) (each, an “SAV POC Term” for the applicable Joint SAV Program, and together with the PCV POC Term, each, a “POC Term”).

Notwithstanding anything to the contrary contained herein, in the event that Merck delivers the Merck Participation Election Notice for a given Program in accordance with this Agreement, then the POC Term for such Program shall automatically continue until ***.

3.3 POC Plan.

(a) Initial POC Plan. Each POC Program shall be conducted in accordance with a plan (and with respect to the PCV Program, in accordance with a budget) that has been prepared and mutually agreed to by the Parties for such POC Program (each, a “POC Plan”). The amended POC Plan for the PCV Program, (**), is attached hereto as Exhibit A-1, and the POC Plan, (**), for the KRAS Program is attached hereto as Exhibit A-2. The initial POC Plan for each Joint SAV Program (other than the KRAS Program) shall be prepared by the Parties in accordance with Sections 3.1(c) and 3.1(d)(iv). A given POC Plan may be amended or updated, to the extent applicable, pursuant to Section 3.3(c). For clarity, each POC Plan may, if applicable, include a schedule for data sharing and sample testing (a “Data Sharing and Sample Testing Schedule”) for the applicable POC Program. In addition, Moderna will use Commercially Reasonable Efforts, at its sole cost and expense, to conduct the experiments set forth on Exhibit A-3, unless otherwise agreed by the Parties in writing, and all Know-How conceived, discovered, developed or otherwise made by or on behalf of a Party or any of its Affiliates or permitted subcontractors of any of the foregoing (solely or jointly by or on behalf of a Party or any of its Affiliates or permitted subcontractors of any of the foregoing) in the course of performing such experiments shall be Moderna Background Know-How, and (**).

(b) Scope. Each POC Plan shall set forth (**). Each POC Plan for a Joint SAV Program shall set forth the anticipated tasks and responsibilities of each Party throughout the applicable POC Program, it being understood that, except as otherwise specifically set forth in such POC Plan, Moderna shall be responsible for non-clinical activities and Manufacturing (including CMC development, with input from Merck) of SAVs (including Collaboration SAV Products) under such POC Plan, and supply of Moderna Agents for use in such Clinical Studies under such POC Plan, and Merck will be responsible for the preparation and filing of INDs and CTAs for, and the conduct of, the Phase I Clinical Study and Phase II Clinical Study of Collaboration SAV Products and supply of Keytruda and Merck Agents for use in such Clinical Studies under such POC Plan. The Parties generally anticipate that the POC Plan for a given POC Program may include the following activities for such POC Program:

(i) (**)

(ii) (**)

(b) Subject to this Agreement (including Section 3.2(c)), unless (i) earlier terminated by mutual written agreement of the Parties, or (ii) extended by mutual written agreement of the Parties, the term of a given SAV POC Program will commence on the date of Initiation of such Joint SAV Program (provided that for clarity, with respect to the KRAS Program, the term shall commence on the Amended Effective Date) and expire upon the earliest of *** (each, an “SAV POC Term” for the applicable Joint SAV Program, and together with the PCV POC Term, each, a “POC Term”).

(c) Notwithstanding anything to the contrary contained herein, in the event that Merck delivers the Merck Participation Election Notice for a given Program in accordance with this Agreement, then the POC Term for such Program shall automatically continue until ***.
(c) **Preparation and Amendment of a POC Plan.** Each of Merck and Moderna will have the right to propose modifications or amendments to a POC Plan; provided that any modifications or amendments to any POC Plan that are proposed by either Party will be subject to review by the POC Committee and written approval by the Parties; provided that neither Party may modify or amend a POC Plan without the written approval of the other Party. With respect to any amendment to the POC Plan for the PCV Program, such amendment shall also include a budget to the extent set forth in Section 3.4.(g)(iii).

(d) **Additional Moderna PCV POC Term Study.** In addition to the Research and Development activities set forth in the POC Plan for the PCV Program, following [***], for a given Collaboration PCV Product, based on [***] that is sufficient to enable the Parties to proceed to a Registrational Study for such Collaboration PCV Product, [***], until the expiration of the Merck Participation Election Period for the PCV Program, Moderna shall be entitled to conduct a Registrational Study for such Collaboration PCV Product (the “**Additional Moderna PCV POC Term Study**”), subject to the following terms and conditions: (i) Moderna shall [***]; (ii) Merck shall [***]; (iii) Moderna may not [***]; (v) Merck shall have the right to [***], (vi) the performance of the Additional Moderna PCV POC Term Study shall not [***], (vii) to the extent that there are any [***], (viii) if Merck exercises the Merck Participation Election for the PCV Program, then [***], (ix) if Merck does not exercise the Merck Participation Election for the PCV Program, then [***], and (x) Moderna shall provide Merck [***].

3.4 **POC Program Performance.**

(a) **Efforts.** The Parties have agreed to engage in POC Programs on the terms and conditions set forth in this Agreement, under the oversight of the POC Committee and in accordance with the applicable POC Plans.

(b) **PCV Program.** Unless otherwise agreed to by the Parties or otherwise explicitly set forth in the POC Plan for the PCV Program, (i) Moderna will be responsible for performing and conducting the PCV Program in accordance with the POC Plan for the PCV Program (including the Manufacture of PCVs (including Collaboration PCV Products), in
accordance with Exhibit K, [***], including [***], and for generating the POC Data Package for the PCV Program, and (ii) Merck shall be solely responsible for manufacturing and supplying all Keytruda necessary for any Clinical Studies involving Collaboration PCV Product(s) in combination with Keytruda, in accordance with the supply terms set forth on Exhibit K.

(c) KRAS Program.

(i) Unless otherwise agreed to by the Parties or otherwise explicitly set forth in the POC Plan for the KRAS Program, (A) Moderna will be responsible for manufacturing and supply of mRNA-5671 in accordance with Exhibit K, and (B) Merck shall be responsible for (x) after the KRAS Transition Date, the conduct of the Phase I Clinical Study and Phase II Clinical Study for mRNA-5671, including [***], and (y) supply of Keytruda for use in such Clinical Studies under such POC Plan.

(ii) KRAS Transition Plan. As of the Amended Effective Date, the initial written plan for the transition of Development activities from Moderna to Merck for the KRAS Program (the “KRAS Transition Plan”) is set forth on Schedule 3.4(c)(ii). The KRAS Transition Plan may be reviewed by and amended by mutual written agreement of the Parties. Each Party will use Commercially Reasonable Efforts to perform the obligations assigned to it under the KRAS Transition Plan in accordance with the timelines set forth therein. All costs and expenses incurred in connection with the conduct of the KRAS Transition Plan shall be borne by the Party incurring such cost or expense. The date upon which activities set forth in the KRAS Transition Plan are complete shall be the “KRAS Transition Date”.

(d) Other Joint SAV Programs. Unless otherwise agreed to by the Parties or otherwise explicitly set forth in the applicable POC Plan, for any given Joint SAV Program (other than the KRAS Program), (i) Moderna shall be solely responsible for performing and conducting the activities assigned to Moderna for such Joint SAV Program in accordance with the applicable POC Plan (including (A) [***]), and (ii) Merck shall be solely responsible for performing and conducting the activities assigned to Merck for such Joint SAV Program in accordance with the applicable POC Plan, including [***].

(e) Diligence. Each Party shall use its Commercially Reasonable Efforts to perform and conduct each POC Program in accordance with the applicable POC Plan (including any applicable timelines set forth therein) and the terms of this Agreement and to achieve the goals and deliverables set forth in each POC Plan, including, for Moderna, [***]. Subject to the foregoing and the terms and conditions of this Agreement (including compliance with the applicable POC Plan), each Party (and not the POC Committee) shall be responsible for managing its own Research and Development efforts within the scope of the activities for a POC Program pursuant to the applicable POC Plan and making decisions with respect to its day-to-day conduct in support of such Research and Development efforts. For clarity, to the extent the Parties do not agree to commence some or all of the Development activities involving [***], this Section 3.4(e) shall not apply to such Development activities involving [***].

(f) Personnel and Resources. Each Party shall dedicate to each POC Program appropriate resources and allocate personnel with an appropriate level of education, experience and training in Researching and Developing mRNA Cancer Vaccines (including Collaboration Products) for such POC Program in order to perform its activities as part of the applicable POC Program efficiently and expeditiously, which resources and personnel shall be consistent with the applicable POC Plan.
(g) Costs for the POC Plan for the PCV Program.

(i) Subject to Section 3.4(g)(iii) and Section 3(a) of Exhibit F, unless otherwise agreed to by the Parties in writing, costs and expenses incurred in the conduct of the POC Plan for the PCV Program (including all POC Program Costs for the PCV Program) will be borne solely by Moderna; provided, however, that, subject to the remainder of this Section 3.4(g), [***]:

1. Up to [***] of the Initial PCV POC Program Funding Amount shall be allocated for activities set forth under the [***], and in the event that the costs and expenses to be incurred in connection with the completion of the activities set forth in the [***] exceed the [***], then [***] shall be responsible for and directly cover any excess costs or expenses up to [***]; provided, however, that (A) in the event that the costs and expenses to be incurred in connection with the completion of the activities set forth under the [***] are reasonably expected to exceed the amount in the [***], then [***] may, at its sole discretion, elect to directly cover any such excess costs or expenses; provided that if [***] does not elect to provide for additional funding for activities set forth under the [***], the Parties shall use good faith efforts to reach agreement on a reasonable solution with respect to such activities set forth under the [***], including the funding thereof and, if the Parties are unable to reach agreement, the [***]; and (B) in the event that the costs and expenses incurred in connection with the completion of the activities set forth under the [***] are less than the [***], then any remaining amount will be [***].

2. Up to [***] of the Initial PCV POC Program Funding Amount shall be allocated for all Collaboration Activities set forth under the [***]; provided, however, that, in the event that the costs and expenses to be incurred in connection with the performance of such Collaboration Activities under the [***], [***] shall be solely responsible for and cover any excess costs or expenses up to the amount in the [***]. In the event that the costs and expenses to be incurred in connection with the performance of such Collaboration Activities are reasonably expected to exceed [***], [***] may, at its sole discretion, elect to directly cover any such excess costs or expenses, and [***] shall continue to [***]; provided, further, that if [***] does not elect to provide for additional funding for such Collaboration Activities, the Parties shall use good faith efforts to reach agreement on a reasonable solution with respect to such Collaboration Activities, including the funding thereof and, if the Parties are unable to reach agreement, the [***]. If Merck exercises the Merck Participation Election for the PCV Program, then as of the Merck Participation Election Date at Merck’s election, (i) [***] of any of the costs incurred by or on behalf of Moderna (or its Affiliates) under this Section 3.4(g)(i)(2) that are in excess of the [***] but less than the amount set forth in the [***] will be (1) [***], or (2) [***]; provided that if Merck does not exercise the Merck Participation Election for the PCV Program, then [***].
(3) Up to [***] of the Initial PCV POC Program Funding Amount may be allocated for [***] solely to the extent the costs and expenses of the Collaboration Activities set forth in the POC Plan for the PCV Program attached hereto as of the Amended Effective Date [***] are less than [***]. With respect to such difference up to the [***], the Parties will endeavor to agree in good faith on [***]. However, if the Parties are unable to so agree, then, in accordance with Section 3.3(c), [***].

(ii) Subject to Section 3.4(g)(iii) and Section 3(a) of Exhibit F, unless otherwise agreed to by the Parties in writing, costs and expenses incurred in the conduct of the portion of the POC Plan for the PCV Program involving [***] will be borne solely by [***]; provided that, once the Parties mutually agree to commence Development activities involving the [***] under the PCV POC Program, in the event that there are any amounts from the [***] that have not been used or allocated for use in accordance with the POC Plan for the PCV Program, the costs and expenses of such activities shall be funded from such remaining amounts; subject to the following:

(1) Up to [***] of the [***] shall be allocated for Collaboration Activities set forth under the amended POC Plan for the PCV Program (as attached hereto as of the Amended Effective Date) for the portion of the PCV Program involving [***]; provided, however, that, in the event that the costs and expenses to be incurred in connection with the performance of such Collaboration Activities are reasonably expected to exceed the [***], [***] may, at its sole discretion, elect to directly cover any such excess costs or expenses, and [***] shall continue to [***]; provided, further, that if [***] for such Collaboration Activities, the Parties shall use good faith efforts to reach agreement on a reasonable solution with respect to such Collaboration Activities, including the funding thereof and, if the Parties are unable to reach agreement, [***].

(iii) In the event that the Parties mutually agree in writing to amend the POC Plan for the PCV Program for additional activities [***], as part of the amendment to the POC Plan for the PCV Program, the Parties shall also mutually agree in writing on a budget for the conduct of such activities. With respect to such activities, the Parties shall [***]; provided that, with respect to activities related to the [***] shall be responsible for all costs and expenses for such activities up to the [***]. Notwithstanding the foregoing, in the event that there are amounts from the [***], as applicable, that have not been used or allocated for use in accordance with the POC Plan for the PCV Program, then prior to the Parties [***], the costs and expenses of such activities shall be funded from the remaining portions of the [***], as applicable.

Notwithstanding anything to the contrary contained herein, unless otherwise agreed to by the Parties in writing, [***] shall be solely responsible for any and all costs and expenses relating to Research involving the [***] and none of such costs or expenses shall count against the [***].

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(h) *Costs for the POC Plans for the Joint SAV Programs.*

(i) Subject to Section 3(a) of Exhibit F, Section 3.1(c)(ii)(5) and this Section 3.4(h), unless otherwise agreed to by the Parties in writing, each Party shall bear and be responsible for the costs and expenses incurred by or on behalf of such Party (or its Affiliates) in the conduct of each POC Plan for the applicable Joint SAV Program.

(ii) For any Merck Internal SAV Program that converts into a Joint SAV Program in accordance with Section 3.1(d)(v), and for which Moderna conducts IND-Enabling Studies and Merck subsequently initiates a Clinical Study for a Collaboration SAV Product for such Joint SAV Program, then within [***] days after [***].

(iii) For any Merck Internal SAV Program that converts into a Joint SAV Program in accordance with Section 3.1(d)(vii), if Merck subsequently exercises the Merck Participation Election for such Joint SAV Program, then an amount equal to [***] of the amount of the costs that are incurred by or on behalf of Merck [***] shall be [***].

(i) *Records.* Each Party will maintain, or cause to be maintained, records of its activities under each POC Program in sufficient detail and in good scientific manner appropriate for scientific, Patent and regulatory purposes, that will properly reflect all work performed therein, for a period consistent with such Party’s record retention policies, but in no event less than required by applicable Laws. Subject to Section 6.1(e), each Party will have the right to reasonably request a copy of the other Party’s records for the applicable POC Program upon providing reasonable rationale for needing such records.

(j) *Reports.* Each Party shall provide to the POC Committee reasonable progress updates at each Calendar Quarter meeting of the POC Committee on the status of the POC Program activities conducted by such Party, including [***]. For clarity, all such reports shall be considered Confidential Information of both Parties. Each Party agrees that it will also provide updates from time to time between such meetings as the other Party may reasonably request.

(k) *Regulatory Matters.* For a given POC Program, during the applicable POC Term:

(i) The POC Lead Regulatory Party shall be primarily responsible for regulatory matters with respect to the Collaboration Products in connection with the performance of the applicable POC Program. The POC Lead Regulatory Party shall ensure that all directions from any Regulatory Authority, ethics committees or institutional review boards with jurisdiction over any Clinical Studies are followed. Further, the POC Lead Regulatory Party shall ensure that all necessary approvals, licenses, registrations or authorizations (including any IND or CTA) from any Regulatory Authority, ethics committees or institutional review boards with jurisdiction over the Clinical Study are obtained prior to initiating performance of such Clinical Study.

(ii) Subject to POC Committee oversight on the overall regulatory strategy for the Collaboration Products, including oversight of the initial IND or CTA filings for a given Collaboration Product, the POC Lead Regulatory Party shall have primary responsibility with respect to submitting Regulatory Filings for the applicable Collaboration Products (other than DMFs) and all communications with, and submissions to, Regulatory Authorities in connection with such Collaboration Products, with the other Party’s support and input, which
support shall be provided by the other Party upon reasonable request by the POC Lead Regulatory Party [***]. The POC Lead Regulatory Party shall also be responsible for all routine maintenance of all INDs or CTAs (other than DMFs) for the applicable Collaboration Products. Without limiting the foregoing, Moderna shall provide such information and assistance as Merck may reasonably request in connection with the completion of and submission of, and maintenance of, Regulatory Filings (other than DMFs), including INDs and CTAs, and responses to inquiries from Regulatory Authorities, provided that (A) to the extent Moderna CMC Information is [***] or (B) in the event disclosure of Moderna CMC Information [***], Merck will notify Moderna [***], provided further that in the event that the Parties are unable to agree [***], then such matter shall be referred to the Executive Officers (or their designees), and if the Executive Officers (or their designees) are unable to agree on such course of action within such time frame, then [***]. In the event additional Moderna CMC Information not currently contained within regulatory documents [***], the Parties shall mutually agree [***]. Moderna will be reasonable [***].

(iii) If Moderna is the POC Lead Regulatory Party for any Clinical Studies involving Keytruda, Moderna shall act as the sponsor of such Clinical Study under its existing IND or CTA for the applicable Collaboration Product and have a Right of Reference to the IND or CTA of Keytruda; provided, however, that in no event shall Moderna file an additional IND or CTA for any Clinical Study involving Keytruda unless required by Regulatory Authorities to do so. If a Regulatory Authority requests an additional IND or CTA for a Clinical Study involving Keytruda, the Parties shall meet and mutually agree on an approach to address such requirement. Merck shall provide reasonable support and input to enable Moderna to prepare and file an amendment solely to the extent required.

(iv) The POC Lead Regulatory Party shall, subject to applicable Law, (1) allow subject matter experts from the other Party to [***], (2) through the POC Committee, allow the other Party a reasonable opportunity to review and comment upon all material Regulatory Filings (other than DMFs or portions of such Regulatory Filings containing Moderna CMC Information) to Regulatory Authorities for the applicable Collaboration Products, and the POC Lead Regulatory Party [***], (3) [***], and (4) promptly provide to individuals in the other Party’s regulatory group copies of any material correspondence or other documents received from Regulatory Authorities with respect to the applicable Collaboration Products. In all cases, Merck shall have the right (but not the obligation) to participate in any discussions with a Regulatory Authority regarding matters related to Keytruda or any Merck Agent. In all cases, Moderna shall have the right (but not the obligation) to participate in any discussions with a Regulatory Authority regarding matters related to [***].

(v) If Moderna is the POC Lead Regulatory Party for any Clinical Studies involving Keytruda, Merck shall provide to Moderna, as necessary, a cross-reference letter or similar communication to the applicable Regulatory Authority to effectuate the Right of Reference for Keytruda. Notwithstanding anything to the contrary in this Agreement, neither Party shall have any right to access the other Party’s CMC data with respect to a Moderna Agent, Merck Agent or Keytruda, as applicable. Merck shall authorize the FDA and other applicable Regulatory Authorities to cross-reference the applicable Merck INDs and CTAs for Keytruda to provide data access to Moderna sufficient to support conduct of any Clinical Study sponsored by Moderna involving Keytruda. If Merck’s IND or CTA is not available in a given country, Merck will file its CMC data with the applicable Regulatory Authority for such country, referencing Moderna’s IND or CTA as appropriate (however, Moderna shall have no right to directly access the CMC data for Keytruda).
(vi) If Moderna is the POC Lead Regulatory Party for any Clinical Studies involving Keytruda, Moderna shall (a) track and collect financial disclosure information from all “clinical investigators” involved in any Clinical Studies involving Keytruda and (b) prepare and submit the certification or disclosure of the same in accordance with all applicable Law, including Part 54 of Title 21 of the United States Code of Federal Regulations (Financial Disclosure by Clinical Investigators) and related FDA Guidance Documents. Prior to the initiation of clinical activities under any Clinical Study sponsored by Moderna involving Keytruda, the Parties shall determine, in writing, whether Moderna shall track and collect separate certification or disclosure forms for each of Merck and Moderna or one (1) “combined” certification or disclosure form for both Merck and Moderna. For purposes of this Section 3.4(k)(vi), the term “clinical investigators” shall have the meaning set forth in Part 54.2(d) of Title 21 of the United States Code of Federal Regulations.

(vii) With respect to any annual reporting period in which Moderna is not an entity that is required to make a Transparency Report under applicable Law, Moderna will: (a) notify Merck, in writing, within [***] days after the commencement of such reporting period that Moderna is not so required; and (b) during such reporting period Moderna will track and provide to Merck data regarding “indirect” payments or other transfers of value by Moderna to such health care professionals to the extent such payments or other transfers of value were required, instructed, directed or otherwise caused by Merck pursuant to this Agreement in the format requested by Merck and provided on a basis to be agreed upon by both Parties. Moderna represents and warrants that any data provided by Moderna to Merck pursuant to part (b) above will be complete and accurate to the best of Moderna’s knowledge. With respect to any such annual reporting period in which Moderna is required to make a Transparency Report under applicable Law, Moderna will provide to Merck, in writing, Moderna’s point of contact for purposes of receiving information from Merck pursuant to this Section 3.4(k)(vii), along with such contact’s full name, email address, and telephone number. Moderna may update such contact from time to time by notifying Merck in writing pursuant to Section 15.15. Where applicable, Merck will provide to such Moderna contact all information regarding [***] provided for use in a Clinical Study required for such reporting. In the event that the [***] provided pursuant to this Section 3.4(k)(vii) changes, Merck shall notify Moderna of such revised value and the effective date thereof. For purposes of this Section 3.4(k)(vii), “Transparency Report” means a transparency report in connection with reporting payments and other transfers of value made to health care professionals, including investigators, steering committee members, data monitoring committee members, and consultants in connection with a Clinical Study in accordance with reporting requirements under applicable Law, including the Physician Payment Sunshine Act and state gift laws, and the European Federation of Pharmaceutical Industries and Associations Disclosure Code, or a Party’s applicable policies.

(viii) Moderna shall be responsible for filing all DMFs for Collaboration Products during the POC Term and in connection therewith the provisions of Section 7.2(b) shall apply mutatis mutandis.
(i) Ownership of Regulatory Filings.

For a given POC Program, the POC Lead Regulatory Party or its Affiliates shall own, maintain, file and hold in its name, all Regulatory Filings (other than DMFs), including INDs or CTAs, for the applicable Collaboration Products. The POC Lead Regulatory Party shall provide the POC Committee with regular updates regarding the status of Regulatory Filings and correspondences for the applicable Collaboration Products, and such Regulatory Filings and correspondences shall be reviewed by the POC Committee. If Merck pays the Participation Election Payment for a given Program, Moderna shall assign and transfer ownership of all relevant INDs or CTAs and Regulatory Filings (other than DMFs) then held by Moderna (or any of its Affiliates) for Collaboration Products for such Program to Merck in accordance with Section 4.3(b).

(ii) The Parties agree and acknowledge that Moderna has filed an IND for a Clinical Study for mRNA-5671 under the KRAS Program prior to the Amended Effective Date, and such IND shall be transferred to Merck in accordance with the KRAS Transition Plan. Notwithstanding the foregoing, in all cases, [***].

(m) Adverse Event Reporting. For a given POC Program, during the applicable POC Term, the POC Lead Regulatory Party shall be responsible for maintaining the global safety database for the Collaboration Products from such POC Program and reporting all Adverse Events related to the clinical activities under such POC Program to the appropriate Regulatory Authorities in the countries in which the applicable Collaboration Products are being Developed, in accordance with the applicable Laws of the relevant countries and Regulatory Authorities. Without limiting the foregoing, upon the other Party’s request, and for the PCV Program if Merck exercises the Merck Participation Election for the PCV Program, in all cases prior to IND/CTA transfer, the POC Lead Regulatory Party shall provide copies of any Serious Adverse Event and applicable non-serious Adverse Event reports with respect to any Collaboration Products from such Program and any details related thereto in accordance with Section 4.3(b)(ii). Within [***] days prior to the Commencement of any Clinical Studies for any Collaboration Products during the applicable POC Term, the Parties will execute a pharmacovigilance agreement or update to the current pharmacovigilance agreement ("POC Pharmacovigilance Agreement") to ensure the exchange of relevant safety data within appropriate timeframes and in an appropriate format to enable the Parties to fulfill local and international regulatory reporting obligations and to facilitate appropriate safety reviews. The POC Pharmacovigilance Agreement will include [***]. Such guidelines and procedures shall be in accordance with, and enable the Parties and their respective Affiliates to fulfill, local and international regulatory reporting obligations to Regulatory Authorities. [***]
(n) Sample Testing.

(i) For the PCV Program, Moderna shall provide samples of biological material collected from subjects participating in a Clinical Study performed under the POC Plan for the PCV Program, including blood and/or tissue samples, to Merck as specified in the applicable protocol or as agreed to by the POC Committee.

(ii) For a given Program, the Parties shall conduct testing on such samples in accordance with the Data Sharing and Sample Testing Schedule (if set forth in the applicable POC Plan) and the applicable protocol. Solely to the extent intended to be shared between the Parties, as specified on the Data Sharing and Sample Testing Schedule in the applicable POC Plan, the Party conducting the sample testing shall provide to the other Party the results of such sample testing in electronic form, or other mutually agreeable alternate form, on the timelines specified in the Data Sharing and Sample Testing Schedule or as otherwise mutually agreed. [***]

3.5 Merck Participation Election Rights

(a) POC Data Package. Promptly following the expiration of the POC Term for a given SAV POC Program, Merck will provide Moderna with the information listed in [***] of the definition of POC Data Package in Section 1.3.3 for such SAV POC Program. In addition, in no event more than [***] days following the earlier of (x) the completion of the Collaboration Activities set forth in the POC Plan for such POC Program and (y) the expiration of the POC Term for such POC Program, Moderna shall provide the POC Data Package for such Program to Merck; provided, however, (A) to the extent Merck has [***] (B) with respect to the PCV Program, to the extent the Parties do not mutually agree to undertake Development activities set forth in the POC Plan for the PCV Program involving [***] pursuant to Section 3.1(a), Moderna shall not be required to include any information regarding [***] in the POC Data Package. After the delivery of the POC Data Package and for the remainder of the Merck Participation Election Period for the applicable Program, Moderna shall, as reasonably requested by Merck, meet with Merck to discuss such POC Data Package and any questions of Merck with respect thereto, including [***].

(b) Grant of Merck Participation Election. On a Program-by-Program basis, Moderna hereby grants to Merck during the Merck Participation Election Period for a given Program the exclusive right, exercisable at Merck’s sole discretion, to continue, in collaboration with Moderna, the Research, Development, Manufacture and Commercialization of mRNA Cancer Vaccines (including Collaboration Products) for such Program, and to exercise the licenses set forth in Section 10.1(c) with respect to such mRNA Cancer Vaccines (including Collaboration Products) for such Program, in each case, solely under the terms and conditions set forth in this Agreement (each, a “Merck Participation Election”).
Merck Participation Election Period, Participation Election. On a Program-by-Program basis, Merck may elect to exercise the Merck Participation Election for a given Program by delivering to Moderna written notice of exercise at any time during the Merck Participation Election Period for such Program (each, a “Merck Participation Election Notice”). Commencing on the Merck Participation Election Date for a given Program, the Parties shall engage in the Joint Development Program for such Program in accordance with Section 4. For the avoidance of doubt, Merck may deliver the Merck Participation Election Notice for one or more Programs (or no Programs) at its discretion, and such determination may be made by Merck on a Program-by-Program basis.

(d) Net Residual Amount. Following the Merck Participation Election for the PCV Program, the Net Residual Amount (if any) will be fully committed towards future Shared Collaboration Costs incurred by or on behalf of the Parties (or their Affiliates) during the Merck Participation Term for the PCV Program; provided, however, that notwithstanding the foregoing, if Merck exercises the Merck Participation Election for the PCV Program prior to the completion of the activities set forth in the then-current POC Plan for the PCV Program, within [***] days after the Merck Participation Election Date for the PCV Program, Moderna will provide Merck with [***] and, unless the Parties otherwise agree, such Net Residual Amount will be fully committed towards [***], and the remainder shall be fully committed towards future Shared Collaboration Costs for the PCV Program incurred by or on behalf of the Parties (or their Affiliates) during the Merck Participation Term for the PCV Program.

3.6 [***] Notwithstanding anything herein to the contrary, in the event that the [***] is incorporated [***] in a given Program, the following terms and conditions of this Agreement as they apply to [***] as incorporated [***] for such Program will be modified as follows:

(a) [***]
(b) [***]
(c) [***]
(d) [***]
(e) [***]
(f) [***]
(g) [***]
(h) [***]
(i) [***]
(j) [***]
3.7 Non-Exercise of Merck Participation Election

(a) Effects. For a given Program (other than for an Internal SAV Program), if:
   (i) Merck does not exercise the Merck Participation Election for such Program during the Merck Participation Election Period for such Program;
   (ii) [***]
   (iii) [***]
   (iv) [***], a “Merck Non-Participation”), then:
      (A) if for the PCV Program, the Merck Participation Election Period, the POC Term, the Collaboration Term and the Collaboration shall terminate solely for the PCV Program, and all Collaboration PCV Products then in existence will be treated as “PCVs” under this Agreement thereafter (other than for purposes of this Section 3.7(a)); provided that [***];
      (B) if for a Joint SAV Program, the Merck Participation Election Period, the POC Term, the Collaboration Term and the Collaboration shall terminate solely for such Joint SAV Program and all Collaboration SAV Products then in existence from such Program will be treated as “SAVs” under this Agreement thereafter (other than for purposes of this Section 3.7(a));
      (C) Merck shall no longer have any licenses or other rights under this Agreement (except [***]) to Research, Develop, Manufacture and Commercialize any Collaboration Products from such Program under this Agreement;
      (D) Sections 10.7 and 10.8 shall terminate with respect to such Program [***];
      (E) (I) If Merck had initiated activities to conduct a Clinical Study under the applicable Joint SAV Program, Merck will prepare and provide to Moderna [***].
         (II) If Merck had Commenced a Clinical Study under the applicable Joint SAV Program [***];
      (F) [***];
      (G) [***];

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(H) Moderna will make the payments set forth in Section 9.2 and Exhibit E in connection with (1) Moderna Net Profits allocated to sales of any Financial PCVs, or (2) Moderna Net Profits allocated to sales of any Financial SAVs up to an aggregate amount equal to [***];

(I) [***]

(J) [***]; and

(K) in all cases, if Moderna is conducting a Clinical Study involving Keytruda, the provisions of Section 3.4(m) shall apply mutatis mutandis. For purposes of clause (H)(2) of this Section 3.7, within [***] after the date of the Merck Non-Participation for a given Joint SAV Program, Merck shall provide to Moderna [***]. Additionally, in the event of a Merck Non-Participation for the PCV Program, then subject to the remainder of this Section 3.7, during [***] period following the effective date of the Merck Non-Participation for the PCV Program, [***].

[***]

In the event that Merck exercises the Merck Non-Participation with respect to a Joint SAV Program before the date of [***], then (1) Merck shall, [***].

In addition, the Parties’ rights and obligations under [***] shall terminate in full with respect to such Program [***]. In addition, on a Program-by-Program basis, if, as of the date of the Merck Non-Participation for such Program, a Party is granting a sublicense to the other Party under an Included In-License for such Program, and such sublicense under such Included In-License survives the Merck Non-Participation for such Program pursuant to this Section 3.7(a), then, (i) the Party receiving such sublicense under such Included In-License shall [***] and (ii) such Party’s rights under such Included In-License will be subject to the terms of such Included In-License; provided that in each case of (i) and (ii), the licensor Party promptly informs the other Party of any [***].

(b) Remaining Activities under the POC Plan for the PCV Program. If (i) Merck exercises the Merck Non-Participation for the PCV Program and (ii) the activities set forth in the then-current POC Plan for the PCV Program are not completed prior to the expiration or termination of the PCV POC Term, then Moderna will retain the Net Residual Amount (if any) and will use the Net Residual Amount for the continued Research, Development, Manufacture or Commercialization of PCVs (including any Collaboration PCV Products then in existence).

4. ADDITIONAL RESEARCH PROGRAM AND JOINT DEVELOPMENT PROGRAM

4.1 Overview

(a) General. If Merck exercises the Merck Participation Election for a given Program, during the Merck Participation Term for such Program, the Parties shall mutually conduct a Research and Development program with the goal of furthering the Research and Development of mRNA Cancer Vaccines (including Collaboration Products) for such Program and conducting Clinical Studies with the goal of obtaining Regulatory Approvals for one or more Collaboration Products for such Program all subject to and in accordance with this Agreement.
(b) **Additional Research Programs.** During the Merck Participation Term for a given Program, the Parties may conduct one or more Additional Research Programs focused on advancing the Research and Manufacturing of mRNA Cancer Vaccines (including Collaboration Products) for such Program, subject to and in accordance with the terms of this Agreement and the applicable Additional Research Plan (each, an “Additional Research Program”).

(c) **Clinical Studies.**

   (i) During the Merck Participation Term for a given Program, the Parties shall conduct Clinical Studies of Collaboration Products from such Program either as a monotherapy or in combination with Other Components, including as a part of clinical development partnerships with Third Parties by either Party or its Affiliates, subject to and in compliance with this Agreement (including the exclusivity provisions hereunder) and the applicable Joint Development Plan and Budget for the applicable Program (the “Joint Development Program” for such Program), as well as Independent Additional Studies for such Program pursuant to Section 4.4 in compliance with this Agreement (including the exclusivity provisions hereunder). In all cases, the Merck Participation Term Lead Regulatory Party shall have the right to cease or suspend the conduct of a given Clinical Study if the Merck Participation Term Lead Regulatory Party reasonably believes there is a Safety Issue.

   (ii) If the Merck Participation Term Lead Regulatory Party suspends the conduct of a Clinical Study for a given Joint SAV Program as a result of a Safety Issue, then the Merck Participation Term Lead Regulatory Party shall provide immediate (and in any event within [***] Business Days of the determination by the Lead Regulatory Party of such Safety Issue) written notice to the other Party of such determination, and the Parties will discuss in good faith whether to initiate a new Joint Development Plan and Budget to resolve the Safety Issue for such Joint SAV Program. If the Parties mutually agree upon a new Joint Development Plan and Budget for such Joint SAV Program, then the Parties will perform the Collaboration Activities (including any nonclinical studies or Clinical Studies) under the new Joint Development Plan and Budget for such Joint SAV Program in accordance with this Agreement. If the Merck Participation Term Lead Regulatory Party provides written notice of a Safety Issue for such Joint SAV Program, and as a result thereof the Parties do not recommence Collaboration Activities to resolve the Safety Issue under such Joint Development Plan and Budget (or amended Joint Development Plan and Budget) for a period of [***], then upon the expiration of such [***] period, then Merck will be deemed to have exercised the Merck Cessation Election for such Joint SAV Program pursuant to Section 10.10. For clarity, if Merck proposes a reasonable Joint Development Plan and Budget to resolve such Safety Issue within such [***] period, (A) Moderna shall [***] and (B) the preparation and initiation of activities under such Joint Development Plan and Budget shall be deemed [***].
4.2 Additional Research Programs.

(a) **General.** During the Merck Participation Term for a given Program, in the event that a Party proposes to conduct an Additional Research Program for such Program, then such Party shall propose the Additional Research Program to the JSC and such Party will prepare an Additional Research Plan for such Additional Research Program, setting forth such activities and budget therefor and, solely to the extent the Parties mutually agree and approve such Additional Research Plan, [***], the Parties shall conduct such Additional Research Program in accordance with the terms of this Agreement and such Additional Research Plan. All costs and expenses incurred by or on behalf of the Parties (or their Affiliates) in connection with the conduct of any Additional Research Program(s) shall be considered Allowable Development Costs. The Parties acknowledge and agree that Research activities under an Additional Research Plan may be [***].

(b) **Additional Research Plans.** Either Party may propose at any meeting of the JSC amendments to any Additional Research Plan. Notwithstanding the foregoing, at a minimum, no later than [***] days prior to the start of a given Calendar Year, the Parties shall propose an updated budget for any ongoing studies or Manufacturing activities under any then-current Additional Research Plans for the Additional Research Programs for the upcoming Calendar Year for the JDC’s review and JSC’s approval. Additional Research Plans that incorporate Manufacturing activities (e.g., process development) for Collaboration Products should also be presented to the JMC for review and comment.

(c) **Efforts.** The Parties will conduct each Additional Research Program on the terms and conditions set forth in this Agreement, under the oversight of the JDC, JSC, and JMC, as applicable, and in accordance with the applicable Additional Research Plan. Each Party shall use its respective Commercially Reasonable Efforts to perform the activities allocated to it pursuant to the applicable Additional Research Plan for a given Additional Research Program in accordance with the terms of this Agreement and within the timelines set forth in such Additional Research Plan, and to achieve the goals and deliverables set forth in such Additional Research Plan. Subject to the foregoing and the terms and conditions of this Agreement (including compliance with the applicable Additional Research Plan), each Party (and not the Joint Steering Committee) shall be responsible for managing its own Research and Manufacturing efforts within the scope of the activities allocated to it pursuant to the applicable Additional Research Plan and for making decisions with respect to its day-to-day conduct in support of such Research and Manufacturing efforts in connection therewith.

4.3 Joint Development Program.

(a) **General.** During the Merck Participation Term for a given Program, it is the expectation of the Parties that (i) Merck will be the Party solely responsible for conducting the clinical Development activities for the Collaboration Products under the Joint Development Plan and Budget for the applicable Program, (ii) with respect to the PCV Program, each Party will be solely responsible for conducting an Independent Additional Study proposed by such Party under the applicable Independent Additional Study Development Plan, (iii) with respect to a given Joint SAV Program, [***], (iv) subject to Section 6.2, Moderna will be responsible for conducting Manufacturing activities, including [***], under the Joint Development Plan and Budget for the applicable Program, and (v) Merck will be primarily responsible for pre-approval Commercialization activities (all subject to Section 8), in each case, unless the Parties otherwise agree.
(b) Development Transition Plan. Promptly following the Merck Participation Election Date for a given Program, Moderna will prepare and provide to Merck a draft plan for the transition of any Development activities then being conducted by or on behalf of Moderna or its Affiliates from Moderna to Merck for such Program (including with respect to the PCV Program, Clinical Studies for Collaboration PCV Products) (a “Development Transition Plan”), which Development Transition Plan will be reviewed by the JDC and subject to the approval of the JSC. If and to the extent applicable, the Development Transition Plan will require Moderna to perform the following activities (provided that, for clarity, the Development Transition Plan shall not include any obligations for Moderna to provide to Merck any information or materials previously provided to Merck or to re-perform any activities that have already been transitioned to Merck), on the timeline set forth in the Development Transition Plan:

(i) transfer and assign to Merck or its designee [***];
(ii) transfer to Merck [***];
(iii) deliver to Merck copies of all [***];
(iv) (A) with respect to the PCV Program, to the extent it is determined pursuant to [***] that [***] should be [***], at Merck’s request, reasonably assist Merck in [***] and (B) with respect to each Joint SAV Program, to the extent it is determined pursuant to [***] that [***] should be [***], at Merck’s request, reasonably assist Merck in [***]; and
(v) deliver to Merck, in an electronic format (the form of which shall be agreed upon by the Parties), [***].

Each Party will use Commercially Reasonable Efforts to perform the obligations assigned to it under the Development Transition Plan in accordance with the timelines set forth therein. All costs and expenses incurred by or on behalf of the Parties (or their Affiliates) in connection with the conduct of the Development Transition Plan shall be considered Allowable Development Costs.

(c) Joint Development Plans.

(i) Within (x) [***] days after the Merck Participation Election Date for the PCV Program, or (y) subject to the last sentence of this Section 4.3(c)(i), [***] days after the date of the Merck Participation Election Notice for a given Joint SAV Program, the Parties shall agree on the Collaboration Activities of the Parties with respect to the applicable Joint Development Program and set forth such activities and a [***] year rolling budget therefor (such budget to be on a study-by-study or activity-by-activity basis) in a joint development plan (each, a “Joint Development Plan and Budget”), the initial draft of which shall be prepared by [***]. The purpose of the Joint Development Plan and Budget for the applicable Program is to set forth the specific Development activities to be performed by the Parties in support of such Joint Development Program, [***]. Each Joint Development Plan and Budget for the applicable Program shall set forth activities that are similar in nature to those contained in the applicable POC Plan. Notwithstanding anything herein to the contrary, if the Parties fail to mutually agree on a Joint Development Plan and Budget for a given Joint SAV Program within [***] days after
the date of the Merck Participation Election Notice for such Joint SAV Program, then Moderna shall deliver written notice (together with an invoice) to Merck that the SAV Participation Election Payment for such Joint SAV Program is due and either (1) Merck may pay the SAV Participation Election Payment for such Joint SAV Program within [***] Business Days after receipt of such notice, and the Parties will continue to diligently work to mutually agree on a Joint Development Plan and Budget for such Joint SAV Program, or (2) if Merck does not make such payment under clause (1), then [***].

(ii) Either Party may propose at any meeting of the JDC amendments to the Joint Development Plan and Budget for the applicable Program; provided, however, if such amendments involve an Additional Study or series of related Additional Studies, the inclusion of such Additional Study(ies) shall be in accordance with Section 4.4. Notwithstanding the foregoing, at a minimum, no later than [***] days prior to the start of a Calendar Year, the Parties shall propose an updated budget for any ongoing studies or activities under the then-current Joint Development Plan and Budget for the applicable Joint Development Program for the upcoming Calendar Year for the JDC’s review and JSC’s approval.

(iii) The Parties have agreed to engage in the Joint Development Programs on the terms and conditions set forth in this Agreement, under the oversight of the JDC and JSC and in accordance with the applicable Development Plans. Each Party shall use its respective Commercially Reasonable Efforts to perform the activities allocated to it pursuant to the Development Plans [***] in accordance with the terms of this Agreement and within the timelines set forth in the Development Plans and [***], respectively, and to achieve the goals and deliverables set forth in the Development Plans and [***], including [***]. Subject to the foregoing and the terms and conditions of this Agreement (including compliance with the Development Plans and [***] and any applicable Clinical Supply Agreement), each Party (and not the JSC) shall be responsible for managing its own Development and Manufacturing efforts within the scope of the activities allocated to it pursuant to the Development Plans and [***] and for making decisions with respect to its day-to-day conduct in support of such Development efforts.

4.4 Additional Studies.

(a) Proposal of Additional Studies.

(i) To the extent that either Party wishes to conduct an Additional Study or related series of Additional Studies of a Collaboration Product (‘***’/that is not set forth in the Joint Development Plan and Budget for the applicable Program for the purpose of seeking Regulatory Approval for such Collaboration Product, such Party shall prepare a [***] year rolling Development plan and budget for such Additional Study(ies) and propose such Additional Study(ies) to the JDC. Such proposed Development plan and budget shall identify the applicable Collaboration Product, [***] (an “Additional Study Proposal”). Following receipt of the Additional Study Proposal from the proposing Party, the non-proposing Party shall have [***] days to decide whether or not to co-fund such Additional Study, and if such non-proposing Party elects to so co-fund, then such Additional Study will be considered a “Joint Development Study”, and the Parties shall amend and update the Joint Development Plan and Budget for the applicable Program to include such Additional Study as a Joint Development Study as part of the Joint Development Program.
If the non-proposing Party fails to elect to co-fund a proposed Additional Study within such [***] day period, then (1) with respect to such proposed Additional Study for the PCV Program, [***] (2) with respect to a proposed Additional Study for a Joint SAV Program, [***], may independently conduct such Additional Study (an “Independent Additional Study”) subject to the terms and conditions of this Section 4.4 and in accordance with such Additional Study Proposal (thereafter, an “Independent Additional Study Development Plan”), provided, however, that if (A) the Independent Additional Study would involve a Collaboration Product in combination with a Moderna Agent when Moderna is the non-proposing Party or a Merck Agent [***] when Merck is the non-proposing Party, then [***], or (B) the non-proposing Party reasonably and in good faith believes that [***], then the proposing Party shall [***].

(b) Costs. The Party sponsoring or conducting an Independent Additional Study under an Independent Additional Study Development Plan shall be responsible for [***] in connection with such Independent Additional Study(ies) and such costs shall be borne in accordance with this Section 4.4 and Exhibit D.

(c) Recording of Costs. All Development Costs pursuant to this Section 4.4 shall be recorded and reported consistent with Exhibit D. Each Party shall keep records associated with Development Costs incurred through performance of an Independent Additional Study Development Plan strictly separate from records associated with Development Costs incurred through performance of the applicable Joint Development Program.

4.5 Records, Reports, Resources

(a) Personnel and Resources. Each Party shall dedicate to the Additional Research Programs, Joint Development Programs and Independent Additional Studies (as applicable) appropriate resources and allocate personnel with an appropriate level of education, experience and training in Researching and Developing mRNA Cancer Vaccines (including Collaboration Products) for such Programs in order to achieve the objectives of the Additional Research Programs, Joint Development Programs and Independent Additional Studies (as applicable) efficiently and expeditiously, which resources and personnel shall be consistent with the Additional Research Plans or Development Plans (as applicable).

(b) Research and Development Costs. Development Costs incurred in the conduct of the Additional Research Programs and Joint Development Programs will be borne in accordance with Exhibit D. Development Costs incurred in the conduct of the Independent Additional Study Development Plan(s) (as applicable) will be borne in accordance with Exhibit D.

(c) Records. Each Party will maintain, or cause to be maintained, records of its activities under the Additional Research Programs, Joint Development Programs and Independent Additional Studies (as applicable) in sufficient detail and in good scientific manner appropriate for scientific, Patent and regulatory purposes, that will properly reflect all work performed therein, for a period consistent with such Party’s record retention policies, but in no event less than required by applicable Laws. Each Party will have the right to reasonably request a copy of any such records upon providing reasonable rationale for needing such records; provided, however, Moderna shall have no right to directly access the CMC data for [***], and Merck shall have no right to directly access the CMC data for [***].

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(d) *Reports.* Each Party shall provide to the JDC a summary written report at each Calendar Quarter meeting of the JDC, describing its progress under the Additional Research Plans or Development Plans (as applicable) during the prior Calendar Quarter, which summary report shall include [***]. Each Party agrees that it will promptly respond to the other Party’s reasonable questions regarding any of the other Party’s reports. For clarity, all such reports shall be considered Confidential Information of each Party. Each Party shall also provide updates from time to time between such meetings as the other Party may reasonably request.

5. **COMPLIANCE**

5.1 **General.** Each Party shall conduct the Internal SAV Programs, POC Programs, Additional Research Programs, Joint Development Programs and Independent Additional Studies and other activities under the Internal SAV Program Plans, POC Plans, Additional Research Plans, Joint Development Plan and Budget for the applicable Program or Independent Additional Study Development Plans in compliance with all applicable Laws. Each Party shall promptly notify the other Party in writing of any deviations from applicable Laws, including, each if and to the extent applicable to the respective Party or its activities hereunder, the Act, the Anti-Kickback Statute (42 U.S.C. §1320a-7b), Civil Monetary Penalty Statute (42 U.S.C. §1320a-7a), the False Claims Act (31 U.S.C. § 3729 et seq.), comparable state statutes, the regulations promulgated under all such statutes, and the regulations issued by the FDA. In addition, each Party hereby certifies that it has not employed or otherwise used in any capacity and will not employ or otherwise use in any capacity, the services of any person debarred under United States law, including Section 21 USC 335a, or any foreign equivalent thereof, in performing any portion of the Internal SAV Programs, POC Programs, Additional Research Programs, Joint Development Programs or Independent Additional Studies or other activities under the Internal SAV Program Plans, POC Plans, Additional Research Plans, Joint Development Plan and Budget for the applicable Program or Independent Additional Study Development Plans. Each Party shall notify the other Party in writing immediately if any such debarment occurs or comes to its attention, and shall, with respect to any person or entity so debarred promptly remove such person or entity from performing activities under the Internal SAV Programs, POC Programs, Additional Research Programs, Joint Development Program or Independent Additional Studies or other activities under the Internal SAV Program Plans, POC Plans, Additional Research Plans, Joint Development Plan and Budget for the applicable Program or Independent Additional Study Development Plans, function or capacity related thereto. Without limiting the foregoing, if animals are used in Research hereunder, the applicable Party will comply with the Animal Welfare Act and any other applicable Laws relating to the care and use of laboratory animals. Merck encourages Moderna to use the highest standards, such as those set forth in the Guide for the Care and Use of Laboratory Animals (NRC, 1996), for the humane handling, care and treatment of such research animals. Any animals which are used in the course of the Internal SAV Programs, POC Programs, Additional Research Programs, Joint Development Programs or Independent Additional Studies or other activities under the Internal SAV Program Plans, POC Plans, Additional Research Plans, Joint Development Plan and Budget for the applicable Program or Independent Additional Study Development Plans, or products derived from those animals, such as eggs or milk, will not be used for food purposes, nor will these animals be used for commercial breeding purposes.
5.2 Use of Human Materials. Without limiting the provisions of Section 5.1, if any human cell lines, tissue, human clinical isolates or similar human-derived materials ("Human Materials") are to be collected or used in the Internal SAV Programs, POC Programs, Additional Research Programs, Joint Development Program or Independent Additional Studies and other activities under the Internal SAV Program Plans, POC Plans, Additional Research Plans, Joint Development Plan and Budget for the applicable Program and Independent Additional Study Development Plans, the applicable Party represents and warrants (i) that it shall comply, with all applicable Laws relating to the collection and/or use of the Human Materials and (ii) that it has obtained or shall obtain, all necessary approvals and appropriate informed consents, in writing, for the collection or use of such Human Materials. Each Party shall provide documentation of such approvals and consents upon the other Party’s request. The applicable Party further represents and warrants that such Human Materials may be used as contemplated in this Agreement without any obligations to the individuals or entities ("Providers") who contributed the Human Materials, including any obligations of compensation to such Providers or any other Third Party for the intellectual property associated with, or commercial use of, the Human Materials for any purpose.

5.3 Compliance with Corporate Policy. Each Party acknowledges that the other Party’s corporate policies require that business must be conducted within the letter and spirit of the law. By signing this Agreement, each Party agrees to conduct the activities contemplated herein in a manner which is consistent with both law and good business ethics. Consistent with the ‘Compliance Program Guidance for Pharmaceutical Manufacturers’ published by the Office of Inspector General, U.S. Department of Health and Human Services, each Party agrees to maintain a compliance program and policies and adequate internal audit program with respect to its detailing and other Commercialization activities in the United States pursuant to this Agreement containing all the elements described in such guidance document, as well as completing any required reporting to any Regulatory Authority. Each Party shall, promptly following the Effective Date, have in place and enforce, and at all times during the Term thereafter will have in place and will enforce, for its (and its Affiliates) employees, a code of conduct and compliance program, including as provided under each Party’s respective corporate policies.

5.4 Business Partner Code of Conduct. Each Party endeavors to hold itself and its business partners to the highest performance, ethical and compliance standards, including basic human rights, encouraging fair and equal treatment for all persons, the provision of safe and healthy working conditions, respect for the environment, the adoption of appropriate management systems and the conduct of business in an ethical manner. In performing its duties under this Agreement, each Party acknowledges the value and importance of performance and ethical behavior in its performance under this Agreement. Without limiting any of Moderna’s other obligations hereunder, Merck expects that Moderna will abide by the letter and spirit of Merck’s Supplier Performance Expectations and Business Partner Code of Conduct (the “Code”), a copy of which is available at http://www.merck.com/about/how-we-operate/code-of-conduct/values.html, in its performance of this Agreement. Moderna is also expected to follow the Pharmaceutical Supply Chain Initiative (PSCI) principles, a copy of which is available at http://www.pharmaceuticalsupplychain.org/. In the event of a conflict or inconsistency between the Code and the express terms of this Agreement, this Agreement shall govern and prevail.

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5.5 **Governments and International Public Organizations.** Without limitation of the foregoing, each Party warrants that none of its employees, agents, officers or other members of its management are officials, officers, agents, representatives of any government or international public organization. Each Party agrees that it shall not make any payment, either directly or indirectly, of money or other assets, including the compensation derived from this Agreement (hereinafter collectively referred as a “Payment”), to government or political party officials, officials of international public organizations, candidates for public office, or representatives of other businesses or persons acting on behalf of any of the foregoing (hereinafter collectively referred as “Officials”) where such Payment would constitute a violation of any Law. In addition, regardless of legality, no Party shall make any Payment either directly or indirectly to Officials if such Payment is for the purpose of influencing decisions or actions with respect to the subject matter of this Agreement or any other aspect of a Party’s businesses.

5.6 **No Authority.** Each Party acknowledges that no employee of the other Party or its Affiliates shall have authority to give any direction, either written or oral, relating to the making of any commitment by such Party or its agents to any Third Party in violation of terms of this or any other provisions of this Agreement.

5.7 **Exclusions Lists.** Each Party certifies to the other Party that, as of the Effective Date and the Amended Effective Date, such Party has screened itself, and its officers and directors, against the Exclusions Lists and that it has informed the other Party whether such Party, or any of its officers or directors has been in Violation. After the execution of this Agreement, each Party shall notify the other Party in writing immediately if any Violation occurs or comes to its attention, and shall, with respect to any person or entity in Violation, promptly remove such person or entity from performing any Internal SAV Programs, POC Program, Joint Development Program, or any other activities hereunder, function or capacity related thereto.

6. **MANUFACTURING AND SUPPLY**

6.1 **During POC Program.**

(a) **mRNA Cancer Vaccines and Collaboration Products.** To the extent supply of mRNA Cancer Vaccines (including Collaboration Products) or mRNA Constructs (formulated or unformulated) is required to perform the activities under a POC Plan for a given Program, Moderna shall be solely responsible (except as set forth in the applicable POC Plan, Exhibit K, or as otherwise mutually agreed to by the Parties in writing) for Manufacturing such mRNA Cancer Vaccines (including Collaboration Products) or mRNA Constructs (formulated or unformulated) in accordance with such POC Plan for such Program and this Agreement and the supply terms set forth in Exhibit K or pursuant to Section 10.13, as applicable.

(b) **Keytruda.** To the extent supply of Keytruda is required to perform the Clinical Studies under a POC Plan for a given Program, Merck shall be solely responsible for supplying such requirements of Keytruda in accordance with such POC Plan for such Program, this Agreement and the supply terms set forth in Exhibit K.
Manufacturing Capabilities. Pursuant to the POC Plan for a given Program [***], Moderna will [***] to establish [***] for use as part of such POC Plan (and the Development Plans, if applicable) for such Program, which will include [***], in accordance with the Development Plans (or POC Plans, if applicable) and this Agreement. [***]

(d) Inspections by Merck During POC Term.

(i) During the SAV POC Term, to the extent Merck has not already conducted a quality audit and an EHS audit of the Collaboration SAV Manufacturing Facility(ies) identified by Moderna pursuant to Section 6.1(c) in the preceding [***] period, Merck shall have a reasonable opportunity to conduct a quality audit and EHS audit of such Collaboration SAV Manufacturing Facility(ies) prior to initiation of cGMP Manufacturing; provided, however, such [***] limitation shall not apply in the event that [***]. Quality audits under this Section may include an audit of[***].

(ii) At least [***] days prior to the anticipated expiration of the POC Term for a given Program, Merck, in each such instance, shall have the right, during normal business hours [***] and with reasonable advance notice, to [***] with respect to the applicable Collaboration Products, solely for the purposes of assisting Merck in determining [***]; [***]. Moderna will support such [***] by Merck by making appropriate resources available to provide the information, data, and records, and to answer questions from Merck. In connection with such [***]. With respect to any SAV Program, if Merck identifies any audit observations in connection with any audits under this Section 6.1(d)(ii), the Parties will discuss in good faith suitable approaches for correcting such observations and will prepare a plan for correcting such observations for such SAV Program; [***].

(iii) With respect to an SAV Program and an audit by Merck of Collaboration SAV Manufacturing Facility(ies) in accordance with Section 6.1(d)(i), if Merck identifies any audit observations, the Parties will discuss in good faith suitable approaches for correcting such observations and the Parties will prepare a plan for correcting such observations for such SAV Program, [***].

(iv) Notwithstanding Section 6.1(d)(i) and Section 6.1(d)(iii), the Parties hereby acknowledge and agree that Merck has conducted, as of the Amended Effective Date, a quality audit and EHS audit with respect to the Collaboration SAV Manufacturing Facility(ies) designated to date for the Manufacture of Collaboration SAV Products for the KRAS Program. As of the Amended Effective Date, as set forth on Schedule 6.1(d)(iv), Moderna and Merck have agreed to the timing and scope of the required corrective actions resulting from such quality and EHS audits. [***] Merck acknowledges that the batches of mRNA-5671 Manufactured by Moderna in such Collaboration SAV Manufacturing Facility(ies) are suitable, as of the Amended Effective Date, for use in Clinical Studies for the KRAS Program, subject to [***].

C Confidential CMC Documents. Notwithstanding anything in this Agreement to the contrary, during the POC Term for a given Program, except with respect [***], Moderna may redact from documents provided or made available to Merck or its Affiliates, and otherwise decline to disclose or provide Merck access to, Moderna CMC Information and proprietary manufacturing processes relating to Moderna CMC Information from such Program.
6.2 Manufacture for Development During Merck Participation Term for a given Program.

(a) mRNA Cancer Vaccines and Collaboration Products. To the extent supply of mRNA Cancer Vaccines (including Collaboration Products) or mRNA Constructs (formulated or unformulated) is required to perform the activities under any Additional Research Plan for a given Program, Moderna shall be solely responsible (except as mutually agreed by the Parties in writing or as set forth in the applicable Joint Development Plan and Budget) for Manufacturing such mRNA Cancer Vaccines (including Collaboration Products) or mRNA Constructs (formulated or unformulated) in accordance with such Additional Research Plan for such Program and this Agreement.

(b) Merck’s Exercise of a Merck Participation Election for SAV Programs. Subject to the remainder of this Section 6.2(b), to the extent supply of Collaboration SAV Products (including mRNA Constructs therefor) is anticipated to be required to perform the activities under any Joint Development Plan and Budget, concurrent with Merck’s review of Moderna’s Manufacturing operations and the Parties’ preparation of a plan for correcting observations for such SAV Program as set forth in Section 6.1(d)(ii), the Parties shall discuss in good faith and mutually agree on [***]. After receipt of [***], the Parties shall discuss in good faith [***]. After such joint discussion and evaluation, if the Parties are not able to agree [***], then [***] shall have the right to make the final determination [***]. For the avoidance of doubt, the discussions and determination as set forth in this Section 6.2(b) for an SAV Program may take place during the POC Term for such SAV Program as well as during the Merck Participation Term for such SAV Program. If the Parties mutually agree, or if [***], that [***], then [***] shall have a reasonable amount of time following such determination to [***].

(c) Merck’s Exercise of a Merck Participation Election for the PCV Program.

(i) With respect to the PCV Program, if Merck identifies any audit observations in connection with any audits under Section 6.1(d)(ii), the Parties will discuss in good faith suitable approaches for correcting such observations and, following the exercise of the Merck Participation Election for the PCV Program [***], will prepare a plan and a budget for correcting such observations for the PCV Program, any resulting corrective action plan and budget must [***], and Moderna shall have a reasonable amount of time following such consultation with, and approval by, Merck to make appropriate corrections. Moderna shall bear all of its own costs and expenses in connection with taking any such corrective actions in accordance with such plan and budget up to [***]. In the event that Moderna incurs costs and expenses in excess of [***] in connection with taking such corrective actions in accordance with such plan and budget, such excess costs shall be treated as Shared Collaboration Costs with respect to the PCV Program under Exhibit D.

(ii) [***] Merck, [***], shall purchase from Moderna up to such capacity ([***]), Collaboration PCV Product for use in Development in connection with the performance of Collaboration Activities during the Merck Participation Term for the PCV Program until [***]. Following [***], upon [***] prior written notice to Moderna, [***].

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(d) *PCV Clinical Supply Agreement and Clinical Quality Agreements.* At least [***] days prior to the anticipated expiration of the POC Term for the PCV Program, the Parties shall initiate good faith discussions with respect to, and within [***] days after Merck exercises the Merck Participation Election for the PCV Program enter into, a supply agreement and a Clinical Quality Agreement with respect to the Manufacture of Collaboration PCV Products for Development purposes during the Merck Participation Term for the PCV Program (if and to the extent Merck exercises the Merck Participation Election), which supply agreement (the “PCV Clinical Supply Agreement”) and Clinical Quality Agreement will include mutually agreed terms and conditions in accordance with Exhibit M, and shall otherwise include terms and conditions consistent with supply and quality agreements that are customary for agreements of this type which Merck utilizes with other non-affiliated Third Party manufacturers.

(e) *SAV Clinical Supply Agreement and Clinical Quality Agreements.* At least [***] days prior to the anticipated expiration of the SAV POC Term for the first SAV Program for which [***], the Parties shall initiate good faith discussions with respect to, and within [***] days after Merck exercises the Merck Participation Election for such SAV Program, enter into a supply agreement and a Clinical Quality Agreement with respect to the Manufacture of Collaboration SAV Products for Development purposes during the Merck Participation Term for such SAV Program (if and to the extent Merck exercises the Merck Participation Election for a given SAV Program), which supply agreement (the “SAV Clinical Supply Agreement”) and Clinical Quality Agreement will include mutually agreed terms and conditions consistent with supply and quality agreements that are customary for agreements of this type [***]. In the event that [***], the Parties may mutually agree to amend the existing SAV Clinical Supply Agreement to include Collaboration SAV Products from such subsequent SAV Program or enter into a new SAV Clinical Supply Agreement for such Collaboration SAV Products.

(f) **Supply Failure; Selection of Alternative Supplier.**

(i) If [***], then Merck would have the right to cause Moderna to effect, and Moderna shall effect a technology transfer in accordance with Exhibit H and the applicable Clinical Supply Agreement to Merck (or its Affiliate) or to a Manufacturing Subcontractor in order to permit Merck (or its Affiliate) or such Manufacturing Subcontractor to Manufacture the applicable Collaboration Product to meet Merck’s requirements for Development activities under the applicable Program under this Agreement. All costs and expenses incurred by or on behalf of the Parties (or their Affiliates) in connection with effecting such technology transfer in accordance with Exhibit H will be Shared Collaboration Costs. Without limiting the foregoing, Moderna shall keep Merck reasonably apprised [***]. Should a technology transfer as expressly set forth in this Section 6.2(f)(i) be required or determined pursuant to Section 6.2(f)(ii), then [***]. During any technology transfer for a Collaboration PCV Product [***]. Following a successful technology transfer to Merck (or its Affiliate) or to a Manufacturing Subcontractor in accordance with Exhibit H, Merck shall assume responsibility for the supply of Collaboration PCV Product for Development and Commercialization activities under the PCV Program, unless otherwise agreed to by the Parties in writing. During any technology transfer for a Collaboration SAV Product[***].

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(ii) Notwithstanding the terms of the SAV Clinical Supply Agreement, immediately upon [***], the Parties, through the JMC, will review and discuss [***]. If the Parties reasonably determine (based on the considerations above) that the best available course of action [***] is for Moderna to [***], Moderna will, with Merck’s input, [***]. If the Parties determine that it is in the best interests of the applicable Program for [***], then Moderna [***], and in such case the Parties will prepare an appropriate plan for review by the JMC and approval by the Parties, including [***]. If the Parties determine that the best available remedy for ensuring that the foregoing requirements are met is some other approach, the Parties will prepare an appropriate plan to reflect such approach for review by the JMC and approval by the Parties, including [***]. Notwithstanding the preceding provisions of this Section 6.2(f)(ii), if the Parties cannot agree on the best available course of [***], the matter will be resolved in accordance with [***]. During the pendency of any such dispute resolution procedure, [***].

(iii) If following a Supply Failure, there is a dispute as to the best approach for ensuring [***], then the costs and expenses incurred by or on behalf of a Party or its Affiliates in connection with [***], shall be considered [***].

(g) Management of Development Manufacturing Capacity.

(i) With respect to the Collaboration Products (except for any Collaboration SAV Product for which Moderna is not responsible to supply [***]), Moderna, in consultation with Merck, shall prepare and maintain a quarterly forecast (each, a “Manufacturing Capacity Forecast”) of the supply of such Collaboration Products, [***]. The Manufacturing Capacity Forecast for each applicable Program is to be updated [***]. The Manufacturing Capacity Forecast for each applicable Program is to be reviewed [***] by the JMC and used by the JMC in coordination with the JDC to inform plans for [***].

(ii) Should the addition or amendment of a Clinical Study to the Manufacturing Capacity Forecast for a given Program result in the need to obtain additional Manufacturing capabilities (including [***], as determined by the JMC [***], the JMC shall jointly evaluate options to increase Manufacturing capabilities [***] with the goal of [***]. All [***] are subject to review by the JMC [***], with respect to Collaboration PCV Products, and [***], with respect to Collaboration SAV Products (provided that [***]; provided that no such [***] shall require a Party to establish [***] without such Party’s prior written consent. Any disputed matter with respect to Collaboration SAV Products pursuant to this Section 6.2(g)(ii) will be resolved in accordance with [***].

(h) To the extent there is a technology transfer pursuant to Section 6.2(f) as a result of [***], any costs and expenses associated with establishing [***] that are incurred by or on behalf of [***], including [***], shall be considered [***].

(i) To the extent supply of Keytruda is required to perform the activities under a Development Plan, Merck shall be responsible for supplying such requirements of Keytruda in accordance with such Development Plan and the supply terms set forth on Exhibit K.

(j) To the extent supply of a Merck Agent is required to perform the activities under a Development Plan, Merck shall be responsible for supplying such requirements of such Merck Agent in accordance with such Development Plan and the supply terms set forth on Exhibit K. To the extent supply of a Moderna Agent is required to perform the activities under a Development Plan, Moderna shall be responsible for supplying such requirements of such Moderna Agent in accordance with such Development Plan and the supply terms set forth on Exhibit K.
To the extent supply of a Third Party Agent is required to perform the activities under a Development Plan, the Party who has contracted with such Third Party for such Third Party Agent shall be responsible for supplying such requirements of such Third Party Agent in accordance with such Development Plan.

6.3 Manufacture for Commercialization During Merck Participation Term for a given Program.

(a) Manufacturing for Commercialization during Merck Participation Term for a given Program. With respect to a given Program, considering the forecasted commercial volume requirements for the applicable Collaboration Product, the Parties shall jointly evaluate options to [***]. Notwithstanding the foregoing, with respect to any Collaboration SAV Product, [***]. The [***] with respect to the PCV Program is subject to review by the JMC and approval by [***] is subject to review by the JMC and approval by Parties, [***]; provided that if the Parties do not approve the [***] pursuant to this Section 6.3(a), such dispute will be resolved in accordance with [***] neither Party’s plan [***] shall include a proposal requiring the other Party to [***]. The initial discussions regarding commercial supply of Collaboration SAV Products may take place at the same time discussions are taking place pursuant to Section 6.2, and if commercial supply may be sourced at the same time [***], then the selection criteria under Section 6.2(b) shall also include [***]. If there is a dispute regarding the Commercial Capacity Buildup Plan for a Joint SAV Program and the Parties resolve the dispute through [***], then the determination [***] and the Party responsible for [***] shall be responsible for payment of the costs and expenses incurred in [***]; provided that such Party shall be entitled to [***].

(b) Commercial Supply Agreements and Commercial Quality Agreements. If Moderna [***], the Parties shall enter into a supply agreement and quality agreement with respect to Manufacture of the applicable Collaboration Product for commercial purposes, which supply agreement (the "Commercial Supply Agreement") and quality agreement (the "Commercial Quality Agreement") shall contain terms and conditions consistent with supply and quality agreements that are customary for agreements of this type that Merck utilizes with other non-affiliated Third Party manufacturers, including, [***].

6.4 Allocation of Capacity. Allocation of capacity for Collaboration Products among Exhibit K. the PCV Clinical Supply Agreement, SAV Clinical Supply Agreement and the Commercial Supply Agreement will be prioritized, in descending order of priority, as follows: [***].

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7. REGULATORY RESPONSIBILITIES DURING THE MERCK PARTICIPATION TERM FOR A GIVEN PROGRAM

7.1 Merck Participation Term Lead Regulatory Party.

(a) During the Merck Participation Term for a given Program, subject to Section 7.1(b), unless otherwise agreed to by the Parties in writing, [***] shall be the Lead Regulatory Party and primarily responsible for regulatory matters with respect to the applicable Joint Development Program and the Collaboration Products for such Program. Subject to JDC oversight on the overall regulatory strategy for the Collaboration Products for such Program, [***] shall have primary responsibility with respect to submitting Regulatory Filings (other than DMFs) for such Program. [***] shall be primarily responsible for all communications with, and submissions to, Regulatory Authorities in connection therewith, provided that [***] shall have a reasonable opportunity to review and comment on the subject matter of all material Regulatory Filings (other than DMFs) (including all material correspondence). At the reasonable request of [***], [***] shall prepare, or otherwise provide assistance in the preparation of, certain portions of Regulatory Filings (***)) for such Program. In the event additional [***] not currently contained within regulatory documents [***], the Parties shall mutually agree on the [***]. Subject to Section 7.1(b), [***] shall also be responsible for all routine maintenance of all INDs or CTAs for Collaboration Products for such Program. [***] shall, subject to applicable Law, [***] shall provide such information and assistance as [***] may reasonably request in connection with the completion of and submission of and maintenance of Regulatory Filings for such Program, including applications for Regulatory Approvals, and responses to agency inquiries (which information [***] shall provide in a timely manner to respond to the agency), for such Collaboration Products for such Program, and the maintenance thereof. In the event [***] receives a request from a Regulatory Authority with respect to such Program for which disclosure of [***] will notify [***] promptly after receiving such request and the Parties shall discuss a course of action within a time frame consistent with the time period requested by such Regulatory Authority, provided that in the event that the Parties are unable to agree on such course of action within such time frame, then such matter shall be referred to [***].

(b) During the Merck Participation Term for a given Program, notwithstanding Section 7.1(a), the Party sponsoring or conducting an Independent Additional Study under an Independent Additional Study Development Plan for such Program (the “IAS Party”) shall be responsible for regulatory matters with respect to such Independent Additional Study for such Program and the Collaboration Products thereunder, including filing and maintaining the IND or CTA for the conduct of such Independent Additional Study and communications with, and submissions to, Regulatory Authorities in connection with such Independent Additional Study; provided, however, that if a Regulatory Authority requires that an Independent Additional Study be conducted under an IND or CTA held by the other Party (the “Non-IAS Party”), then the Parties shall discuss in good faith an alternative approach if reasonably available. The non-IAS Party shall provide other information and assistance as the IAS Party may reasonably request in connection with the completion of and submission of INDs or CTAs for Independent Additional Studies for such Program; provided, however, Moderna shall have no right to directly access the CMC data for [***]. In addition to the foregoing, if [***]; provided that, if the applicable Regulatory Authority requires [***]. Without limiting the foregoing, the Parties agree to grant each other such Rights of Reference as are necessary, and to otherwise cooperate in good faith, to enable the conduct of Independent Additional Studies in accordance with the terms of this Agreement, including to with respect to submission of Regulatory Filings, applications for Regulatory Approvals and the maintenance thereof.
7.2 Ownership of Regulatory Filings.

(a) Subject to Section 7.1(b) and Section 7.2(b), during the Merck Participation Term for a given Program, all applications for Regulatory Approval, the Regulatory Approvals, and other Regulatory Filings (other than DMFs) (including all INDs and CTAs) relating to the applicable Collaboration Products will be the property of [***] and held in the name of [***] or its designees. [***] shall provide the JDC with regular updates regarding the status of Regulatory Filings and correspondences for Collaboration Products, and such Regulatory Filings and correspondences shall be reviewed by the JDC or a working group established by such committee.

(b) With respect to the Collaboration Products, if not previously prepared and filed, Moderna will, at Merck’s request, prepare, file and maintain with all applicable Regulatory Authorities a DMF for the Collaboration Products and, subject to the remainder of this Section 7.2(b), Moderna shall also provide such other information and assistance as Merck may reasonably request in connection with the completion of and submission of applications for Regulatory Approvals for Collaboration Products and the maintenance thereof. Merck and its Affiliates and Sublicensees may refer to such DMF in any filing made in connection with obtaining or maintaining a Regulatory Approval for a Collaboration Product and [***] hereby grants such a Right of Reference. [***] will be responsible for assuring that during the Term, such [***] will be in the form appropriate for filing with all applicable Regulatory Authorities, including those in [***], and [***] shall be maintained in full force and effect by [***] during the Term and will not be amended without the consent of [***], other than with respect to amendments that [***] will, on written request by [***], provide to the requesting party and to any specified Regulatory Authority [***]. If [***] has not filed [***], then any and all [***] required to be included in any Regulatory Filing [***] shall be provided by [***] to the appropriate individuals [***]. To the extent that [***], then [***] will first notify and discuss with the appropriate representatives at [***]; provided that such [***] employees [***].

(c) With respect to any Independent Additional Study, upon the IAS Party’s completion of an Independent Additional Study for a given Program, the IAS Party will provide the data and related information and documents with respect thereto to the non-IAS Party, and the Parties will meet in person to review and discuss the results and data of such study, the safety and efficacy profile of the proposed Collaboration Product or label expansion with respect to such Collaboration Product that could be requested via a filing for a Regulatory Approval. [***] shall be responsible for filing, and, subject to [***] shall be obligated to file the application for Regulatory Approval for a given Collaboration Product following receipt of clinical data from the conduct of an Independent Additional Study upon the request of the IAS Party for such Independent Additional Study; provided further that if not already assigned [***].

7.3 Adverse Event Reporting. During the Merck Participation Term for a given Program, prior to [***] shall be responsible for individual and aggregate safety reporting for any Clinical Studies involving the applicable Collaboration Product for such Program (as applicable), [***] shall provide [***] an electronic copy of the [***]. Upon receipt of completion of [***] shall assume responsibility for the individual and aggregate safety reporting (as applicable) [***]. Until [***], each Party agrees to notify the other Party of any information of which such Party becomes aware concerning any Adverse Events with respect to such Collaboration Product for such Program. Such notice shall be provided in English in the form of a processed CIOMS I within [***] days of such Party receiving such information where such potential Adverse Events is a SAE and associated with the clinical uses, Clinical Studies, investigations, tests or marketing of such Collaboration Product for such Program. Adverse Event reports of unexpected and fatal
or life-threatening events which are possibly, probably, definitely related or of unknown relationship to the use of a given Collaboration Product for such Program must be forwarded to the other Party within [***] after receipt of such information. It is understood and agreed that these Adverse Events reporting requirement provisions are based on the respective policies and procedures of the Parties and applicable regulatory reporting requirements. In the event of changes to applicable regulatory requirements for Adverse Events reporting, the Parties agree to comply with any such required revised notification requirements. At this same time, Moderna and Merck shall enter into discussions regarding one or more pharmacovigilance agreements (or updates to the current pharmacovigilance agreement) for the Collaboration Product for such Program, as applicable (the “Pharmacovigilance Agreement”). In all cases, [***]. For the avoidance of doubt, [***].

7.4 Right of Reference During Merck Participation Term for a given Program. During the Merck Participation Term for a given Program, each Party shall provide to the other, as necessary, a cross-reference letter or similar communication to the applicable Regulatory Authority to effectuate the Right of Reference such other Party’s Other Component(s) that are included in a Development Plan. Notwithstanding anything to the contrary in this Agreement, neither Party shall have any right to access the other Party’s CMC data with respect to a Moderna Agent, Merck Agent or Keytruda, as applicable. Each Party shall authorize FDA and other applicable Regulatory Authorities to cross-reference the applicable INDs and CTAs for any Collaboration Product, Moderna Agent, Merck Agent or Keytruda, as applicable, used in the conduct of a Clinical Study for such Program under a Development Plan to provide data access to the other Party sufficient to support conduct of any Clinical Study sponsored by such other Party involving such Collaboration Product for such Program, Moderna Agent, Merck Agent or Keytruda, as applicable. If a Party’s IND or CTA for such Program is not available in a given country, subject to [***], such Party will file its CMC data for such Program with the applicable Regulatory Authority for such country, referencing the other Party’s IND or CTA for such Program as appropriate (however, [***]). The Party conducting a Clinical Study under a Right of Reference shall (a) track and collect financial disclosure information from all “clinical investigators” involved in such Clinical Study and (b) prepare and submit the certification or disclosure of the same in accordance with all applicable Law, including Part 54 of Title 21 of the United States Code of Federal Regulations (Financial Disclosure by Clinical Investigators) and related FDA Guidance Documents. Prior to the initiation of clinical activities under any Clinical Study for such Program sponsored by (a) Moderna involving a Collaboration Product for such Program, Keytruda or a Merck Agent or (b) Merck involving a Moderna Agent, the Parties shall determine, in writing, whether the Party conducting such Clinical Study for such Program shall track and collect separate certification or disclosure forms for each of Merck and Moderna or one (1) “combined” certification or disclosure form for both Merck and Moderna. For purposes of this Section 7.4, the term “clinical investigators” shall have the meaning set forth in Part 54.2(d) of Title 21 of the United States Code of Federal Regulations.

7.5 Regulatory Costs. During the Merck Participation Term for a given Program, the reasonable and documented costs and expenses of the Parties in performing its respective regulatory obligations pursuant to this Section 7 prior to receipt of Regulatory Approval for a given Collaboration Product for such Program shall be considered Development Costs.
8. COMMERCIALIZATION RESPONSIBILITIES

8.1 Overview. On a Collaboration Product-by-Collaboration Product basis, subject to the oversight of the JSC and JCC and the remainder of this Section 8, Merck will plan Commercialization Activities with respect to such Collaboration Product in the Territory, including discussing such plans with Moderna and the Co-Promotion of such Collaboration Products by Moderna in the U.S. Merck will be solely responsible for all Commercialization Activities relating to such Collaboration Product in the Territory, including the booking of all sales of Collaboration Products, subject to Moderna’s right to perform certain Co-Promotion activities (with Merck) in the United States as specified in Sections 8.5 and 8.6 and any Co-Promotion Agreement.

8.2 Commercialization Efforts.

(a) United States. On a Collaboration Product-by-Collaboration Product basis, Merck (itself or through one or more Affiliates) will use Commercially Reasonable Efforts to Commercialize such Collaboration Product in the U.S., and to carry out the tasks specified under the Global Commercialization Plan for each Collaboration Product in the U.S. in a timely and effective manner and in compliance in all material respects with applicable Law.

(b) Ex-U.S. On a Collaboration Product-by-Collaboration Product basis, Merck (itself or through one or more Affiliates) will use Commercially Reasonable Efforts to Commercialize such Collaboration Product ex-U.S., and to carry out the tasks specified under the Global Commercialization Plan for each Collaboration Product ex-U.S. in a timely and effective manner and in compliance in all material respects with applicable Law.

8.3 Global Commercialization Strategy. Before the Commencement of the first Registrational Study for any Collaboration Product following the exercise of the Merck Participation Election for the applicable Program, Merck shall provide, and within [***] days after such provision the JCC will review and update for approval by the JSC, a written summary of the global Commercialization strategy for all Collaboration Products included in the Joint Development Plan and Budget for the applicable Program in the Territory. Such strategy should include [***]. For clarity, any and all such communications and strategy involving the Commercialization of a Collaboration Product will be limited to those permitted under applicable Law, including antitrust Laws.

8.4 Global Commercialization Plan(s).

(a) Initial Global Commercialization Plan(s). For each Collaboration Product, an initial high-level Global Commercialization Plan shall be prepared by Merck and submitted to the JCC for review and JSC approval no later than [***] prior to the anticipated date of first filing for Regulatory Approval for such Collaboration Product. The JCC will set the required form and contents of such Global Commercialization Plan, which will include activities relating to [***]; provided that, for clarity, the JCC may determine that not all of the foregoing elements are appropriate for inclusion in the initial Global Commercialization Plan or updates thereto prior to Collaboration Product launch.
(b) **Global Commercialization Budget(s).** At such times as the JCC will deem appropriate, but in no event later than [***] prior to the anticipated date of first filing for Regulatory Approval for a Collaboration Product, and concurrently with the preparation of the initial Global Commercialization Plan, on a Collaboration Product-by-Collaboration Product basis, Merck will prepare an initial budget for the Global Commercialization Plan for such Collaboration Product, that outlines the financial resources and expenses to be incurred by or on behalf of the Parties (or their Affiliates) in execution of the Global Commercialization Plan, with input from Moderna on costs associated with activities assigned to Moderna in the associated Global Commercialization Plan (each a “Global Commercialization Budget”). The JCC will review and comment on and the JSC will approve such Global Commercialization Budget; provided that the Global Commercialization Budget may not be increased by more than [***] of the anticipated Allowable Commercialization Costs in such Global Commercialization Budget within a Calendar Year without submitting an amended Global Commercialization Budget for review and comment by the JCC and approval by the JSC; provided that, Merck shall have the right to incur Commercialization costs in excess of [***] of the anticipated Allowable Commercialization Costs in such Global Commercialization Budget within a Calendar Year to the extent that such Commercialization costs are not previously approved by the JSC shall be solely borne by Merck for the purposes of calculating each Party’s share of the Cash Profits or Losses for such Calendar Year. Thereafter, Merck, with input from Moderna, will update the Global Commercialization Budget at least [***] per Calendar Year (and in any event at any time the Global Commercialization Plan is updated or amended with respect to any Commercialization Activities), and the JCC will review and comment on and the JSC shall approve any such update or any other amendment to the Global Commercialization Budget. The JCC will set the required form and contents of the Global Commercialization Budget, but at a minimum the contents shall include [***].

(c) **Updated Global Commercialization Plan(s) and Global Commercialization Budget(s).** Not later than [***] of each Calendar Year, or more often as the Parties mutually deem appropriate, Merck shall submit to the JCC for review and comment updated Global Commercialization Plans and Global Commercialization Budgets for the following Calendar Year, which the JCC shall review and comment on, and the JSC shall approve, no later than [***] of such Calendar Year and attach to the minutes of the meeting of the JSC at which any Global Commercialization Plan, Global Commercialization Budget or any amendment, modification or update to either or both is approved by the JSC.

8.5 **Co-Promotion of Collaboration Products in U.S.**

(a) **Co-Promotion.** Except as otherwise set forth in this Agreement, the Parties intend that the Parties will share in the Co-Promotion of Collaboration Products in the U.S. on the terms and conditions set forth in this Section 8.5 and Section 8.6.

(b) **Co-Promotion Agreements.** On a Collaboration Product-by-Collaboration Product basis, prior to the submission of the first Global Commercialization Plan for such Collaboration Product to the JCC, the Parties will enter into a co-promotion agreement (the “Co-Promotion Agreement”) setting forth the terms and conditions of the Parties’ Co-Promotion of such Collaboration Product in the U.S. Each Co-Promotion Agreement will be consistent with this Section 8.5 and Section 8.6, and will contain additional reasonable and customary terms and
8.6 Co-Promotion Terms. Each Co-Promotion Agreement entered into pursuant to Section 8.5 will reflect the principles set forth in this Section 8.6, unless otherwise expressly agreed by the Parties.

(a) Team Building and Training. Merck will direct the standards for job descriptions, qualifications, roles, responsibilities and training of Moderna’s sales representatives and key account managers and Moderna will prepare and implement, consistent in all material respects with the Global Commercialization Plan, a training program and training materials for such sales representatives, to which Merck may contribute, at its election. In addition, Merck will specify the conduct and content of details (including detail scripts) for a Collaboration Product. Moderna will cause each of its sales representatives and key account managers assigned to a Collaboration Product to attend and complete the training program developed by Merck for such Collaboration Product in the U.S. to assure a consistent, focused promotional strategy and message as and to the extent consistent with applicable Law.

(b) Responsibilities. Subject to Section 8.6(c) below, each Party will be solely responsible for recruiting, hiring and maintaining its sales force of sales representatives and key account managers for promotion of a Collaboration Product in accordance with its standard procedures and the requirements of this Agreement. Each Party will be responsible for the activities of its sales representatives and key account managers, including compliance by its sales representatives and key account managers with training and detailing requirements. In particular, each Party will provide its sales representatives and key account managers assigned to a Collaboration Product with the level of oversight, management, direction and sales support with respect to the promotion of such Collaboration Product necessary to effectively and efficiently promote such Collaboration Product in accordance with the terms of this Agreement and applicable Law.

(c) Sales Force Matters.

(i) Number of Representatives. Moderna will have the right, but not the obligation, to provide no less than [***] but no more than [***] of the total sales representatives and of the total key account managers used by both Parties for promotion of a Collaboration Product in the U.S. The Global Commercialization Plan for a Collaboration Product that is intended to be Co-Promoted in the U.S. will set forth the precise number of Moderna sales representatives and key account managers consistent with the foregoing and Moderna shall [***]. Each Party agrees that any of its sales representatives or key account managers involved in the promotion of a Collaboration Product will not have any legal or regulatory disqualifications, bars or sanctions.

(ii) Establishment; Launch Readiness. No later than [***] prior to the estimated date of the launch of the first Collaboration Product in the U.S., Moderna will present its sales representative and key account manager capabilities to Merck. If Merck identifies [***], then Merck shall have the right to [***].
(iii) Hiring. Moderna will be solely responsible for recruiting, hiring and maintaining its sales representatives and key account managers in accordance with [***], if any, and shall have sole control over such sales representatives and key account managers. Notwithstanding the foregoing, however, upon Moderna’s reasonable request, Merck will assist Moderna in the establishment of the sales representatives and key account managers by providing assistance with the profiling of personnel during hiring.

(iv) Use of Contract Sales Organizations. [***].

(v) Compensation Programs for Sales Representatives. Each Party shall be solely responsible for any compensation that is payable to its sales representatives and key account managers consistent with the applicable Global Commercialization Plan. Each Party represents and warrants to the other Party that its compensation programs for its sales representatives and key account managers do not, and will not, provide financial incentives that, to its knowledge, facilitate the promotion, sales, and marketing of the Collaboration Product in violation of applicable Laws.

(d) Promotional Materials. In the United States, to the extent Moderna is Co-Promoting, each Party’s sales representatives and key account managers assigned to a Collaboration Product will utilize only Promotional Materials that have been approved by the JCC. All detailing activities conducted by each Party’s sales representatives will be consistent in all material respects with the Promotional Materials so approved. Each Party will train and instruct their respective sales representatives to make only those statements and claims regarding such Collaboration Product, including as to efficacy and safety, which are consistent with such Collaboration Product labeling and accompanying inserts and the approved Promotional Materials.

(c) JCC Reports. Each of Merck and Moderna will provide the JCC with a report, as soon as practicable but in no event later than [***] days following the end of each Calendar Quarter during the Term following the Regulatory Approval of a Collaboration Product to be Commercialized in the U.S., setting forth the number of details made by its sales representatives of such Collaboration Product in the U.S. during such Calendar Quarter. Costs and expenses for sales representatives and key account managers will be charged to the Profit & Loss Share as in Exhibit D.

(f) Records. Each Party will maintain records and otherwise establish procedures to ensure compliance with all applicable Laws and professional requirements that apply to the promotion and marketing of the Collaboration Products.

8.7 Branding. To the extent permitted by applicable Law and applicable Regulatory Authorities, all Collaboration Products sold in or distributed for the Territory will have the corporate brands of each Party displayed on an equally prominent basis. At such time as the JCC will deem appropriate, the Parties will enter into appropriate trademark licensing agreements to achieve the foregoing.

8.8 Promotional Materials. Merck will be responsible for the creation, preparation, production, reproduction and filing with the applicable Regulatory Authorities, of relevant Promotional Materials relating to each Collaboration Product for use in the Territory. All such Promotional Materials will be compliant with applicable Law and, if applicable, consistent in all material respects with the Global Commercialization Plan for such Collaboration Product and, if applicable, consistent in all material respects with the branding strategy for such Collaboration Product.
8.9 **Sales and Distribution.**

(a) **Collaboration Products.** Merck will be solely responsible for booking of sales, handling all returns, recalls, order processing, invoicing and collection, inventory and receivables, and, subject to the good faith consideration by Merck of input from Moderna, Distribution Matters relating to each Collaboration Product in the Territory. Moderna will not accept orders for Collaboration Products or make sales for its own account or for Merck’s account, and if Moderna receives any order for Collaboration Products in the Territory, it will refer such orders to Merck for acceptance or rejection. Merck will be solely responsible for negotiating and contracting with managed care entities, hospitals, integrated systems, pharmacies, long term care organizations, group purchasing organizations, pharmacy benefit managers, and governments, consistent in all material respects with the Global Commercialization Plan.

(b) **Keytruda and Merck Agents.** Merck will be solely responsible for all Commercialization activities for Keytruda and for all Merck Agents in the Territory, in each case including handling all returns, recalls, order processing, invoicing and collection, booking of sales, inventory and receivables, government pricing programs and medical affairs, including negotiating and contracting with managed care entities, hospitals, integrated systems, pharmacies, long term care organizations, group purchasing organizations, pharmacy benefit managers, and governments. Moderna will not accept orders for Keytruda or for Merck Agents, or make sales for its own account or for Merck’s account, and if Moderna receives any order for Keytruda or a Merck Agent (as applicable) in the Territory, it will refer such orders to Merck for acceptance or rejection. For clarity, Moderna shall have no rights to any revenue from any Merck Agent or Keytruda.

(c) **Moderna Agents.** Moderna will be solely responsible for all Commercialization activities for all Moderna Agents in the Territory, in each case including handling all returns, recalls, order processing, invoicing and collection, booking of sales, inventory and receivables, government pricing programs and medical affairs, including negotiating and contracting with managed care entities, hospitals, integrated systems, pharmacies, long term care organizations, group purchasing organizations, pharmacy benefit managers, and governments. Merck will not accept orders for Moderna Agents or make sales for its own account or for Moderna’s account, and if Merck receives any order for Moderna Agents in the Territory, it will refer such orders to Moderna for acceptance or rejection. For clarity, Merck shall have no rights to any revenue from any Moderna Agent.
8.10 Commercialization Reports. Each Party will keep the JCC fully informed regarding the progress and results of Commercialization activities for Collaboration Products in the U.S., including [***]. Merck will provide the JCC on a [***] basis a rolling annual forecast of projected unit sales, revenue and market share for Collaboration Products ex-U.S. The Parties will work together to provide such forecast for Collaboration Products in the U.S.

8.11 [***]
   (a) [***]
   (b) [***]
   (c) [***]

8.12 [***]

9. PAYMENTS

9.1 Program Funding. The Parties agree and acknowledge that pursuant to the terms of the Original Agreement, Merck has previously paid Moderna a one-time payment of Two Hundred Million Dollars (U.S. $200,000,000) (the “Upfront Payment”), which payment will be non-refundable, non-creditable, not subject to set-off, and not be reduced by any withholding or similar taxes. Subject to Sections 3.5(d) and 3.7(b) and Exhibit D, Moderna shall utilize the Upfront Payment for the performance of Collaboration Activities for the PCV Program under this Agreement.

9.2 Non-Exercise of Merck Participation Election. If Merck does not exercise the Merck Participation Election for a given Program, (a) [***], no further payments shall be due under this Agreement from Merck to Moderna with respect to such Program or the Collaboration Products thereunder (other than with respect to any payment obligations that have accrued prior to the Merck Participation Election Period expiry for such Program, Merck’s indemnification obligations under Section 13.6(a) or for supply of the applicable Collaboration Products in accordance with Section 3.7) and (b) Moderna shall pay to Merck for a given Calendar Quarter its share of (1) Moderna Net Profits allocated to sales of any Financial PCVs or (2) the Moderna Net Profits allocated to sales of any Financial SAVs up to an aggregate amount equal to the Merck SAV Program Costs (at which point, such SAVs shall cease to be Financial SAVs) in accordance with Exhibit E.
9.3 Exercise of Merck Participation Election.

(a) Participation Election Payment.

(i) If Merck exercises the Merck Participation Election for the PCV Program, then within [***] Business Days after the exercise of the Merck Participation Election for the PCV Program, and receipt of an invoice from Moderna, Merck will pay to Moderna a one-time payment of Two Hundred Fifty Million Dollars (U.S. $250,000,000) (the “PCV Participation Election Payment”), which payment will be non-refundable, non-creditable, not subject to set-off, and not be reduced by any withholding or similar taxes.

(ii) If Merck exercises the Merck Participation Election for a given Joint SAV Program, then within [***] Business Days after the Parties agree to the initial Joint Development Plan and Budget for such Joint SAV Program in accordance with Section 4.3(c)(i), Moderna will send an invoice to Merck, and within [***] Business Days after receipt of such invoice, Merck will pay to Moderna a one-time payment of, as applicable, (i) with respect to the exercise of the Merck Participation Election for the KRAS Program, [***], or (ii) for a Joint SAV Program other than the KRAS Program, (A) if prior to the Merck Participation Election for such Joint SAV Program, Merck has not previously exercised the Merck Participation Election for any Joint SAV Program, [***], (B) if prior to the Merck Participation Election for such Joint SAV Program, Merck has exercised the Merck Participation Election for any Joint SAV Program, [***], or (C) thereafter for any other Joint SAV Program, [***] (each, an “SAV Participation Election Payment”, and together with the PCV Participation Election Payment, each a “Participation Election Payment”), which payment will be non-refundable, non-creditable, not subject to set-off, and not be reduced by any withholding or similar taxes.

(b) Profit & Loss Share. If Merck pays the Participation Election Payment for a given Program, then, subject to [***] and Exhibit E with respect to a Joint SAV Program, the Parties will share in Cash Profits or Losses with respect to Collaboration Products from such Program as follows: Moderna will bear (and be entitled to) fifty percent (50%), and Merck will bear (and be entitled to) fifty percent (50%) (the “Profit & Loss Share”). [***] Procedures for Calendar Quarter reporting of actual results and review and discussion of potential discrepancies, quarterly reconciliation, reasonable forecasting, and other finance and accounting matters, are set forth on Exhibit D, and to the extent not set forth in Exhibit D, will be established by the JSC, subject to Section 2.7(b).

9.4 Payments for In-Licenses. The Parties will make payments for In-Licenses in accordance with Exhibit D, Exhibit E and Exhibit F.

9.5 Payment Terms.

(a) Manner of Payment. All payments to be made by a Party hereunder will be made in U.S. dollars by wire transfer to such bank account as the other Party may designate.

(b) Reports and Payments of Cash Profits or Losses. For as long as payments are due under this Section 9, Merck or Moderna will furnish to the other Party, as applicable, a written report, after the end of each Calendar Quarter, showing the amount of Cash Profits or Losses and each Party’s allocation of the Cash Profits or Losses in accordance with Exhibit D and Exhibit E, and any other payments accrued during such Calendar Quarter.
(c) **Records; Audits.** Each Party will keep, and will cause each of their other Selling Parties, as applicable, to keep adequate books and records of accounting for the purpose of calculating all amounts payable by either Party to the other Party hereunder and ensuring each Party’s compliance hereunder. For the [***] following the end of the Calendar Year to which each will pertain, such books and records of accounting (including those of its Affiliates, as applicable) will be kept at each of their principal place of business. At the request of either Party, the other Party will permit (and procure its Affiliates, to permit) an independent certified public accounting firm of internationally recognized standing selected by the auditing Party and reasonably acceptable to the other Party to have access during normal business hours to such of the records as may be reasonably necessary to verify the accuracy of the payments due hereunder for any Calendar Year ending not more than [***] following the end of any Calendar Year. Such examinations may not be conducted more than [***] in any Calendar Year or be repeated for any Calendar Year. The accounting firm shall disclose to the auditing Party only whether the reports are correct or incorrect and the amount of any discrepancy. No other Confidential Information shall be provided. If such accounting firm correctly identifies a discrepancy made during such period, the appropriate Party shall pay the other Party the amount of the discrepancy within [***] days of the date of delivery of such accounting firm’s written report so correctly concluding, or as otherwise agreed upon by the Parties. The fees charged by such accounting firm shall be paid by the auditing Party, provided that if the underpayment or overcharge exceeds [***], the audited Party shall pay the fees. Upon the expiration of [***] following the end of any Calendar Year, absent willful misconduct or fraud by a Party (its Affiliates, as applicable) the calculation of amounts payable with respect to such Calendar Year shall be binding and conclusive upon the Parties, and the Parties shall be released from any liability or accountability with respect to amounts payable for such Calendar Year. The auditing Party shall treat all financial information subject to review under this Section 9.5(c) in accordance with the confidentiality and non-use provisions of this Agreement, and shall cause its accounting firm to enter into an acceptable confidentiality agreement with the audited Party obligating it to retain all such Confidential Information in confidence pursuant to such confidentiality agreement.

(d) **Taxes.** Subject to Section 9.1 and Section 9.3, a Party may deduct or withhold from any payments due to the other Party amounts for payment of any withholding Tax that is required by Law to be paid to any tax authority with respect to such payments. To the extent that any such amounts are so deducted or withheld, such amounts will be treated for all purposes of this Agreement as having been paid to the other Party. The paying Party will give written notice of its intent to withhold any amounts under this Section 9.5(d) at least [***] days in advance of any payment being made. The paying Party will give proper evidence as to the payment of any such Tax within a reasonable amount of time, but in any event within [***] days of payment. The receiving Party will provide the paying Party all necessary documents and correspondence, and will also use commercially reasonable efforts to provide to the paying Party any other cooperation or assistance on a reasonable basis as may be necessary to enable the paying Party to claim exemption from such deduction or withholding Taxes. The Parties will reasonably cooperate with each other in seeking relief or reduction in the deduction or withholding of any Tax under any double Taxation or other similar treaty or agreement from time to time in force and in seeking to receive a refund of any withholding Tax or to claim a foreign Tax credit.
(e) Currency Exchange. With respect to Net Sales invoiced in U.S. dollars, the Net Sales and the amounts due hereunder will be expressed in U.S. dollars. In the case of sales outside the United States, the rate of exchange to be used in computing the monthly amount of currency equivalent in United States Dollars due a Party shall be made at [***].

(f) Blocked Payments. In the event that, by reason of applicable Law in any country, it becomes impossible or illegal for the paying Party (or any other Selling Party) to transfer, or have transferred on its behalf, payments owed the other Party hereunder, the paying Party will promptly notify the other Party of the conditions preventing such transfer and such payments will be deposited in local currency in the relevant country to the credit of the other Party in a recognized banking institution designated by the other Party or, if none is designated by the other Party within a period of [***] days, in a recognized banking institution selected by the paying Party or another Selling Party, as the case may be, and identified in a written notice given to the other Party.

(g) Interest Due. If any payment due to either Party under this Agreement is overdue (and is not subject to a good faith dispute), then such paying Party will pay interest thereon (before and after any judgment) at an annual rate [***] of the lesser of [***] after payment of such sum became due until payment thereof in full together with such interest.

9.6 Equity Investment. Moderna and Merck will enter into the Equity Agreement as of the Amended Effective Date.

10. LICENSES; EXCLUSIVITY

10.1 Grants to Merck.

(a) Licenses During Internal SAV Program Term and POC Term.

(i) Subject to the terms of this Agreement, solely to the extent Merck conducts any Research activities under a given Internal SAV Program Plan for a Merck Internal SAV Program, during the Internal SAV Program Term for such Merck Internal SAV Program, Moderna, on behalf of itself and its Affiliates, hereby grants to Merck a sublicensable (subject to Section 10.3(a)), worldwide, co-exclusive license (with Moderna and its Affiliates), under the Moderna Technology to perform Research activities under such Internal SAV Program Plan.

(ii) Subject to the terms of this Agreement, solely to the extent Merck has any Research, Development or Manufacturing obligations under a given POC Plan, during the POC Term for such Program, Moderna, on behalf of itself and its Affiliates, hereby grants to Merck a sublicensable (subject to Section 10.3(a)), worldwide, co-exclusive license (with Moderna and its Affiliates), under the Moderna Technology to perform Research or Development under such POC Plan, or to perform such Manufacturing activities set forth in such POC Plan, Supply Agreement, or Exhibit K, or as mutually agreed by the Parties in writing; provided, for clarity, Merck will exercise its rights to Manufacture solely (A) as set forth in the applicable POC Plan, Supply Agreement, or Exhibit K, or as mutually agreed by the Parties in writing or (B) after the occurrence of an event that obligates Moderna to effect a technology transfer to Merck for such POC Plan hereunder.
(b) Licenses in the Event of a Merck Non-Participation. Subject to the terms of this Agreement, in the event a Merck Non-Participation for the PCV Program occurs, then, Moderna, on behalf of itself and its Affiliates, hereby grants to Merck [***].

(c) Licenses Following the Merck Participation Election Date. Subject to the terms of this Agreement, including Sections 10.8, 10.10 and [***], during the Merck Participation Term for a given Program, Moderna, on behalf of itself and its Affiliates, hereby grants to Merck sublicensable (subject to Section 10.3(a)), worldwide licenses, under the Moderna Technology, to:

   (i) Research mRNA Cancer Vaccines for such Program, only under and in accordance with any applicable Additional Research Plan for such Program; provided, however, that [***];

   (ii) Develop Collaboration Products from such Program, under and in accordance with any applicable Joint Development Plan and Budget for such Program or Independent Additional Study Development Plan for such Program;

   (iii) Commercialize Collaboration Products from such Program in the Territory; and

   (iv) subject to Section 10.1(c), Manufacture Collaboration Products from such Program; provided, for clarity, Merck will exercise its rights to Manufacture any Collaboration Product solely [***];

Subject to Section 10.1(e), the licenses set forth in clauses (i), (ii) and (iv) will be co-exclusive (with Moderna and its Affiliates), and the license set forth in clause (iii) will be exclusive (even as to Moderna and its Affiliates but subject to Sections 8.5 and 8.6).

(d) Additional Licenses. Subject to the terms of this Agreement (including Section 3.1(d), 10.8, 10.10 and [***] and without limiting Section 10.1(b)), Moderna, on behalf of itself and its Affiliates, hereby grants to Merck, [***]:

   (i) under [***]

   (ii) under [***]

   (iii) under [***].

(e) Retained Rights; Limitations. Notwithstanding the co-exclusive or exclusive licenses set forth in Section 10.1(a) or Section 10.1(c), Moderna retains rights under the Moderna Technology to perform and to have its Affiliates, Sublicensees and Third Party subcontractors, and Third Party licensees (and Moderna will be responsible for ensuring the performance and compliance by such Third Party licensee with the applicable terms of this Agreement as if such Third Party were “Moderna” hereunder), perform Moderna's assigned obligations and responsibilities and exercise its rights under this Agreement (including any Internal SAV Program Plan, POC Plan, any Additional Research Plan or any Development Plan), any Supply Agreement and any Co-Promotion Agreement, provided Moderna complies with Section 10.4 for any such Third Party subcontractors.
10.2 Grants to Moderna.

(a) Licenses During Internal SAV Program Term and POC Term.

(i) Subject to the terms of this Agreement, solely to the extent Moderna conducts Manufacturing activities in accordance with the supply terms set forth in Exhibit N for a given Merck Internal SAV Program, during the Internal SAV Program Term for such Merck Internal SAV Program, Merck, on behalf of itself and its Affiliates, hereby grants to Moderna a sublicensable (subject to Section 10.3(a)), worldwide, co-exclusive license (with Merck and its Affiliates), under the Merck Technology to perform Manufacturing activities on SAVs in accordance with the terms set forth in Exhibit N for such Merck Internal SAV Program.

(ii) Subject to the terms of this Agreement, solely with respect to Moderna’s Research, Development and Manufacturing activities under a given POC Plan or, to the extent permitted pursuant to Section 3.3(d), during the POC Term for such Program, Merck, on behalf of itself and its Affiliates, hereby grants to Moderna a sublicensable (subject to Section 10.3(b)), worldwide, co-exclusive license (with Merck and its Affiliates), under the Merck Technology, to perform Research, Development and Manufacturing activities under the applicable POC Plan or as otherwise provided by Section 3.3(d).

(b) Licenses in the Event of a Merck Non-Participation. Subject to the terms of this Agreement, in the event a Merck Non-Participation occurs for a given Program [***] then Merck, on behalf of itself and its Affiliates, hereby grants to Moderna [***].

(c) Licenses Following the Merck Participation Election Date. Subject to the terms of this Agreement, including Sections 10.7, 10.10 and [***], during the Merck Participation Term for a given Program, Merck, on behalf of itself and its Affiliates, hereby grants to Moderna a sublicensable (subject to Section 10.3(b)), worldwide licenses, under the Merck Technology, to:

   (i) Research mRNA Cancer Vaccines for such Program, solely under and in accordance with any applicable Additional Research Plan for such Program; provided, however, that [***];

   (ii) Develop Collaboration Products from such Program, under and in accordance with any applicable Joint Development Plan and Budget for such Program or Independent Additional Study Development Plan for such Program; and

   (iii) subject to Sections 6.2 and 6.3, Manufacture Collaboration Products from such Program in accordance with the applicable Supply Agreements.

Subject to Section 10.2(e), the licenses set forth in clauses (i), (ii) and (iii) will be co-exclusive (with Merck and its Affiliates).
(d) Additional Licenses. Subject to the terms of this Agreement (including Section 10.7), Merck, on behalf of itself and its Affiliates, hereby grants to Moderna [***]:

(i) under [***];
(ii) under [***];
(iii) under [***].

(e) Retained Rights; Limitations. Notwithstanding the co-exclusive licenses set forth in Section 10.2(a) or Section 10.2(c), Merck retains rights under the Merck Technology to perform and to have its Affiliates, Sublicensees and Third Party subcontractors, and Third Party licensees (and Merck will be responsible for ensuring the performance and compliance by such Third Party licensee with the applicable terms of this Agreement as if such Third Party were “Merck” hereunder), perform Merck’s assigned obligations and responsibilities and exercise its rights under this Agreement (including any Internal SAV Program Plan, POC Plan, any Additional Research Plan or any Development Plan) or any Supply Agreement, provided Merck complies with Section 10.4 for any such Third Party subcontractors.

10.3 Sublicensing.

(a) Merck Sublicensing. Merck may grant sublicenses under any of the licenses granted to Merck by Moderna under Section 10.1 or to the Rights of Reference granted under this Agreement (1) to one or more Affiliates (with the right to sublicense through multiple tiers in accordance with this Agreement) without requiring Moderna’s prior written consent, (2) to one or more Third Party subcontractors (in accordance with Section 10.4) of Merck (or its Affiliate) to perform the subcontracted activities, [***]; provided that[***], the grant of any such sublicense to an Affiliate or Third Party shall not relieve Merck of its obligations under this Agreement, and Merck will be responsible for ensuring the performance and compliance by such Affiliate or Third Party with the applicable terms this Agreement as if such Affiliate or Third Party were “Merck” and any [***] as if such Affiliate or Third Party were “Merck”, in each case, to the extent applicable to such Sublicensee; provided, further, that, as a condition precedent to and requirement of any such sublicense to a Third Party under the foregoing clauses [***]:

(i) such sublicense is set forth in a written agreement;
(ii) Merck will provide Moderna with a copy of any such sublicense agreement and each material amendment thereto within [***] days of execution thereof, which may be redacted as necessary to protect confidential information and other commercially sensitive information; and
(iii) such sublicense agreement shall be consistent with and subject to the applicable terms and conditions of this Agreement.

(b) Moderna Sublicensing. Moderna may grant sublicenses under any of the licenses granted to Moderna by Merck under Section 10.2 or Section 10.10 or to the Rights of Reference granted under this Agreement (1) to one or more Affiliates (with the right to sublicense through multiple tiers in accordance with this Agreement) without requiring Merck’s
prior written consent, (2) to one or more Third Party subcontractors (in accordance with Section 10.4) of Moderna (or its Affiliate) to perform the subcontracted activities, [***]; provided that, [***], the grant of any such sublicense to an Affiliate or Third Party shall not relieve Moderna of its obligations under this Agreement, and Moderna will be responsible for ensuring the performance and compliance by such Affiliate or Third Party with the applicable terms this Agreement as if such Affiliate or Third Party were “Moderna” and any included Merck In-License as if such Affiliate or Third Party were “Moderna”, in each case, to the extent applicable to such Sublicensee; provided, further, that, as a condition precedent to and requirement of any such sublicense to a Third Party under the foregoing clauses [***]:

(i) such sublicense is set forth in a written agreement;

(ii) Moderna will provide Merck with a copy of any such sublicense agreement and each material amendment thereto within [***] days of execution thereof, which may be redacted as necessary to protect confidential information and other commercially sensitive information; and

(iii) such sublicense agreement shall be consistent with and subject to the applicable terms and conditions of this Agreement.

10.4 Subcontractors. Each Party may subcontract any of its Research, Development or Manufacturing activities to be performed hereunder to an Affiliate or, solely with the prior written consent of the other Party (such consent not to be unreasonably withheld), to a Third Party; provided, however, that in all cases, such Party shall ensure that any such Third Party permitted subcontractor will have entered into a written agreement with such Party that includes terms and conditions protecting and limiting use and disclosure of Confidential Information and Know-How at least to the same extent as under this Agreement, and such Party shall require any such Affiliate or Third Party and its personnel to assign to such Party all right, title and interest in and to any Patents or Know-How created, conceived or discovered in connection with the performance of any subcontracted activities; provided, however, that a Party shall be entitled to [***]. Notwithstanding the foregoing, each Party shall be permitted to (x) utilize Third Party permitted subcontractors that are identified on Exhibit L-1 with respect to such Party, which exhibit lists the identity of the applicable Third Party subcontractor and a description of the activities that such Third Party subcontractor is authorized to perform hereunder and also with respect to Merck any other Manufacturing Subcontractor, and (y) subcontract or otherwise agree to perform any Development activities to be performed under an Independent Additional Study Development Plan to any Third Party, in each case, without requiring the prior written consent of the other Party, subject to Section 10.12 and also allowing for customary and reasonable provisions for the treatment of sharing of resulting data and the performance of the Independent Additional Study (other than to any Third Party that is a direct competitor in the mRNA therapeutic/vaccine field (for example, as of the Amended Effective Date, the Third Parties listed on Exhibit L-2), which subcontract will require such other Party’s prior written consent, such consent not to be unreasonably withheld, conditioned or delayed) and (z) Merck may subcontract any of its Commercialization activities to be performed hereunder to (1) an Affiliate or (2) a Third Party. Each Party shall oversee the performance by any of its Affiliate or Third Party permitted subcontractors, and shall remain responsible and primarily liable for the performance of such activities in accordance with this Agreement. Each Party hereby expressly waives any requirement that the other Party exhaust any right, power or remedy, or proceed against any subcontractor for any obligation or performance hereunder, prior to proceeding directly against the Party engaging the subcontractor.
10.5 Section 365(n) of the Bankruptcy Code. All rights and licenses granted under or pursuant to any section of this Agreement, are, and will be deemed to be for all purposes of Section 365(n) of Title 11 of the United States Code and of any similar provisions of applicable Laws under any other jurisdiction (the “Bankruptcy Code”), rights and licenses to “intellectual property” (as defined in Section 101(35A) of the Bankruptcy Code). Each Party agrees that the other Party, as a licensee of rights and licenses under this Agreement, will retain and may fully exercise all of its rights and elections under the Bankruptcy Code. The Parties further agree that, in the event of the commencement of a bankruptcy proceeding by or against a Party under the Bankruptcy Code or analogous provisions of applicable Law outside the U.S., the other Party will be entitled to a complete duplicate of, or complete access to (as appropriate), any intellectual property licensed to such other Party held by such first Party and its successors and assigns (including all embodiments thereof), which, if not already in such other Party’s possession, will be promptly delivered to it (a) upon any such commencement of a bankruptcy proceeding upon such other Party’s written request therefor, unless such first Party elects to continue to perform all of its obligations under this Agreement, or (b) if not delivered under clause (a), following the rejection of this Agreement by such first Party in the bankruptcy proceeding upon written request therefor by such other Party.

10.6 Third Party In-Licenses. The terms and conditions for the inclusion and treatment under the Collaboration of Patents and Know-How in-licensed by a Party pursuant to Third Party In-Licenses are set forth on Exhibit F.

10.7 Moderna Exclusivity.

(a) [***]

(i) [***]

(ii) [***]

(b) mRNA-PCV Field.

(i) During the POC Term for the PCV Program, Moderna will not, [***].

(ii) During the Merck Participation Term for the PCV Program, Moderna will not, [***].

(c) SAV Research Term Exclusivity. During the SAV Research Term, Moderna will not, [***].

(d) [***] Exclusivity.
On a Joint SAV Program-by-Joint SAV Program basis, during the POC Term for such Joint SAV Program, [***].

During the Merck Participation Term for such Joint SAV Program, [***].

During the POC Term and any Merck Participation Term (as applicable) [***].

(e) Exception for Business Combination.

(i) Notwithstanding Sections [***], if a Business Combination occurs with respect to Moderna or its parent Affiliate with a Third Party, and the Third Party (or any of such Third Party’s Affiliates or any successors or assigns of such Third Party or such Third Party’s Affiliates, other than Moderna and its Affiliates as of the Business Combination) has as of the Business Combination, or later has, a program (or rights thereto) that would otherwise violate any of [***] “Moderna Business Combination Program”), then [***]; provided that [***]. In addition, upon any such Business Combination of Moderna or its parent Affiliate, the following shall apply:

1. At Merck’s written election within [***] after the closing date of such Business Combination of Moderna or its parent Affiliate, [***];

2. If, within the period from [***] after the closing of such Business Combination until [***] of such closing, [***].

(ii) In addition to the other provisions of this Section 10.7(e), Merck shall have the right to [***].

(iii) In addition, notwithstanding [***], if (A) Moderna or its Affiliate acquires a Third Party (by merger, consolidation or otherwise) so that such Third Party becomes an Affiliate over which Moderna or its Affiliate has control (as defined in Section 1.13), or (B) Moderna or its Affiliate acquires all or substantially all of the assets of a Third Party (including any subsidiaries or divisions thereof) (each of (A) and (B), a “Moderna Acquisition”), and, in each case, the Third Party (or any of such Third Party’s Affiliates or any successors or assigns of such Third Party or such Third Party’s Affiliates, other than Moderna and its Affiliates as of the Moderna Acquisition) already has, or the acquired assets contain, as applicable, a program that existed prior to, or was substantially in the process of being implemented prior to such Moderna Acquisition and is in fact implemented shortly after such Moderna Acquisition, the Moderna Acquisition that would otherwise violate any of [***] (a “Moderna Acquisition Program”), then Moderna or such Affiliate will, within thirty (30) days after the closing of such Moderna Acquisition, provide written notice to Merck that Moderna or such Affiliates has rights to a Moderna Acquisition Program as a result of a Moderna Acquisition, which written notice will [***]. Alternatively, [***].
10.8 Merck Exclusivity.

(a) mRNA-PCV Field.

(i) During the POC Term for the PCV Program, Merck will not, [***].

(ii) During the Merck Participation Term for the PCV Program, Merck will not, [***].

(b) SAV Research Term Exclusivity. During the SAV Research Term, [***].

(c) [***] Exclusivity.

(i) [***], during the POC Term for such Joint SAV Program, [***].

(ii) [***], during the Merck Participation Term for such Joint SAV Program, [***].

(iii) [***], during the POC Term and any Merck Participation Term (as applicable), [***].

(iv) [***]

(d) Exception for Business Combination.

(i) Notwithstanding Section [***], if (i) a Business Combination occurs with respect to Merck or its Affiliate with a Third Party, and the Third Party (or any of such Third Party’s Affiliates or any successors or assigns of such Third Party or such Third Party’s Affiliates, other than Merck and its Affiliates as of the Business Combination) has as of the Business Combination, or later has, a program (or rights thereto) that would otherwise violate any of [***] (each, a “Merck Business Combination Program”), then [***]; provided that [***].
(ii) In addition, notwithstanding Section [***], if (A) Merck or its Affiliate acquires a Third Party (by merger, consolidation or otherwise) so that such Third Party becomes an Affiliate over which Merck or its Affiliate has control (as defined in Section 1.12), or (B) Merck or its Affiliate acquires all or substantially all of the assets of a Third Party (including any subsidiaries or divisions thereof) (each of (A) and (B), a “Merck Acquisition”), and, in each case, the Third Party (or any of such Third Party’s Affiliates or any successors or assigns of such Third Party or such Third Party’s Affiliates, other than Merck and its Affiliates as of the Merck Acquisition) already has, or the acquired assets contain, as applicable, a program that existed prior to, or was substantially in the process of being implemented prior to such Merck Acquisition and is in fact implemented shortly after such Merck Acquisition, the Merck Acquisition that would otherwise violate any of [***] (a “Merck Acquisition Program”), then Merck or such Affiliate will, within thirty (30) days after the closing of such Merck Acquisition, provide written notice to Moderna that Merck or such Affiliates has rights to a Merck Acquisition Program as a result of a Merck Acquisition, which written notice will [***]. Alternatively, [***].

(e) Non-Restricted Activities.

(i) The Parties hereby acknowledge and agree that Merck’s obligations under [***] will not apply to any Research, Development, Manufacture or Commercialization of [***]; provided that Merck will ensure that during the Collaboration Term for the PCV Program, [***].

(ii) The Parties hereby acknowledge and agree that Merck’s obligations under [***] will not apply to any of Merck’s or its Affiliates’ (1) internal Research activities, (2) Research activities with academic collaborators or non-profit institutions, or (3) Non-Commercial Combination Activities, in each case ((1)-(3)) that [***]; provided that, in each case ((1)-(3)), Merck will ensure that during the Collaboration Term for a given SAV Program, (A) [***], (B) Moderna Confidential Information is [***], (C) Moderna Background Technology is [***], and (D) the licenses granted under Section 10.1(d) shall not be used in the conduct of the above-referenced activities relating [***].

10.9 No Grant of Inconsistent Rights. Neither Party nor its Affiliates shall assign, transfer, convey or otherwise grant to any Person or otherwise encumber (including through lien, charge, security interest, mortgage, encumbrance or otherwise, but excluding liens in connection with financings) any rights to any Moderna Technology or Merck Technology (or any rights to any intellectual property that would otherwise be included in the Moderna Technology or Merck Technology), as applicable, in any manner that is inconsistent with or would interfere with the grant of the rights or licenses to Merck or Moderna hereunder. For the avoidance of doubt, the Parties understand and agree that the Merck Participation Election right for a given Program, as described herein, shall be [***].

10.10 Merck Cessation of Collaboration Activities. Notwithstanding anything to the contrary set forth herein, on a Program-by-Program basis, at any time during the Merck Participation Term for a given Program, Merck shall have the right, but not the obligation, to elect to cease performance of activities under the Collaboration with respect to such Program upon delivery of [***] prior written notice to Moderna (each, a “Merck Cessation Election”). Each Merck Cessation Election for a given Program shall clearly identify [***]. Subject to the terms of this Agreement, upon the exercise of a Merck Cessation Election for a given Program, the following shall apply:
(a) The Merck Participation Term, the Collaboration Term and the Collaboration for such Program shall terminate, and all Collaboration Products from such Program then in existence will be treated thereafter as “PCVs” or “SAVs”, as applicable, under this Agreement (other than [***]). Merck shall no longer have any licenses or other rights under this Agreement (without limiting the license grants in Section 10.1(d)) to Research, Develop, Manufacture and Commercialize Collaboration Products from such Program under this Agreement. [***]

(b) Merck will prepare and provide to Moderna a draft plan for the transition of Collaboration Activities with respect to such Program from Merck to Moderna (a “Cessation Transition Plan”), which Cessation Transition Plan will be reviewed and approved by the Parties. Each Party will use Commercially Reasonable Efforts to perform the obligations assigned to it under the Cessation Transition Plan in accordance with the timelines set forth therein.

(c) The license grants to Merck under Section 10.1(b) with respect to such Program shall terminate. Each sublicense granted by Merck to any rights licensed to it under Section 10.1(c) with respect to such Program shall terminate. The license grants set forth in Section 10.1(d) shall continue in full force and effect.

(d) The license grants to Moderna under Section 10.2(c) with respect to such Program shall terminate, and each sublicense granted by Moderna to any rights licensed under Section 10.2(c) shall terminate. Effective as of the date of the Merck Cessation Election for such Program, Merck shall grant, and hereby does grant (without any further action on the part of either Party), on behalf of itself and its Affiliates, to Moderna a sublicensable (subject to Section 10.3(b)), worldwide, perpetual, irrevocable exclusive license under the Merck Technology, to Research, Develop, Manufacture and Commercialize the Collaboration Products from such Program in the Territory, and the license grants set forth in Section 10.2(d) shall continue in full force and effect.

(e) In the event of a Merck Cessation Election for the PCV Program, the exclusivity provisions in Sections [***] shall terminate for the PCV Program.

(f) In the event of a Merck Cessation Election for a given Joint SAV Program, then the exclusivity provisions in Sections [***] shall terminate with respect to such Joint SAV Program.

(g) At Moderna’s election, Merck will responsibly wind-down, in accordance with accepted pharmaceutical industry norms and ethical practices, any on-going Clinical Studies with respect to Collaboration Products from such Program then in existence in [***] or, if requested by Moderna, Merck will transfer responsibility for any such Clinical Study to Moderna, in each case in accordance with the Cessation Transition Plan. Merck will be responsible for payment of any costs associated with such wind-down or transfer. [***].
(h) As promptly as practicable after the date of the Merck Cessation Election for a given Program, Merck and its Affiliates shall, to the extent Merck and its Affiliates have the right to do so under applicable Law, assign and transfer to Moderna or Moderna’s designee possession and ownership of all material Regulatory Filings, Regulatory Approvals, all final pre-clinical and Clinical Study reports and clinical study protocols, and all data, including non-clinical and Clinical Data, in each case, in Merck’s possession and Control and to the extent solely related to Collaboration Products from such Program then in existence. All data and other information shall be transferred in the form and format in which it is maintained by Merck or its Affiliate. Original paper copies shall only be transferred, if required by applicable Law. Merck and its Affiliates shall not be required to [***]. At Merck’s election, for such Program, Merck shall either [***]. In the event of failure to obtain assignment of any of the items required to be assigned under this Section 10.10(h), Merck hereby consents and grants to Moderna or its designee the right to access and reference (without any further action required on the part of Merck, whose authorization to file this consent with any Regulatory Authority is hereby granted) any such item to the extent solely related to Collaboration Products from such Program.

(i) Subject to the terms of the applicable Cessation Transition Plan, Merck and its Affiliates shall [***].

(j) Merck will promptly transfer and assign to Moderna all of Merck’s and its Affiliates’ rights, title and interests in and to the trademark(s) solely used to identify the Collaboration Products from such Program then in existence (but not any house marks, or logos or any trademark of Merck or its Affiliates, containing the word “Merck” or any such Affiliate) owned by Merck and used for the Collaboration Products from such Program then in existence.

(k) Subject to the applicable Cessation Transition Plan, Merck will transfer to Moderna any finished goods inventory of Collaboration Products from such Program then in existence Controlled by Merck or its Selling Parties as of the date of the Merck Cessation Election for such Program (if any) at cost for such supply. [***][***]

(l) For any Collaboration Product from such Program then being Developed in a Clinical Study pursuant to this Agreement in combination with [***] or any Merck Agent that is commercially available:

(i) Merck will grant to Moderna a Right of Reference [***] to continue the Development of such Collaboration Products from such Program in combination with [***] or such Merck Agent (as applicable) under appropriate Regulatory Filings or Regulatory Approvals.

(ii) Merck shall supply [***] or such Merck Agent (as applicable) to Moderna in accordance with Exhibit K for further Clinical Studies of such Collaboration Products from such Program in combination with [***] or such Merck Agent until Regulatory Approval for such Collaboration Product, but in any event [***]. Moderna shall provide Merck with a copy of any data generated from any such Clinical Study for Merck’s use in connection with [***] or such Merck Agent, and in all cases, if Moderna is conducting a Clinical Study involving [***], the provisions of Section 3.4(m) shall apply mutatis mutandis.

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(m) The Parties’ rights and obligations under [***] shall terminate in full with respect to such Program and the Collaboration Products thereunder (provided that for clarity, this Agreement shall remain in full force and effect for all other Programs and Collaboration Products). [***]. In addition, on a Program-by-Program basis, if, as of the date of the Merck Cessation Election for such Program, a Party is granting a sublicense to the other Party under an Included In-License for such Program, and such sublicense under such Included In-License survives the Merck Cessation Election for such Program pursuant to this Section 10.10, then, (i) the Party receiving such sublicense under such Included In-License shall [***] and (ii) such Party’s rights under such Included In-License will be subject to the terms of such Included In-License; provided that in each case of (i) and (ii), the licensor Party promptly informs the other Party of any [***].

(n) [***]

10.11 [***].

(a) [***]

(b) [***]

10.12 Exclusion of Agent Intellectual Property.

(a) Notwithstanding any other provision of this Agreement, “Moderna Background Know-How”, “Moderna Background Patents”, “Merck Background Know-How” and “Merck Background Patents” shall not include any Know-How, Patents or other rights, and no licenses shall or are granted hereunder, with respect to [***] or any Moderna Agent, Merck Agent or Third Party Agent, including any Agent Technology, other than [***].

(b) Further, notwithstanding Sections 11.2 through 11.4, [***].

10.13 Supply and Use of Materials; Cooperation. At the reasonable request of the other Party, a Party will supply the other Party Materials Controlled by such Party for Research consistent with and in furtherance of the POC Plan, Joint Development Plan and Budget or Additional Research Plan for a given Program, as applicable. Each Party will use any Materials provided by the other Party hereunder only in accordance with the POC Plan, Joint Development Plan and Budget or Additional Research Plan for the applicable Program, and otherwise in accordance with the terms and conditions of this Agreement (including for clarity in connection with activities conducted by the Parties during the Merck Participation Election Period for a given Program in connection with the Research, Development, Manufacture or Commercialization of the Collaboration Products from such Program), the use limitations agreed to by the Parties and any reasonable instructions provided by the Party furnishing the Materials. Except with the prior written consent of the supplying Party (such consent not to be unreasonably withheld, delayed or conditioned), the Party receiving any Materials will not distribute or otherwise allow the release of such Materials to any Third Party, except for subcontracting as permitted hereunder or otherwise in connection with the Research, Manufacture, Development and Commercialization of Collaboration Products by the Parties hereunder, to the extent consistent with the use limitations agreed to by the Parties. All Materials delivered to the receiving Party will be used in compliance with all applicable Law. The
Materials supplied under this Agreement will be used with prudence and appropriate caution in any experimental work because not all of their characteristics may be known. The receiving Party shall not reverse engineer, reverse compile, disassemble or otherwise attempt to derive the composition or underlying information, structure or ideas of the provider’s Materials, and in particular shall not analyze the provider’s Materials by physical, chemical or biochemical means except as necessary to perform its obligations under this Agreement.

11. OWNERSHIP OF TECHNOLOGY

11.1 Disclosure. Subject to Section 6.1(e), each Party will promptly disclose to the other Party in writing, and will cause its Affiliates and subcontractors to so disclose, the conception, creation or discovery of any Collaboration Know-How.

11.2 Ownership of Moderna Agent Technology[***]. Subject to the license grants to Merck under this Agreement, as between the Parties, Moderna will own and retain all right, title and interest in and to all (a) improvements, modifications, developments, enhancements and inventions arising in the performance of activities hereunder from the use of, and specifically relating to, any Moderna Agent or their use (collectively “Moderna Agent Technology”), [***] conceived, created or discovered during the performance of Collaboration Activities. Accordingly, Merck will promptly disclose to Moderna in writing, the conception, creation, or the discovery, of any Moderna Agent Technology, [***] by or on behalf of Merck or its Affiliates. Merck, for itself and on behalf of its Affiliates, hereby assigns (and to the extent such assignment can only be made in the future hereby agrees to assign) to Moderna all its right, title and interest in and to any Moderna Agent Technology, [***]. Merck will cooperate, and will cause the foregoing persons and entities to cooperate, with Moderna to effectuate and perfect the foregoing ownership, including by promptly executing and recording assignments and other documents consistent with such ownership.

11.3 Ownership of Merck Agent Technology [***]. Subject to the license grants to Moderna under this Agreement, as between the Parties, Merck will own and retain all right, title and interest in and to all (a) improvements, modifications, developments, enhancements and inventions arising in the performance of activities hereunder from the use of, and specifically relating to, Keytruda or any Merck Agent or their use (collectively, “Merck Agent Technology”) [***] conceived, created or discovered during the performance of Collaboration Activities. Accordingly, Moderna will promptly disclose to Merck in writing, the conception, creation or discovery of any Merck Agent Technology [***] by or on behalf of Moderna or its Affiliates. Moderna, for itself and on behalf of its Affiliates, hereby assigns (and to the extent such assignment can only be made in the future hereby agrees to assign), to Merck all its right, title and interest in and to any Merck Agent Technology [***]. Moderna will cooperate, and will cause the foregoing persons and entities to cooperate, with Merck to effectuate and perfect the foregoing ownership, including by promptly executing and recording assignments and other documents consistent with such ownership.

11.4 Ownership of [***]; Joint Technology. Subject to the license grants by one Party to the other under this Agreement, as between the Parties, all [***] conceived, created or discovered, by or on behalf of either Party or its Affiliates either alone or jointly with Third Party(ies), or by the Parties or their Affiliates jointly under or in connection with this Agreement,
whether or not conceived, created or discovered at a facility owned or controlled by such Party and whether or not patented or patentable (including any and all Patents and other intellectual property rights with respect thereto), will be owned in accordance with inventorship and in accordance with applicable Law in the United States. For the avoidance of doubt, subject to Section 11.6, and to the license grants in this Agreement, the Parties will each own an equal, undivided interest in any and all Joint Technology. Each Party will, and does hereby, assign, and will cause its Affiliates and subcontractors to so assign, to the other Party, without additional compensation, such right, title and interest in and to any Joint Technology as well as any intellectual property rights with respect thereto, as is necessary to fully effect the joint ownership provided for in the foregoing sentence of this Section 11.4.

11.5 United States Law. The determination of whether Know-How and Patents are conceived, created or discovered by a Party for the purpose of allocating proprietary rights (including Patent, copyright or other intellectual property rights) therein, in accordance with Section 11.4, will, for purposes of this Agreement, be made in accordance with applicable Law in the United States. In the event that United States Law does not apply to the conception, creation or discovery of any Know-How or Patents hereunder, each Party will, and does hereby, assign, and will cause its Affiliates to so assign, to the other Party, without additional compensation, such right, title and interest in and to any Know-How and Patents as well as any intellectual property rights with respect thereto, as is necessary to fully effect ownership as would have been determined under U.S. Law.

11.6 Exploitation of Joint Technology. Each Party will exercise its ownership rights in and to the Joint Technology, including the right to license and sublicense or otherwise to exploit, transfer or encumber its ownership interest, without an accounting or obligation to, or consent required from, the other Party, but subject to Section 12 and the license grants under this Agreement. At the reasonable written request of a Party, the other Party will in writing grant such consents and confirm that no such accounting is required to effect the foregoing regarding Joint Technology.

11.7 No Implied Rights. No license, sublicense or other right is or will be created or granted hereunder by implication, estoppel or otherwise. Any licenses, sublicenses or rights will be granted only as expressly provided in this Agreement. Neither Party nor any of its Affiliates will use or practice any Know-How or Patents licensed or provided to such Party or any of its Affiliates outside the scope of or otherwise not in compliance with the rights and licenses granted to such Party and its Affiliates under this Agreement.

11.8 Patent Prosecution, Maintenance and Enforcement. Provisions regarding the Prosecution and Maintenance of Patents, and enforcement of Patents, are set forth in Exhibit J.

12. CONFIDENTIALITY

12.1 Confidential Information.

(a) Confidential Information. Each Party (“Disclosing Party”) may have disclosed or will disclose to the other Party (“Receiving Party”), and Receiving Party may acquire during the course and conduct of activities under this Agreement, certain proprietary or confidential information of Disclosing Party. The term “Confidential Information” means (i) all
proprietary tangible samples of, and confidential information about, Materials and (ii) all confidential ideas and information of any kind, whether in written, oral, graphical, machine-readable or other form, whether or not marked as confidential or proprietary, which are transferred, disclosed or made available to Receiving Party by Disclosing Party or at the request of Receiving Party. Without limiting the foregoing, all confidential information about (1) the Moderna Technology will be considered Confidential Information of Moderna, (2) the Merck Technology will be considered Confidential Information of Merck, (3) Joint Technology will be treated as Confidential Information of both Parties, and (4) the Collaboration Products from a given Program will be treated as Confidential Information of both Parties during the Collaboration Term for such Program. For the avoidance of doubt, the restrictions and limitations set forth in this Section 12 shall not limit any other restrictions or limitations set forth herein with respect to the use and disclosure of information.

(b) Restrictions. During the Term and for [***] thereafter, Receiving Party will, and will cause its Affiliates and their respective officers, directors, employees and agents to, keep all Disclosing Party’s Confidential Information in confidence with the same degree of care with which Receiving Party holds its own confidential information (though no less than reasonable care). Receiving Party will not use, and will cause its Affiliates and their respective officers, directors, employees and agents not to use, Disclosing Party’s Confidential Information except for in connection with the performance of its obligations and exercise of its rights under this Agreement. Subject to the terms of this Agreement, Receiving Party has the right to disclose Disclosing Party’s Confidential Information without Disclosing Party’s prior written consent, to the extent and only to the extent reasonably necessary or useful, to Receiving Party’s Affiliates and their employees, subcontractors, Sublicensees, consultants or agents who have a need to know such Confidential Information in order to perform its obligations and exercise its rights under this Agreement and who are required to comply with restrictions on use and disclosure similarly restrictive as those in this Section 12.1(b). Receiving Party will use [***] to cause those entities and persons to comply with such restrictions on use and disclosure. Notwithstanding the foregoing sentence, Receiving Party assumes responsibility for those entities and persons maintaining Disclosing Party’s Confidential Information in confidence and using same only for the purposes described herein.

(c) Exceptions. Receiving Party’s obligation of nondisclosure and the limitations upon the right to use the Disclosing Party’s Confidential Information set forth in Section 12.1(b) will not apply to the extent that Receiving Party can demonstrate that the Disclosing Party’s Confidential Information: (i) was known to Receiving Party or any of its Affiliates prior to the time of disclosure; (ii) is or becomes public knowledge through no fault or omission of Receiving Party or any of its Affiliates; (iii) is obtained by Receiving Party or any of its Affiliates from a Third Party under no obligation of confidentiality to Disclosing Party; or (iv) has been independently developed by employees, subcontractors, consultants or agents of Receiving Party or any of its Affiliates without the aid, application or use of Disclosing Party’s Confidential Information, as evidenced by contemporaneous written records. Notwithstanding the foregoing, (A) any Confidential Information will not be deemed to be within the foregoing exceptions merely because such information is embraced by more general information in the public domain or in the possession of the Receiving Party or any of its Affiliates, and (B) any combination of features will not be deemed to be within the foregoing exceptions merely because individual features are in the public domain or in the possession of the Receiving Party or any of its Affiliates, but only if the combination itself and its principle of operation are in the public domain or in the possession of the Receiving Party or any of its Affiliates.
(d) Permitted Disclosures. Receiving Party may disclose Disclosing Party’s Confidential Information to the extent (and only to the extent) such disclosure is reasonably necessary in the following instances:

(i) in order to comply with applicable Law or with a legal or administrative proceeding;

(ii) in connection with (a) prosecuting or defending litigation or (b) the Prosecution and Maintenance of Patents in accordance with this Agreement;

(iii) in connection with exercising any rights or other licenses under this Agreement, including [***];

(iv) in the case of Merck, [***]; and

(v) in the case of Moderna, [***].

In the case of a disclosure pursuant to (A) Sections [***], where reasonably possible, Receiving Party will notify Disclosing Party of Receiving Party’s intent to make any disclosure pursuant thereto sufficiently prior to making such disclosure [***], and (B) with respect to [***], each of those named people and entities are required to comply [***], the Receiving Party assumes responsibility for those entities and persons maintaining Disclosing Party’s Confidential Information in confidence and using same only for the purposes described herein.

12.2 Publications. The Parties may desire to publish in scientific journals and present at scientific conferences the results of the Collaboration Activities, subject to the following process. Notwithstanding anything to the contrary herein, either Party may propose publication of the results of the Collaboration Activities following scientific review by the JSC (if in force); provided, that no such publication will be made without written approval by Moderna and Merck. After receipt of the proposed publication by both Merck and Moderna, such written approval or disapproval will be provided within [***] days. Both Parties understand that a reasonable commercial strategy may require delay of publication of information or filing of Patent applications, therefore the Parties agree to review and consider delay of publication and filing of patent applications under certain circumstances for a reasonably limited period of time. Once publications have been reviewed by each Party and have been approved for publication, the same publications do not have to be provided again to the other Party for review for a later submission for publication. Expedited reviews for abstracts or poster presentations may be arranged if mutually agreeable to the Parties. Each Party will acknowledge the other Party’s technical, non-financial contributions in any such publication.
12.3 Terms of this Agreement; Publicity.

(a) Restrictions. The Parties agree that the terms of this Agreement and the Equity Agreement will be treated as Confidential Information of both Parties, and thus may be disclosed only as permitted by Section 12.1(d). Each Party will also be permitted to disclose the terms of this Agreement and any Supply Agreement (including the exhibits hereto and thereto), in each case under appropriate confidentiality provisions, on a need to know basis, to a Party’s (and its Affiliates’) existing investors and equity holders and to [***], provided that (1) the disclosing Party agrees to redact information that it reasonably believes is not relevant to the proposed transaction, and (2) [***]. Except as required by applicable Law, each Party agrees not to issue any press release or public statement disclosing information relating to this Agreement, the transactions contemplated hereby or any of the terms hereof without the prior written consent of the other Party (such consent not to be unreasonably withheld, delayed or conditioned), or as such consent may be obtained in accordance with Section 12.1(c), or as permitted by Section 12.1(d).

(b) Securities Filings; Law. Each Party acknowledges and agrees that the other Party may submit this Agreement (including for clarity, the Exhibits and Schedules hereto) to the United States Securities and Exchange Commission (the “SEC”) or any other securities exchange and if a Party does submit this Agreement to the SEC or any other securities exchange, such Party agrees to consult with the other Party with respect to the preparation and submission of, a confidential treatment request for this Agreement. If a Party is required by applicable Law to make a disclosure of the terms of this Agreement in a filing with or other submission to the SEC or any other securities exchange or otherwise to comply with Law, and (i) such Party has provided copies of the disclosure to the other Party as far in advance of such filing or other disclosure as is reasonably practicable under the circumstances, (ii) such Party has promptly notified the other Party in writing of such requirement and any respective timing constraints, and (iii) such Party has given the other Party a reasonable amount of time under the circumstances from the date of notice by such Party of the required disclosure to comment upon, request confidential treatment or approve such disclosure, then such Party will have the right to make such public disclosure at the time and in the manner reasonably determined by its counsel to be required by Law. [***]

(c) Press Releases. Neither Party may issue any press release or make any other public announcement or statement concerning this Agreement, the transactions contemplated hereby or the terms hereof, without the prior written approval of the other Party, except as may be required by applicable Law. In the event either Party (the “Issuing Party”) desires to issue a press release or other public statement disclosing information relating to this Agreement, the transactions contemplated hereby or the terms hereof, the Issuing Party will provide the other Party (the “Reviewing Party”) with a copy of the proposed press release or public statement (the “Release”) and seek the Reviewing Party’s prior written consent; provided that no such consent shall be required for press releases or other public statements required by Law (but the Issuing Party shall still provide the Reviewing Party with a copy of the Release for comment in accordance with this Section 12.3(c)). The Issuing Party will specify with each such Release, taking into account the urgency of the matter being disclosed, a reasonable period of time within which the Receiving Party may provide any comments on such Release and if the Receiving Party fails to provide any comments during the response period called for by the Issuing Party, the Reviewing Party will be deemed to have not consented to the issuance of such Release. If the Receiving Party provides any comments, the Parties will consult on such Release and work in good faith to prepare a mutually acceptable Release. Either Party may subsequently publicly disclose any information previously contained in any Release so consented to.
(d) Joint Press Release. The Parties agree to issue the joint press release in Exhibit I promptly following Antitrust Clearance Date; provided that (i) if either Party reasonably believes that there should be revisions to the form of press release in Exhibit I as a result of events or circumstances occurring after the Amended Effective Date but prior to the issuance of such press release, then prior to the issuance of the joint press release, the Parties will work in good faith and mutually agree on revisions to the joint press release in Exhibit I to reflect such events or circumstances and (ii) prior to the issuance of the joint press release in Exhibit I, either Party shall have the right, upon notice to the other Party, to propose revisions to any quotes from such Party’s personnel in the press release set forth in Exhibit I, and the other Party shall not unreasonably withhold consent to such revisions.

13. REPRESENTATIONS AND WARRANTIES; LIMITATIONS OF LIABILITY; INDEMNIFICATION; COVENANTS

13.1 Representations and Warranties of Each Party. Each Party represents and warrants to the other as of the Effective Date and as of the Amended Effective Date that:

(a) Such Party is duly organized, validly existing and in good standing under the laws of the jurisdiction in which it is organized.

(b) Such Party (i) has the legal right and power to enter into this Agreement, to extend the rights granted or to be granted to the other in this Agreement, and to fully perform its obligations hereunder, including to grant the licenses set forth herein, and (ii) has taken all requisite action on its part to authorize the execution and delivery of this Agreement and the performance of its obligations hereunder. This Agreement has been duly executed and delivered on behalf of such Party, and constitutes a legal, valid and binding obligation, enforceable against such Party in accordance with its terms, except as may be limited by bankruptcy, insolvency, reorganization or other laws affecting creditors’ rights generally and by general equitable principles.

(c) Neither such Party nor its Affiliates has been debarred or is subject to debarment. Neither it nor its Affiliates will use in any capacity, in connection with the services to be performed under this Agreement, any person who has been debarred pursuant to Section 306 of the Act, or who is the subject of a conviction described in such section. In addition, neither it nor its Affiliates has used in any capacity, in connection with any Research or Development activities with respect to the mRNA Technology or any Collaboration Product included hereunder carried out prior to the Amended Effective Date, any person who has been debarred or was the subject of a conviction described in Section 306 of the Act. Such Party agrees to inform the other Party in writing immediately if it or any person who is performing services under this Agreement is debarred or is the subject of a conviction described in Section 306 of the Act, or if any action, suit, claim, investigation or legal or administrative proceeding is pending or, to the best of such Party’s or its Affiliates’ Knowledge, is threatened, relating to the debarment or conviction of such Party or any person performing services under this Agreement.

(d) All necessary consents, approvals and authorizations of all governmental authorities and other Persons required to be obtained by such Party to enter into, or perform its obligations under, this Agreement have been obtained.
13.2 Additional Representations of Moderna. Moderna represents and warrants to Merck that as of the Effective Date and the Amended Effective Date; provided, for clarity, that Moderna has made representations and warranties with respect to SAVs solely as of the Amended Effective Date:

(a) there are no actions, judgments or settlements against or owed by Moderna (or any of its Affiliates) and to Moderna’s Knowledge, no threatened claims or litigation relating to the Moderna Background Patents and/or Moderna Background Know-How;

(b) Schedule 1.235 sets forth a true, correct and complete list of Moderna Background Patents and such schedule contains all application numbers and filing dates, registration numbers and dates, jurisdictions and owners.

(c) to Moderna’s Knowledge (i) all Patents within the Moderna Background Patents have been procured or are being procured from the respective patent offices in accordance with applicable Law, and (ii) the issued Patents within the Moderna Background Patents are not invalid or unenforceable, in whole or in part;

(d) it (and its Affiliates) has not prior to the Amended Effective Date (i) assigned, transferred or conveyed its right, title and/or interest in Moderna Background Patents or Moderna Background Know-How, or (ii) otherwise granted any rights to any Third Parties that would, in the case of clauses (i) and/or (ii), conflict with the rights granted to Merck hereunder, and, to Moderna’s Knowledge, there is no unauthorized use, infringement or misappropriation of any Moderna Background Patent or Moderna Background Know-How;

(e) it or its Affiliate is the sole and exclusive owner of the Moderna Background Patents and Moderna Background Know-How, all of which are as of the Amended Effective Date free and clear of any liens, charges and encumbrances (excluding those entered into in the ordinary course of financing its business), and no other Person has as of the Amended Effective Date any claim of ownership whatsoever with respect to the Moderna Background Patents and Moderna Background Know-How;

(f) [***]

(g) [***]

(h) there are no agreements to which Moderna or its Affiliates are a party (including any licenses), granting any licenses or other rights to (or from) Moderna (or any of its Affiliates) relating to the Research, Development, Manufacture and Commercialization of mRNA Cancer Vaccines (including Collaboration Products) as contemplated hereunder; and

(i) [***]

(j) [***]
13.3 Additional Representations of Merck. Merck represents and warrants to Moderna that as of the Effective Date and the Amended Effective Date; provided, for clarity, that Merck has made representations and warranties with respect to SAVs solely as of the Amended Effective Date:

(a) there are no actions, judgments or settlements against or owed by Merck (or any of its Affiliates) and to Merck’s Knowledge, no threatened claims or litigation relating to the Merck Background Patents and/or Merck Background Know-How;

(b) [***]

(c) [***]

(d) there are no agreements to which Merck or its Affiliates are a party (including any licenses), granting any licenses or other rights to (or from) Merck (or any of its Affiliates) relating to the Research, Development, Manufacture or Commercialization of mRNA Cancer Vaccines (including Collaboration Products) as contemplated hereunder.

13.4 Disclaimers. WITHOUT LIMITING THE RESPECTIVE RIGHTS AND OBLIGATIONS OF THE PARTIES EXPRESSLY SET FORTH HEREIN, EACH PARTY SPECIFICALLY DISCLAIMS ANY GUARANTEE THAT THE COLLABORATION ACTIVITIES OR ANY mRNA CANCER VACCINE OR COLLABORATION PRODUCT WILL BE SUCCESSFUL, IN WHOLE OR IN PART. EXCEPT AS OTHERWISE EXPRESSLY PROVIDED IN THIS AGREEMENT OR ANY SUPPLY AGREEMENT, THE PARTIES MAKE NO REPRESENTATIONS AND EXTEND NO WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED (AND EACH PARTY HEREBY EXPRESSLY DISCLAIMS ANY AND ALL REPRESENTATIONS AND WARRANTIES NOT EXPRESSLY PROVIDED IN THIS AGREEMENT), INCLUDING WITH RESPECT TO ANY mRNA TECHNOLOGY, mRNA CANCER VACCINE TECHNOLOGY, PATENTS OR KNOW-HOW, mRNA CANCER VACCINES OR COLLABORATION PRODUCTS, INCLUDING WARRANTIES OF VALIDITY OR ENFORCEABILITY OF ANY PATENTS, TITLE, QUALITY, MERCHANTABILITY, FITNESS FOR A PARTICULAR USE OR PURPOSE, PERFORMANCE, AND NONINFRINGEMENT OF ANY THIRD PARTY PATENTS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

13.5 No Consequential Damages. NOTWITHSTANDING ANYTHING IN THIS AGREEMENT, EXCEPT FOR DAMAGES DUE TO THE FRAUD OR WILLFUL MISCONDUCT OR GROSS NEGLIGENCE OF THE LIABLE PARTY, NEITHER PARTY WILL BE LIABLE TO THE OTHER OR ANY THIRD PARTY WITH RESPECT TO ANY SUBJECT MATTER OF THIS AGREEMENT FOR ANY INDIRECT, PUNITIVE, SPECIAL OR CONSEQUENTIAL DAMAGES, EVEN IF SUCH PARTY HAS BEEN INFORMED OR SHOULD HAVE KNOWN OF THE POSSIBILITY OF SUCH DAMAGES; PROVIDED, THAT THIS SECTION 13.5 WILL NOT APPLY TO THE PARTIES’ INDEMNIFICATION RIGHTS AND OBLIGATIONS UNDER SECTION 13.6.
13.6 Indemnification and Liability.

(a) Indemnification by Merck. Merck will indemnify Moderna, its Affiliates and their respective directors, officers, employees and agents, and their respective successors, heirs and assigns (collectively, “Moderna Indemnitees”), and defend and save each of them harmless, from and against any and all losses, damages, liabilities, costs and expenses (including reasonable attorneys’ fees and expenses) (collectively, “Losses”) in connection with any and all suits, investigations, claims or demands of Third Parties (collectively, “Third Party Claims”) arising from or occurring as a result of: [***], except in each case [***] for those Losses and Third Party Claims for which Moderna has an obligation to indemnify Merck pursuant to Section 13.6(b) (or would have had such Third Party Claim been made against Merck under this Agreement), as to which Losses each Party will indemnify the other to the extent of their respective liability; provided, that Merck will not be obligated to indemnify Moderna Indemnitees for any Losses or Third Party Claims to the extent that such Losses or Third Party Claims arise as a result of gross negligence or willful misconduct on the part of a Moderna Indemnitee or breach of this Agreement by Moderna.

(b) Indemnification by Moderna. Moderna will indemnify Merck, its Affiliates and their respective directors, officers, employees and agents, and their respective successors, heirs and assigns (collectively, “Merck Indemnitees”), and defend and save each of them harmless, from and against any and all Losses in connection with any and all Third Party Claims arising from or occurring as a result of: [***] except in each case ((i)-(vii)) for those Losses and Third Party Claims for which Merck has an obligation to indemnify Moderna pursuant to Section 13.6(a) (or would have had such Third Party Claim been made against Moderna under this Agreement), as to which Losses each Party will indemnify the other to the extent of their respective liability for the Losses; provided, that Moderna will not be obligated to indemnify Merck Indemnitees for any Losses or Third Party Claims to the extent that such Losses or Third Party Claims arise as a result of gross negligence or willful misconduct on the part of a Merck Indemnitee or breach of this Agreement by Merck.

(c) Notice of Claim. All indemnification claims provided for in Section 13.6(a) and Section 13.6(b) will be made solely by such Party to this Agreement (the “Indemnified Party”). The Indemnified Party will promptly notify the indemnifying Party (an “Indemnification Claim Notice”) of any Losses or the discovery of any fact upon which the Indemnified Party intends to base a request for indemnification under Section 13.6(a) or Section 13.6(b), but in no event will the indemnifying Party be liable for any Losses that result from any delay in providing such notice. Each Indemnification Claim Notice must contain a description of the claim and the nature and estimated amount of such Loss (to the extent that the nature and amount of such Loss is known at such time). The Indemnified Party will furnish promptly to the indemnifying Party copies of all papers and official documents received in respect of any Losses and Third Party Claims. Notwithstanding the foregoing, any delay or failure to provide any notices or copies pursuant to this Section 13.6(c) shall not constitute a waiver or release of, or otherwise limit, the Indemnified Party’s rights to indemnification under this Section 13.6 except to the extent that such delay or failure materially prejudices the indemnifying Party’s ability to defend against the relevant claims.
(d) Defense, Settlement, Cooperation and Expenses.

(i) At its option, the indemnifying Party may assume the defense of any Third Party Claim by giving written notice to the Indemnified Party within [***] days after the indemnifying Party’s receipt of an Indemnification Claim Notice. The assumption of the defense of a Third Party Claim by the indemnifying Party will not be construed as an acknowledgment that the indemnifying Party is liable to indemnify the Indemnified Party in respect of the Third Party Claim, nor will it constitute a waiver by the indemnifying Party of any defenses it may assert against the Indemnified Party’s claim for indemnification. Upon assuming the defense of a Third Party Claim, the indemnifying Party may appoint as lead counsel in the defense of the Third Party Claim any legal counsel selected by the indemnifying Party (the indemnifying Party will consult with the Indemnified Party with respect to a possible conflict of interest of such counsel retained by the indemnifying Party). In the event the indemnifying Party assumes the defense of a Third Party Claim, the Indemnified Party will immediately deliver to the indemnifying Party all original notices and documents (including court papers) received by the Indemnified Party in connection with the Third Party Claim. Should the indemnifying Party assume the defense of a Third Party Claim, except as provided in Section 13.6(d)(ii), the indemnifying Party will not be liable to the Indemnified Party for any legal costs or expenses subsequently incurred by such Indemnified Party in connection with the analysis, defense or settlement of the Third Party Claim. [***]

(ii) Without limiting Section 13.6(d)(i), any Indemnified Party will be entitled to participate in, but not control, the defense of such Third Party Claim and to employ counsel of its choice for such purpose; provided, that such employment will be at the Indemnified Party’s own cost and expense unless [***].

(iii) With respect to any Third Party Claims that relate solely to the payment of money damages in connection with a Third Party Claim and that will not result in the Indemnified Party’s becoming subject to injunctive or other relief or otherwise adversely affecting the business of the Indemnified Party in any manner, and as to which the indemnifying Party will have acknowledged in writing the obligation to indemnify the Indemnified Party hereunder, the indemnifying Party will have the sole right to agree to the entry of any judgment, enter into any settlement or otherwise dispose of such Loss, on such terms as the indemnifying Party, in its sole discretion, will deem appropriate. With respect to all other Losses in connection with Third Party Claims, where the indemnifying Party has assumed the defense of the Third Party Claim in accordance with Section 13.6(d)(i), the indemnifying Party will have authority to agree to the entry of any judgment, enter into any settlement or otherwise dispose of such Loss provided it obtains the prior written consent of the Indemnified Party (such consent not to be unreasonably withheld, delayed or conditioned). The indemnifying Party will not be liable for any settlement or other disposition of a Loss by an Indemnified Party that is reached without the prior written consent of the indemnifying Party. Regardless of whether the indemnifying Party chooses to defend or prosecute any Third Party Claim, no Indemnified Party will admit any liability with respect to or settle, compromise or discharge, any Third Party Claim without the prior written consent of the indemnifying Party, such consent not to be unreasonably withheld, delayed or conditioned.

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(iv) If the indemnifying Party chooses to defend or prosecute any Third Party Claim, the Indemnified Party will, and will cause each other Indemnified Party to, cooperate in the defense or prosecution thereof and will furnish such records, information and testimony, provide such witnesses and attend such conferences, discovery proceedings, hearings, trials and appeals as may be reasonably requested in connection therewith. Such cooperation will include access during normal business hours afforded to indemnifying Party to, and reasonable retention by the Indemnified Party of, records and information that are reasonably relevant to such Third Party Claim, and making Indemnified Parties and other employees and agents available on a mutually convenient basis to provide additional information and explanation of any material provided hereunder, and the indemnifying Party will reimburse the Indemnified Party for all its reasonable out-of-pocket costs and expenses in connection therewith.

(v) Except as provided above in this Section 13.6(d), the reasonable and verifiable costs and expenses, including attorneys’ fees and expenses, incurred by the Indemnified Party in connection with any claim will be reimbursed on a Calendar Quarter basis by the indemnifying Party, without prejudice to the indemnifying Party’s right to contest the Indemnified Party’s right to indemnification and subject to refund in the event the indemnifying Party is ultimately held not to be obligated to indemnify the Indemnified Party.

13.7 Insurance. Each Party will maintain at its sole cost and expense, an adequate liability insurance or self-insurance program (including product liability insurance) to protect against potential liabilities and risk arising out of activities to be performed under this Agreement, and any agreement related hereto and upon such terms (including coverages, deductible limits and self-insured retentions) as are customary in the U.S. pharmaceutical industry, or, if such activities are conducted outside the U.S., as are customary in such country, for the activities to be conducted by such Party under this Agreement. The coverage limits set forth herein will not create any limitation on a Party’s liability to the other under this Agreement. Each Party shall provide the other Party with written evidence of such insurance upon request. Each Party shall provide the other Party with written notice at least [***] days prior to the cancellation, non-renewal or material change in such insurance or self-insurance which materially adversely affects the rights of the other Party hereunder.

13.8 Covenants of Moderna. Moderna hereby covenants that Moderna shall throughout the Term:
   (a) [***]
   (b) [***]

14. TERM AND TERMINATION

14.1 Term. This Agreement shall commence as of the Effective Date and, unless sooner terminated by mutual written consent, will continue on a Program-by-Program basis (a) if Merck exercises the Merck Participation Election for such Program, until the date on which both Parties cease Researching, Developing, Manufacturing or Commercializing mRNA Cancer Vaccines (including the Collaboration Products) from such Program without the intention to resume, and (b) if Merck does not exercise the Merck Participation Election for such Program or
if Merck exercises the Merck Cessation Election for such Program, until the date on which Moderna and its Affiliates cease Researching, Developing, Manufacturing or Commercializing Financial PCVs or Financial SAVs, as applicable, with respect to such Program without the intention to resume (each, a “Program Term”). This Agreement shall expire in full upon the later of (i) the end of the SAV Research Term and (ii) the expiration of all Program Terms (the “Term”). Notwithstanding the foregoing, the Parties shall make an HSR Filing under the Equity Agreement, and this Agreement shall terminate and the Original Agreement shall be reinstated in full without any amendments or modifications (A) at the election of either Party, immediately upon notice to the other Party, in the event that the FTC or the DOJ obtains a preliminary injunction under the HSR Act against the Parties to enjoin the transactions contemplated by the Equity Agreement or (B) at the election of either Party, immediately upon notice to the other Party, in the event that the Antitrust Clearance Date has not occurred on or prior to ninety (90) days after the submission of the HSR Filing. As used herein: (1) “FTC” means the United States Federal Trade Commission, (2) “DOJ” means the Antitrust Division of the United States of America Department of Justice, and (3) “Antitrust Clearance Date” means the earliest date on which the Parties have actual knowledge that all applicable waiting periods under the HSR Act with respect to the transactions contemplated by this Agreement have expired or have been terminated.

14.2 No Termination; Right to Seek Damages.

(a) In further consideration of the payments by Merck and the significant contributions by each Party, neither Party shall have any right to terminate this Agreement except as expressly set forth herein and the Parties hereby agree and acknowledge that the foregoing is reasonable and necessary to protect the legitimate interests of each Party.

(b) Notwithstanding anything to the contrary in this Agreement (including Sections 14.2(a) and [***]), in addition to all rights and remedies of the Parties under this Agreement, each Party shall be entitled to seek damages (including reasonable attorneys’ fees and expenses) or other equitable remedies (including pursuant to Section 15.2), at Law or otherwise, with respect to any material breach of this Agreement by the other Party.

14.3 [***]

14.4 [***]

14.5 Certain Additional Consequences. For the avoidance of doubt, notwithstanding anything to the contrary contained herein (other than to the extent of the exclusive licenses granted by Merck to Moderna with respect to Collaboration Products, and without any licenses or other rights in or to any Moderna Technology or Confidential Information of Moderna (except as set forth in Sections 10.1(b) and 10.1(d))), (i) in the event of a Merck Non-Participation or Merck Cessation Election, in each case, with respect to a given Program, Merck and Affiliates [***].
14.6 Return of Confidential Information. Except as otherwise necessary to continue exercising any ongoing licenses under this Agreement, with respect to a given Program, upon the Merck Non-Participation, the [***], the Merck Cessation Election, or the end of the Program Term, in each case, with respect to such Program, the Parties will return (or destroy or erase, as directed by the other Party) all data, files, records and other materials containing or comprising the other Party’s Confidential Information with respect to such Program [***]. In addition, except as otherwise necessary to continue exercising any ongoing licenses under this Agreement, upon expiration of this Agreement, the Parties will return (or destroy or erase, as directed by the other Party) all data, files, records and other materials containing or comprising the other Party’s Confidential Information. Notwithstanding the foregoing, (i) in respect of physical embodiments of information, the Parties will be permitted to retain one copy of such data, files, records, and other materials for non-commercial archival purposes, and (ii) in respect of any information stored electronically or in other non-physical media, it will be sufficient for such Party to procure that access to such information is restricted to non-commercial archiving purposes only.

14.7 Survival. In addition to [***], as applicable, the following provisions will survive expiration of this Agreement: [***]. Expiration of this Agreement will not relieve the Parties of any liability or obligation which accrued hereunder prior to the effective date of such termination or expiration nor preclude either Party from pursuing all rights and remedies it may have hereunder or at law or in equity with respect to any breach of this Agreement. All other rights and obligations will terminate upon expiration of this Agreement.

15. GENERAL PROVISIONS

15.1 Dispute Resolution.

(a) Disputes. Disputes of any nature arising under, relating to, or in connection with this Agreement (“Disputes”) will be resolved pursuant to this Section 15.1.

(b) Dispute Escalation. In the event of a Dispute between the Parties, the Parties will first attempt to resolve such dispute by negotiation and consultation between themselves or the JSC. In the event that such dispute is not resolved on an informal basis within [***] days from receipt of the written notice of a Dispute, any Party may, by written notice to the other (or with respect to a Dispute arising at the JSC, by the JSC within [***] days after the JSC first considers such Dispute in accordance with Section 2.4(c)), have such dispute referred to the Executive Officers (or their designee, which designee is required to have decision-making authority on behalf of such Party), who will attempt to resolve such Dispute by negotiation and consultation for a [***] day period following receipt of such written notice.

(c) Full Arbitration.

(i) In the event the Parties have not resolved such Dispute within [***] of receipt of the written notice referring such Dispute to the Executive Officers, either Party may at any time after such [***] period submit such Dispute to be finally settled by arbitration administered in accordance with the procedural rules of the American Arbitration Association (“AAA”) in effect at the time of submission, as modified by this Section 15.1(c). The arbitration will be governed by the Laws of the state of New York. The arbitration will be heard and determined by three (3) arbitrators who are retired judges or attorneys with at least [***] of relevant experience in the pharmaceutical and biotechnology industry, each of whom will be impartial and independent. Each Party will appoint one (1) arbitrator and the third (3rd) arbitrator will be selected by the two (2) Party-appointed arbitrators, or, failing agreement within [***] following appointment of the second arbitrator, by AAA. Such arbitration will take place

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in [***]. The arbitration award so given will be a final and binding determination of the dispute, will be fully enforceable in any court of competent jurisdiction, and will not include any damages expressly prohibited by Section 13.5. Fees, costs and expenses of arbitration are to be divided by the Parties in the following manner: Merck will pay for the arbitrator it chooses, Moderna will pay for the arbitrator it chooses, and the Parties will share payment for the third arbitrator. Except in a proceeding to enforce the results of the arbitration or as otherwise required by applicable Law, neither Party nor any arbitrator may disclose the existence, content or results of any arbitration hereunder without the prior written consent of both Parties (each such consent not to be unreasonably withheld, delayed or conditioned).

(ii) In addition to the foregoing provisions of this Section 15.1(c), in the event that a provision of this Agreement requires “Special Arbitration”, then the following rules will apply with respect to the Dispute that is subject to Special Arbitration: Within [***] of the appointment of the third (3rd) arbitrator, each Party will submit to the arbitrators in writing its final proposal for resolving the matter that is the subject of such Dispute (“Dispute Proposal”) and any relevant background information and materials it deems appropriate. In connection with reaching its decision, the arbitrators may (A) order the Parties to produce any documents or other information that are relevant to the arbitrators’ decision, and (B) if the arbitrators deem it necessary, set a date for a hearing no later than [***] Business Days (or such other period of time as agreed to by the Parties) after submission of the last Dispute Proposal, to be attended by both Parties with each Party having the right to be represented by counsel of its choice. The arbitrators will determine which of the two Dispute Proposals submitted by the Parties will prevail in the Special Arbitration in the best interest of the applicable Collaboration Product(s), and will not have authority to render any other substantive decision. The Dispute Proposal selected by the arbitrators shall be binding on the Parties (and, to the extent such Dispute Proposal amends a Plan or budget for a given Program, such Plan or budget shall be deemed amended to the effect of such selected Dispute Proposal, as applicable). Such decision will be rendered by the arbitrators no later than [***] Business Days after the later of (x) receipt by the arbitrators of the Parties’ Dispute Proposals as set forth in this Section 15.1(c), or (y) the conclusion of any hearing conducted pursuant to clause (B) above. The Parties will use diligent efforts to cause the completion of any such arbitration within [***] following the initiating Party’s written notice to submit the Dispute to Special Arbitration (or such longer period of time as the Parties may mutually agree).

(d) Injunctive Relief. Notwithstanding the dispute resolution procedures set forth in this Section 15.1, in the event of an actual or threatened breach of this Agreement, the aggrieved Party may seek provisional equitable relief (including restraining orders, specific performance or other injunctive relief), without first submitting to any dispute resolution procedures hereunder.

(e) Tolling. The Parties agree that all applicable statutes of limitation and time-based defenses (such as estoppel and laches) will be tolled while the dispute resolution procedures set forth in this Section 15.1 are pending, and the Parties will cooperate in taking all actions reasonably necessary to achieve such a result.
15.2 **Cumulative Remedies and Irreparable Harm.** All rights and remedies of the Parties hereunder will be cumulative and in addition to all other rights and remedies provided hereunder or available by agreement, at law or otherwise. Each Party acknowledges and agrees that breach of any of the terms or conditions of this Agreement may cause irreparable harm and damage to the other and that such damage may not be ascertaineable in money damages and that as a result thereof the non-breaching Party would be entitled to seek on an interim basis from a court and on a permanent basis from an arbitral tribunal equitable or injunctive relief restraining any breach or future violation of the terms contained herein by the breaching Party without the necessity of proving actual damages or posting bond. Such right to equitable relief is in addition to whatever remedies either Party may be entitled to as a matter of law or equity, including money damages.

15.3 **Business Combination.** Notwithstanding anything to the contrary herein, in the event of an acquisition of a Party by a Significant Third Party as part of a Business Combination, then for purposes of this Agreement, [***]. “**Significant Third Party**” means a Third Party [***].

15.4 **Relationship of Parties.** Nothing in this Agreement is intended or will be deemed to constitute a partnership, agency, employer-employee or joint venture relationship between the Parties. No Party will incur any debts or make any commitments for the other, except to the extent, if at all, specifically provided herein. There are no express or implied Third Party beneficiaries hereunder.

15.5 **Compliance with Law.** Each Party will perform or cause to be performed any and all of its obligations or the exercise of any and all of its rights hereunder in good scientific manner and in compliance with all applicable Law.

15.6 **Force Majeure.** Neither Party will be liable to the other for failure of or delay in performing obligations set forth in this Agreement, and neither will be deemed in breach of such obligations, if such failure or delay is due to natural disasters or any causes reasonably beyond the control of such Party; provided, that the Party affected will promptly notify the other of the force majeure condition and will exert reasonable efforts to eliminate, cure or overcome any such causes and to resume performance of its obligations as soon as possible.

15.7 **Governing Law.** This Agreement will be governed by and construed in accordance with the Laws of the state of New York, without respect to its conflict of laws rules or principles that might otherwise refer construction or interpretation of this Agreement to the substantive Law of another jurisdiction; provided, that any dispute relating to the scope, validity, enforceability or infringement of any Patents will be governed by, and construed and enforced in accordance with, the substantive Laws of the jurisdiction in which such Patents apply. The Parties agree to exclude the application to this Agreement of the United Nations Convention on Contracts for the International Sale of Goods.

15.8 **Counterparts; Facsimiles.** This Agreement may be executed in one or more counterparts, each of which will be deemed an original, and all of which together will be deemed to be one and the same instrument. Facsimile or PDF execution and delivery of this Agreement by either Party will constitute a legal, valid and binding execution and delivery of this Agreement by such Party.

15.9 **Headings.** All headings in this Agreement are for convenience only and will not affect the meaning of any provision hereof.
15.10 **Waiver of Rule of Construction.** Each Party has had the opportunity to consult with counsel in connection with the review, drafting and negotiation of this Agreement. Accordingly, the rule of construction that any ambiguity in this Agreement will be construed against the drafting party will not apply.

15.11 **Interpretation.** Whenever any provision of this Agreement uses the term “including” (or “includes”), such term will be deemed to mean “including without limitation” (or “includes without limitations”), “Herein,” “hereby,” “hereunder,” “hereof” and other equivalent words refer to this Agreement as an entirety and not solely to the particular portion of this Agreement in which any such word is used. Except where the context otherwise requires, whenever used, the singular will include the plural, the plural the singular, the use of any gender will be applicable to all genders and the word “or” is used in the inclusive sense (and/or). Unless otherwise provided, all references to Sections, Schedules and Exhibits of this Agreement. References to any Sections include Sections and subsections that are part of the related Section (e.g., a section numbered “Section 2.1” would be part of “Section 2”, and references to “Section 2.1” would also refer to material contained in the subsection described as “Section 2.1(a)”). Citations to a statute or regulation will be deemed to mean such statute or regulation and any amendment or supplement thereto or any replacement thereof. As used herein “$” or “dollars” means United States Dollars.

15.12 **Binding Effect.** This Agreement will inure to the benefit of and be binding upon the Parties, their Affiliates, and their respective lawful successors and assigns.

15.13 **Assignment.**

(a) **Generally.** This Agreement may not be assigned by either Party, nor may either Party delegate its obligations or otherwise transfer any licenses granted herein or other rights created by this Agreement, except as expressly permitted hereunder, without the prior written consent of the other Party, which consent will not be unreasonably withheld, delayed or conditioned; provided, that either Party may assign this Agreement (i) in whole or in part, to an Affiliate (provided that the Party assigning to an Affiliate will remain fully liable for any acts or omissions, including financial liabilities, of such Affiliate) or (ii) in whole to such Party’s successor in connection with the merger, consolidation, sale of all or substantially all of its assets or that portion of its business pertaining to the subject matter of this Agreement, or any Business Combination of such Party, in each case, without the consent of the other Party. The rights and obligations of the Parties under this Agreement will be binding upon and inure to the benefit of the successors and permitted assigns of the Parties, and the name of a Party appearing herein will be deemed to include the name of such Party’s successors and permitted assigns to the extent necessary to carry out the intent of this Section 15.13. Any attempted assignment not in accordance with this Section 15.13(a) will be void.

(b) **Additional Confidentiality Procedures.** In the event Modena or any Affiliate of Modena that does work hereunder or is in possession of Confidential Information of Merck undergoes a Business Combination, neither Merck nor any Affiliate of Merck shall be required to assign to Modena any right, title or interest in or to any [***] conceived, created or discovered following such Business Combination.
15.14 **Extension to Affiliates.** Each Party shall have the right to extend the rights, licenses, immunities and obligations granted or imposed in this Agreement to one or more of its Affiliates to perform certain activities hereunder. All applicable terms and provisions of this Agreement shall apply to any such Affiliate to which this Agreement has been extended to the same extent as such terms and provisions apply to such Party. Each Party shall remain fully liable for any acts or omissions, including financial liabilities, of such Affiliates. To the extent that this Agreement imposes obligations on any Affiliates of a Party, such Party agrees to cause its Affiliates to perform such obligations.

15.15 **Notices.** All notices, requests, demands and other communications required or permitted to be given pursuant to this Agreement will be in writing and will be deemed to have been duly given upon the date of receipt if delivered by hand, recognized international overnight courier, confirmed facsimile transmission, or registered or certified mail, return receipt requested, postage prepaid to the following addresses or facsimile numbers:

If to Moderna:
ModernaTX, Inc.
200 Technology Square
Cambridge, MA 02139
Attention: Chief Executive Officer

With a copy to:
ModernaTX, Inc.
200 Technology Square
Cambridge, MA 02139
Attention: General Counsel

If to Merck:
Merck Sharp & Dohme Corp.
One Merck Drive
Whitehouse Station, NJ 08889-0100
Attention: Office of Secretary
Facsimile No.: (908) 735-1246

With a copy to:
Merck Sharp & Dohme Corp.
2000 Galloping Hill Road
PO Box 539
Mailstop K-1-4161
Kenilworth, NJ 07033-1310
Attention: Senior Vice President, Business Development

Either Party may change its designated address and facsimile number by notice to the other Party in the manner provided in this Section 15.15.

15.16 **Amendment and Waiver.** This Agreement may be amended, supplemented, or otherwise modified only by means of a written instrument signed by both Parties; provided, that any unilateral undertaking or waiver made by one Party in favor of the other will be enforceable if undertaken in a writing signed by the Party to be charged with the undertaking or waiver. Any waiver of any rights or failure to act in a specific instance will relate only to such instance and will not be construed as an agreement to waive any rights or fail to act in any other instance, whether or not similar.
15.17 **Severability.** In the event that any provision of this Agreement will, for any reason, be held to be invalid or unenforceable in any respect, and if the rights or obligations of either Party under this Agreement will not be materially and adversely affected thereby, (a) such provisions will be given no effect by the Parties and will not form part of this Agreement, (b) all other provisions of this Agreement will remain in full force and effect, and (c) the Parties will negotiate in good faith to modify this Agreement to preserve (to the extent possible) their original intent.

15.18 **Entire Agreement.** This Agreement, together with any other agreement executed or to be executed in connection herewith, including the Equity Agreement, Supply Agreements, Quality Agreements, Co-Promotion Agreements (if any), POC Pharmacovigilance Agreement and the Pharmacovigilance Agreement, sets forth the complete, final and exclusive agreement with respect to the subject matter hereof and supersedes all other agreements and understandings between the Parties with respect to the subject matter hereof (including the Mutual Confidential Disclosure Agreement (dated February 27, 2013, as amended on December 10, 2015)) as it relates to cancer vaccines using mRNA. For the avoidance of doubt, this Agreement and the transactions contemplated hereby do not amend, supplement or otherwise modify any of the terms or conditions of any other agreement between the Parties, including the 2015 Collaboration Agreement, the 2016 CSA and any other agreements entered into pursuant to the 2015 Collaboration Agreement or 2016 CSA. The 2015 Collaboration Agreement and the 2016 CSA shall remain in full force and effect in accordance with their respective terms and conditions.

15.19 **HSR Act.** Each of Merck and Moderna shall prior to the election of any rights set forth in Section 3.5(c) if legally required submit to the United States Federal Trade Commission and the Antitrust Division of the United States Department of Justice, any HSR Filing required of it under the HSR Act, which forms shall specifically request early termination of the initial HSR Act waiting period; provided further that each of Merck and Moderna shall, prior to the election of any rights set forth in Section 3.5(c) if legally required, make any other applicable competition or antitrust law filing with any other governmental authority (“ex-U.S. Antitrust Filing”). The Parties will cooperate with one another to the extent necessary in the preparation of any such HSR Filing and ex-U.S. Antitrust Filing. The Parties hereto commit to instruct their respective counsel to cooperate with each other and use good faith, diligent efforts to facilitate and expedite the identification and resolution of any such issues and, consequently, the expiration of the applicable HSR Act waiting period or applicable clearances or approvals under any other applicable non-U.S. antitrust or competition law, such good faith diligent efforts to include counsel’s undertaking: (i) to keep each other appropriately informed of communications received from and submitted to personnel of the reviewing antitrust authority; and (ii) to confer with each other regarding appropriate contacts with and response to personnel of the United States Federal Trade Commission and the Antitrust Division of the United States Department of Justice or other applicable competition or antitrust governmental authority. Each Party will be responsible for its own costs, expenses and filing fees associated with any HSR Filing or other ex-U.S. Antitrust Filing. In respect of any HSR Filing or ex-U.S. Antitrust Filing, each of Merck and Moderna will use its good faith, diligent efforts to eliminate any concern on the part of any
court or governmental authority regarding the legality of the proposed transaction, including cooperating in good faith with any government investigation and the prompt production of documents, information and witnesses requested in the course of any such investigation, including those contained in a Request for Additional Information and Documentary Materials (as that term is defined in the HSR Act) or equivalent legal requirements under any other non-U.S. competition or antitrust law. Nothing in this Section shall require either Party to consent to the divestiture or other disposition of any of its or its Affiliates’ assets or to consent to any other structural or conduct remedy, and each Party and its Affiliates shall have no obligation to contest, administratively or in court, any ruling, order or other action of the United States Federal Trade Commission and the Antitrust Division of the United States Department of Justice, any non-US antitrust or competition law authority or any Third Party respecting the transactions contemplated by this Agreement. The Parties shall not make any election described in Section 3.5(c) of this Agreement until all applicable competition or antitrust approvals, clearances or decision (including under the HSR Act and any other applicable competition or antitrust laws) are obtained or any applicable waiting periods have expired or terminated.

[Remainder of this Page Intentionally Left Blank]
IN WITNESS WHEREOF, the Parties have caused this Amended and Restated mRNA Cancer Vaccine Collaboration and License Agreement to be executed by their respective duly authorized officers as of the Amended Effective Date.

MODERNA, INC.

By: /s/ Stéphane Bancel
    (Signature)
Name: Stéphane Bancel
Title: CEO

MERCK SHARP & DOHME CORP.

By: /s/ Benjamin Thorner
    (Signature)
Name: Benjamin Thorner
Title: SVP & Head of BD&L
EXHIBIT A-1

POC Plan for PCV Program

[***]

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EXHIBIT B

Financial Definitions

“Additional Regulatory Costs” means costs incurred: [***].

a) “Allowable Commercialization Costs” means the internal costs (i.e. FTE Costs) and Out-of-Pocket Costs actually incurred by or on behalf of a Party or its Affiliates or Sublicensees, that are [***] including [***]: [***]

b) [***]

c) [***]

d) [***]

e) [***]

f) [***]

g) [***],

in each case (except in the case of [***] to the extent such costs are consistent with, during the Merck Participation Term for a given Joint SAV Program or the PCV Program, the Global Commercialization Plan and the Global Commercialization Budget for such Joint SAV Program or the PCV Program or otherwise approved by the JSC, plus Permitted Overages. [***]The Parties agree that Allowable Commercialization Costs will not include costs or expenses of a Party or its Affiliates or Sublicensees to the extent: [***].

No expense included in an Allowable Commercialization Cost shall also be included in other costs in the calculations of Moderna Net Profits or Cash Profits or Losses.

“Allowable Development Costs” means, with respect to a Joint Development Plan and Budget, or Additional Research Plan, in each case for a given Joint SAV Program or the PCV Program, the Development Costs actually incurred by or on behalf of a Party or its Affiliates or Sublicensees with respect to such Joint Development Plan and Budget or Additional Research Plan that are consistent with the applicable budget [***] or otherwise approved by the JSC, plus Permitted Overages. Allowable Development Costs shall not include costs or expenses of a Party or its Affiliates or Sublicensees to the extent: [***].

“Cash Profits or Losses” has the meaning set forth in Exhibit D. In the case where Cash Profits or Losses is positive, it shall be referred to as “Cash Profits”, and in the case where Cash Profits or Losses is negative, it shall be referred to as “Cash Losses”.

“Commercial Liabilities” means, on a country-by-country basis, any Losses incurred by or on behalf of a Party or its Affiliates or Sublicensees in connection with a Third Party Claim in connection with the Research, Development, Commercialization or Manufacture of a Collaboration Product, including [***]. For purposes of Exhibit E, Commercial Liabilities shall also apply to Losses incurred by or on behalf of Moderna or its Affiliates or Sublicensees mutatis mutandis with respect to each Financial PCV or Financial SAV, as applicable.

“Cost of Goods Sold” with respect to each mRNA Cancer Vaccine (including a Collaboration Product), means [***]. Notwithstanding the foregoing, with respect to each mRNA Cancer Vaccine (including a Collaboration Product), to the extent there [***].

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“Credit Against Profits Mechanism” means each mechanism detailed in (a) Paragraph 4 of Section B of Exhibit D, with respect to the Profit & Loss Share and (b) Paragraph 11 of Exhibit E, with respect to the Non-Participation PCV Net Profit Share, Non-Participation SAV Net Profit Share, PCV Cessation Net Profit Share or SAV Cessation Net Profit Share, as applicable.

“Development Costs” means all internal costs (i.e. FTE Costs) and Out-of-Pocket Costs actually incurred by or on behalf of a Party (or its Affiliates or Sublicensees) and that [***], to the extent set forth in the budget within the Additional Research Plan, the Joint Development Plan and Budget or an Independent Additional Study Development Plan, in each case for a given Joint SAV Program or the PCV Program, including:

(a) [***]
(b) [***]
(c) [***]
(d) [***]
(e) [***]
(f) [***]
(g) those Patent and Trademark Expenses incurred for the Prosecution and Maintenance of Patents (which shall not be subject to the budget requirements above);
(h) [***]

[***]With respect to the foregoing, any internal costs shall be calculated based on the number of FTEs used to perform the applicable activity multiplied by the FTE Rate. For purposes of Exhibit E, Development Costs shall also apply to costs incurred by or on behalf of Moderna or its Affiliates or Sublicensees mutatis mutandis with respect to each Financial PCV or Financial SAV, as applicable.

“Direct Marketing Expenses” means all internal costs (i.e. FTE Costs) and Out-of-Pocket Costs actually incurred by or on behalf of a Party [***]:

(a) [***]
(b) [***]
(c) [***]
(d) [***]
(e) [***]
(f) [***]
(g) [***]
(h) [***]
(i) [***]
(j) [***]
(k) [***]
Direct Marketing Expenses shall not include any Selling Expenses and the costs of activities that promote a Party’s business as a whole without being product specific (e.g., corporate image advertising). For purposes of Exhibit E, Direct Marketing Expenses shall also apply to costs incurred by or on behalf of Moderna or its Affiliates or Sublicensees mutatis mutandis with respect to each Financial PCV or Financial SAV, as applicable.

“Distribution Expenses” with respect to each Collaboration Product, means [***]. For purposes of Exhibit E, Distribution Expenses shall also apply to costs incurred by or on behalf of Moderna or its Affiliates or Sublicensees mutatis mutandis with respect to each Financial PCV or Financial SAV, as applicable.

“Financial PCV” means [***].

“Financial SAV” means, [***].

“Gross Profit” means, with respect to a Collaboration Product, Net Sales of a Collaboration Product less Cost of Goods Sold for such Collaboration Product. For purposes of Exhibit E, Gross Profit shall apply mutatis mutandis with respect to each Financial PCV or Financial SAV, as applicable.

“IAS Costs” means Development Costs incurred with respect to any Independent Additional Study for a Collaboration Product subject to the applicable Independent Additional Study Plan.

[***]

[***]

[***]

“Indirect Marketing Expenses” with respect to each Collaboration Product, means [***]. For purposes of Exhibit E, Indirect Marketing Expenses shall also apply to costs incurred by or on behalf of Moderna or its Affiliates or Sublicensees mutatis mutandis with respect to each Financial PCV or Financial SAV, as applicable.

[***]

[***]
“Manufacturing Costs” shall consist of “U.S. GAAP Standard Cost” and “Product Specific Manufacturing Variances” as defined below. Notwithstanding the foregoing, for purposes of Exhibit D and Exhibit E as used in Cost of Goods Sold, Manufacturing Costs will not include [***]. For purposes of Exhibit E, Manufacturing Costs shall also apply to costs incurred by or on behalf of Moderna or its Affiliates or Sublicensees with respect to each Financial PCV or Financial SAV, as applicable, *mutatis mutandis*.

“Medical Affairs Costs” means all internal costs (i.e. FTE Costs) and Out-of-Pocket Costs actually incurred by or on behalf of a Party [***]. For purposes of Exhibit E, Medical Affairs Costs shall also apply to costs incurred by or on behalf of Moderna or its Affiliates or Sublicensees with respect to each Financial PCV or Financial SAV, as applicable, *mutatis mutandis*.

[***]

“Merck Reimbursement Cap” has the meaning set forth in Exhibit E.

“Moderna Commercialization Costs” means, on a Program-by-Program basis for a given Joint SAV Program or the PCV Program, all Shared Commercialization and Related Manufacturing Costs [***], including [***]. All provisions and principles set forth in the definition of Allowable Commercialization Costs and [***] shall apply to Moderna Commercialization Costs, *mutatis mutandis*.

“Moderna Costs Report” has the meaning set forth in Exhibit E.

“Moderna Development Costs” means, on a Program-by-Program basis for a given Joint SAV Program or the PCV Program, all Shared Development and Related Manufacturing Costs [***], including [***]. All provisions and principles set forth in the definition of Allowable Development Costs and [***] shall apply to Moderna Development Costs, *mutatis mutandis*.

“Moderna Net Profits” means, with respect to Financial PCVs or Financial SAV, as applicable, Gross Profits from such Financial PCVs or Financial SAV, as applicable, less the Moderna Commercialization Costs and Moderna Development Costs for such Financial PCVs or Financial SAV, as applicable. For clarity, costs that are included in one category of costs shall not be deducted a second time in calculating any other costs that are deducted in calculating Moderna Net Profits.

[***]

“Non-Participation PCV Net Profit Share” shall have the meaning set forth in Exhibit E.

“Non-Participation SAV Net Profit Share” shall have the meaning set forth in Exhibit E.

“Other Operating Income/Expense” means the following items, [***]:

(a) [***]

(b) [***]
“Out-of-Pocket Costs” means costs and expenses paid to Third Parties by or on behalf of Moderna or its Affiliates or Sublicensees or Merck or its Affiliates or Sublicensees in accordance with the budget set forth in, the POC Plans (including POC Capacity PCV Buildup Plan), Development Plan(s), Additional Research Plans, Global Commercialization Plan(s), Incremental Capacity Buildup Plans or Commercial Capacity Buildup Plans, as applicable.

“Patent and Trademark Expenses” means the reasonable, documented, out of pocket fees and expenses of outside counsel, and filing and maintenance expenses, incurred in connection with (i) the Prosecution and Maintenance of; and (ii) any trademark applications or registered trademarks used in connection with the Commercialization of any Collaboration Product, including . For purposes of Exhibit E, Patent and Trademark Expenses shall also apply to costs incurred by or on behalf of Moderna or its Affiliates or Sublicensees mutatis mutandis with respect to each Financial PCV or Financial SAV, as applicable.

“PCV Cessation Net Profit Share” has the meaning set forth in Exhibit E.

“Product Specific Manufacturing Variances” means .

“Profitability Date” means, with respect to a given Joint SAV Program or the PCV Program, the last day of the Calendar Quarter during which the quarterly Cash Profits or Losses (as defined in Exhibit D) from such Program are positive (i.e., greater than zero, or the Moderna Net Profits for such Program are positive (i.e., greater than zero), as applicable.

“Reconciliation Report” has the meaning set forth in Exhibit D.

“SAV Cessation Net Profit Share” has the meaning set forth in Exhibit E.

“Selling Expenses” means, with respect to a Collaboration Product, all costs and expenses associated with .

“Shared Commercialization and Related Manufacturing Costs” means Allowable Commercialization Costs and .
“Shared Collaboration Costs” means the Shared Development and Related Manufacturing Costs and the Shared Commercialization and Related Manufacturing Costs.

“Shared Costs Report” has the meaning set forth in Exhibit D.

“Shared Development and Related Manufacturing Costs” means Allowable Development Costs and [***].

“Shared Profits or Losses” has the meaning set forth in Exhibit D. In the case where Shared Profits or Losses is positive, it shall be referred to as “Shared Profits”; and in the case where Shared Profits or Losses is negative, it shall be referred to as “Shared Losses”.

“Sublicensee” as used in this Exhibit B, and Exhibit D and Exhibit E, means [***].

“Testing Costs” means the costs that are [***]. For purposes of Exhibit E, Testing Costs shall apply to costs incurred by or on behalf of Moderna or its Affiliates or Sublicensees with respect to each Financial PCV or Financial SAV, as applicable, mutatis mutandis.

“U.S. GAAP Standard Cost” means, if applicable, the following with respect to such product:

(a) [***]
(b) [***]
(c) [***]
   (i) [***]
   (ii) [***]
   (iii) [***]
   (iv) [***]
   (v) [***]
   (vi) [***]
   (vii) [***]
   (viii) [***]
   (ix) [***]
(d) [***]
   (i) [***]
   (ii) [***]
   (iii) [***]
   (iv) [***]
   (v) [***]
   (vi) [***]
   (vii) [***]
   (viii) [***]
   (ix) [***]

[***]

The U.S. GAAP Standard Cost will be established each Calendar Year for the upcoming year according to the forecast for requirements for such product.
EXHIBIT C

Relative Commercial Value

If a Selling Party intends to sell a Combination Product, then the following shall apply:

1. With respect to sales of Combination Products, Net Sales shall be calculated on a country-by-country basis as follows:

   [***] [***]
   [***] [***]
   [***] [***]

2. [***]

3. [***]

   (a) The Parties shall meet approximately [***] prior to the anticipated First Commercial Sale of such Combination Product in the Territory to negotiate in good faith and agree to [***] (the “Relative Commercial Value”).[***]

   (b) [***].

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This Exhibit D to the Agreement covers financial planning, accounting policies and procedures to be followed in determining the Profit & Loss Share and the cost sharing between the Parties. The Profit & Loss Share shall be calculated on a Program-by-Program basis for a given Joint SAV Program or the PCV Program. The Profit & Loss Share is not a legal entity and has been defined for identification purposes only.

A. Profit & Loss Share

1. Principles of Reporting.

   1.1 The presentation of results of operations of the Parties will include each of the following line items (as each is defined in Exhibit B or elsewhere in the Agreement) be based on each Party’s respective financial information presented separately and on a consolidated basis in the reporting format depicted as follows (the “P&L”):

   
   
   

   1.2 Effect of Commercial Grants.

   1.2.1 In connection with a Commercial Grant: (a) such Third Party receiving the Commercial Grant [***], and (b) Sublicense Income received by such Party and its Affiliates from such Third Party will [***], unless [***].

   1.2.2 The treatment of a Commercial Grant under [***] pursuant to the foregoing Paragraph 1.2.1 of this Section A of Exhibit D with respect to Commercial Grants by a Party or any of its Affiliates in [***] will require the prior written consent of the other Party, [***].

   1.2.3 Any Commercial Grant may include rights to Manufacture and Develop to support Commercialization in the country(ies) of such Commercial Grant, but the Parties do not intend for Commercial Grants to be used to Develop or Manufacture the applicable Collaboration Product(s) more generally.
1.3 It is the intention of the Parties to interpret definitions to be consistent with this Exhibit D and GAAP (except for Cost of Goods Sold given the exclusion of depreciation of certain assets in the calculation of Manufacturing Costs). Where costs included in the foregoing calculation are determined based on either Party’s system of cost or project accounting, each Party agrees to provide reasonable supporting documentation, as may be requested by the other Party, to ensure that each Party’s methodologies are reasonable and consistently applied. To the extent that such costs are not readily determinable based on the respective Party’s system of cost or project accounting, the ISC will develop a reasonable methodology for determining such costs. Reasonable methodologies may include a standard rate or some other appropriate basis for allocating costs. For reconciliation, billing and reporting hereunder, any costs included in the P&L incurred in a currency other than U.S. dollars will be translated into U.S. dollars in accordance with Section 9.5(e) of the Agreement.

1.4 If necessary, a Party will make the appropriate adjustments to the financial information it supplies under this Exhibit D to conform to the above format of reporting results of operation.

1.5 Principles:

1.5.1 In calculating the revenues and costs in this Exhibit D, the following principles shall apply:

(a) There shall be no double counting of any costs or expenses or of any revenues, and to the extent a cost or expense has been included in one category or sub-category, it shall not be included in another; similarly, to the extent any revenue has been taken into account in one category or sub-category it shall not be taken into account in another.

(b) To the extent an item of income or revenue is received by a Party or a cost or expense is incurred in a given Calendar Quarter by a Party, and can be demonstrated [***].

(c) To the extent any cost by a Party has applicability to both the Collaboration Product and to any other product, a portion of such costs will be [***] allocated by such Party to the Collaboration Product in good faith; provided the other Party shall have the right to dispute such allocation in good faith and request additional information prior to including such cost as a Shared Collaboration Cost under this Exhibit D. In addition, to the extent any cost by a Party has applicability to more than one Program, a portion of such costs will be [***] allocated by such Party to each applicable Program in good faith; provided the other Party shall have the right to dispute such allocation in good faith and request additional information prior to including such cost as a Shared Collaboration Cost for the applicable Program under this Exhibit D.

(d) All costs and expenses shall be determined, and all calculations shall be made, in accordance with GAAP, as applicable, and consistent with the Parties internal cost allocation practices used in connection with pharmaceutical products owned or controlled solely by each Party without requirement to share profits or significant royalties with any Third Party, and further consistent with the same policies and principles as it utilizes consistently within its group and business units when making internal cost allocations.
Without limiting the foregoing, if either Party in good faith believes that the methodology set forth herein does not accurately reflect the revenues and costs for a Collaboration Product, Program or otherwise for the Collaboration, upon request of such Party, the Parties shall in good faith discuss such concerns and, if the Parties mutually agree upon acceptable revisions to the methodologies set forth herein, they shall amend Exhibit B, Exhibit D or Exhibit E, as appropriate. For clarity, the foregoing principles shall also apply to the costs and expenses calculated in Exhibit E mutatis mutandis.

2. **Cash Profits or Losses and Shared Collaboration Costs.**

   2.1 If Merck elects the Merck Participation Election for a given Program, each Party is entitled to fifty percent (50%) of the Cash Profits or Losses from such Program for a given [***] subject to this Exhibit D.

   2.2 **Certain Exclusions from Shared Collaboration Costs.** To the extent any Manufacturing Costs are incurred by a Party due to [***] by such Party, then such Manufacturing Costs shall be borne solely by such Party and shall not be included in Cost of Goods Sold to be included in the Shared Costs Report hereunder.

3. **Audits.** The record keeping and audit provisions set forth in Section 9.5(c) of the Agreement will apply with respect to all amounts payable by either Party to the other Party under the Profit & Loss Share.

4. **Reporting of Shared Costs.** Within [***] days after the end of [***], each Party shall provide the other Party with a detailed activity-based summary statement (with supporting documentation [***]) of the Shared Collaboration Costs and Costs of Goods Sold incurred by or on behalf of such Party (or its Affiliate or Sublicensee) in such [***], as applicable (each, a "Shared Costs Report"). [***]

5. **Reporting of Net Sales.** On a [***] basis, Merck will provide to Moderna an estimate of gross sales and Net Sales of such Collaboration Product in U.S. dollars during the prior [***] and units of such Collaboration Product sold during such period according to Merck’s sales reporting system, which will be consistent with the financial planning, accounting and reporting procedures set forth in this Exhibit D. Each such report will be provided as early as possible, but no later than [***] days after the last day of the [***] in question, and will separately provide [***] figures. The Parties understand that all Net Sales of Collaboration Products will be booked in accordance with GAAP and otherwise in accordance with the definition of Net Sales.

6. **Reconciliation.** Subject to the remainder of this Exhibit D, within [***] days after the end of [***], each Party will provide to the other a written report setting forth the calculations of aggregate Net Sales and aggregate costs under the Shared Costs Report for such [***] received or funded by such Party. Within [***] days after receipt of such reports, the Parties will agree on a consolidated written report (the “Reconciliation Report”) setting forth the calculations of each Party’s share of such aggregate Net Sales and aggregate costs under the Shared Costs Report and the net amount that would be owed from one Party to the other Party to effectuate, subject to Paragraph 6.1 of this Section A of Exhibit D, an equal share of the resulting Cash Profits or Losses between the Parties. Such net amount would then be adjusted in accordance with Paragraph 17 of Section B of this Exhibit D.

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Payment. Any undisputed net payment owed from one Party to the other Party in order for the Parties to share equally all such costs in the Shared Costs Report, other than [***], shall be paid within [***] days following completion of such Reconciliation Report and an invoice therefor [***]; provided, that [***].

Budgets and Overages. Each Party shall use Commercially Reasonable Efforts to ensure that the actual costs associated with the performance of activities allocated to it in the Additional Research Plan, Joint Development Plan and Budget, Global Commercialization Plan, Incremental Capacity Buildup Plan and Commercial Capacity Buildup Plan (if applicable), in each case for the applicable Program, in a Calendar Year do not exceed [***] of the budgeted costs allocated to such Party for such Calendar Year as set forth in the budget for each applicable plan. Costs for the performance of all activities described in the applicable plan and budget and allocated to a given Party that exceed the estimated allocated costs therefor as set forth in the budget by up to [***] shall be referred to herein as the “Permitted Overage”, and such costs shall be included as Shared Development and Related Manufacturing Costs or Shared Commercialization and Related Manufacturing Costs, as applicable. If either Party believes that the actual costs in relation to its activities allocated to a given Party in a Calendar Year will exceed the allocated budget as set forth in the applicable plan and budget (plus the Permitted Overage) for all such activities allocated to such Party during such Calendar Year, such Party may request the JSC to review and approve such activities and the costs thereof before undertaking such excess cost. In the event that the JSC does not approve an increase in the
For clarity, any costs incurred by or on behalf of a Party (or its Affiliates) that are in excess of the budget (plus the Permitted Overage) for such costs as set forth in the applicable Joint Development Plan and Budget, Global Commercialization Plan, Incremental Capacity Buildup Plan, Additional Research Plan or Commercial Capacity Buildup Plan, in each case, for the applicable Program, shall be [***].

9. **Recording of Costs; Reports.** Each Party shall keep records associated with Development Costs incurred through performance of the Joint Development Plan and Budget for the applicable Program strictly separate from records associated with Development Costs incurred through performance of an Independent Additional Study Development Plan. Unless otherwise agreed by the JSC, the financial data in the Shared Costs Report will include calculations in local currency and United States Dollars (converted into United States Dollars in accordance with Section 9.5(e) of the Agreement). The JSC shall approve the form of any necessary documentation relating to any payments hereunder in connection with the Joint Development Program, Additional Study Development Plan, Global Commercialization Plan, Incremental Capacity Buildup Plan, or Commercial Capacity Buildup Plan, as applicable, so as to afford the Parties appropriate accounting treatment in relation to any of the transactions or payments contemplated hereunder.

10. **Expense Reduction.** The Parties agree to cooperate in identifying and implementing opportunities to reduce the costs incurred in the conduct of each Joint Development Plan and Budget, Additional Study Development Plan, Global Commercialization Plan or Incremental Capacity Buildup Plan or Commercial Capacity Buildup Plan, as applicable, including costs of equipment, consumables such as laboratory supplies and Third Party services such as toxicology, clinical studies or manufacturing services, provided such cooperation does not unduly delay or hamper a Party in the performance of its activities thereunder.

11. **Effective Accounting Date Termination.** The Profit & Loss Share for a given Program shall continue until the earlier of the last day of the month following the effective date of (a) the expiration of the Agreement with respect to such Program, or (b) the exercise of the Merck Cessation Election for such Program pursuant to Section 10.10 of the Agreement. For clarity, following the discontinuation of the Profit & Loss Share for a given Program pursuant to subsection (b) above, the terms of **Exhibit E** shall apply. Termination of the Profit & Loss Share shall not relieve either Party from its obligation to share Shared Collaboration Costs (including any Commercial Liabilities) relating to the period up to the date of termination or expiration.

12. [***]

13. [***]

14. [***]

(a) [***]
15. [***]

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16. [***]

16.1 [***]

16.2 [***]

17. **Credit Against Profits Mechanism**. The Credit Against Profits Mechanism with respect to the Profit & Loss Share shall operate as follows:

17.1 [***]

17.1.1 [***]

17.1.2 [***]

17.2 [***]

17.2.1 [***]
17.2.2 [*]

17.3 [*]

17.4 [*]

18. [*]

18.1 [*]

18.1.1 [*]

18.1.2 [*]

18.2 [*]

18.2.1 [*]

18.2.2 [*]

19. [*]

20. [*]
This Exhibit E to the Agreement covers financial planning, accounting policies and procedures to be followed in determining the economic effects and the cost sharing between the Parties in the following situations: (i) a Merck Non-Participation for a given Joint SAV Program or the PCV Program or (ii) a Merck Cessation Election for a given Joint SAV Program or the PCV Program. For the avoidance of doubt, this Exhibit E shall apply and be calculated on a Program-by-Program basis.

A. Merck Non-Participation for the PCV Program

The provisions of this Section A of Exhibit E (i.e., Paragraphs 1-13 of this Exhibit E) shall apply only to Financial PCVs.

1. Allocation of Moderna Net Profits and Costs

1.1 In the event of a Merck Non-Participation for the PCV Program pursuant to Section 3.7(a) of the Agreement, subject to [***] this Exhibit E, Merck shall be entitled to [***] (the “Non-Participation PCV Net Profit Share”).

1.2 [***]

2. Principles of Reporting

2.1 The presentation of results of operations of Moderna with respect to Financial PCVs will include each of the following line items (as each is defined in Exhibit B or elsewhere in the Agreement) be based on Moderna’s financial information presented separately and on a consolidated basis in the reporting format depicted as follows:

[***]

2.2 Effect of Commercial Grants. With respect to Financial PCVs, the following shall apply:

2.2.1 In connection with a Commercial Grant: (a) such Third Party receiving the Commercial Grant [***], and (b) [***] shall apply, unless [***].

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2.2.2 The treatment of a Commercial Grant under [***] pursuant to the foregoing Paragraph 2.2.1 of this Exhibit E with respect to Commercial Grants by a Party or any of its Affiliates in [***] will require the prior written consent of the other Party, [***].

2.2.3 Any Commercial Grant may include rights to Manufacture and Develop to support Commercialization in the country(ies) of such Commercial Grant, but the Parties do not intend for Commercial Grants to be used to Develop or Manufacture the applicable Collaboration PCV Product(s) more generally.

2.3 It is the intention of the Parties to interpret definitions to be consistent with this Exhibit E and GAAP (except for Cost of Goods Sold given the exclusion of depreciation of certain assets in the calculation of Manufacturing Costs). Where costs included in the foregoing calculation are determined based on Modena’s system of cost or project accounting, Modena agrees to provide reasonable supporting documentation, as may be requested by Merck, to ensure that Modena’s methodologies are reasonable and consistently applied. To the extent that such costs are not readily determinable based on Modena’s system of cost or project accounting, the Parties will mutually develop a reasonable methodology for determining such costs. Reasonable methodologies may include a standard rate or some other appropriate basis for allocating costs. For reconciliation, billing and reporting hereunder, any costs included in the above table incurred in a currency other than U.S. dollars will be translated into U.S. dollars in accordance with Section 9.5(e) of the Agreement.

2.4 If necessary, Modena will make the appropriate adjustments to the financial information it supplies under this Exhibit E to conform to the above format of reporting results of operation.

3. Audits. The record keeping and audit provisions set forth in Section 9.5(c) of the Agreement will apply with respect to all amounts payable by Modena to Merck under this Exhibit E.

4. Reporting of Modena Costs. Within [***] days after the end of [***], Modena shall provide Merck with a [***] summary statement (with supporting documentation [***] of the Modena Development Costs, Modena Commercialization Costs and Costs of Goods Sold incurred by or on behalf of Modena (or its Affiliate or Sublicensee) in such [***], as applicable for Financial PCVs (each, a “Modena Costs Report”). [***]

5. Reporting of Net Sales. On a [***] basis, Modena will provide to Merck an estimate of gross sales and Net Sales in U.S. dollars during the prior [***] of such Financial PCVs and units of such Financial PCV sold during such period according to Modena’s sales reporting system, which will be consistent with the financial planning, accounting and reporting procedures set forth in this Exhibit E. Each such report will be provided as early as possible, but no later than [***] days after the last day of the [***] in question, and will separately provide [***] figures. The Parties understand that all Net Sales of Financial PCVs will be booked in accordance with GAAP and otherwise in accordance with the definition of Net Sales.

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6. **Recording of Costs; Reports.** All Moderna Development Costs, Cost of Goods Sold and Moderna Commercialization Costs pursuant to this Exhibit E shall be recorded and reported consistent with GAAP (except [***]), consistently applied.

7. [***]
   {***}

8. [***]
   (a) [***]
   (b) {***}
   (c) {***}
   (d) {***}
   (e) {***}
   (f) {***}

9. [***]

10. [***]

11. **Credit Against Profits Mechanism.** The Credit Against Profits Mechanism with respect to the Non-Participation PCV Net Profit Share shall operate as follows:
   
   11.1 [***]
   11.2 {***}
   11.3 [***]

12. [***]
   12.1 [***]
   12.1.1 [***]
   12.1.2 [***]
13. [***]

13.1 [***]

B. Merck Cessation of Collaboration Activities for the PCV Program

The provisions of this Section B of Exhibit E (i.e., Paragraphs 14-15 of this Exhibit E) shall apply only to Financial PCVs.


14.1 In the event of a Merck Cessation Election for the PCV Program pursuant to Section 10.10 of the Agreement, subject to the remainder of this Exhibit E[***], for each [***] following the effective date of the Merck Cessation Election for the PCV Program, Merck shall be entitled to [***] (the “PCV Cessation Net Profit Share”).

14.2 [***]

14.2.1 [***]

14.2.2 [***]

14.2.3 [***]

14.3 [***]

15. General. The provisions of Paragraphs 2 through 13 of this Exhibit E shall apply to the PCV Cessation Net Profit Share, mutatis mutandis; [***].

C. Merck Non-Participation for a Given Joint SAV Program

The provisions of this Section C of Exhibit E (i.e., Paragraph 16 of this Exhibit E) shall apply only to Financial SAVs and shall be calculated on a Joint SAV Program-by-Joint SAV Program basis.

16. Allocation of Moderna Net Profits and Costs

16.1 In the event of a Merck Non-Participation for a given Joint SAV Program pursuant to Section 3.7(a) of the Agreement, subject to [***] this Exhibit E, Merck shall be entitled to [***] of Moderna Net Profits of Financial SAVs for a given [***] up to an aggregate amount equal to the Merck SAV Program Costs for such Joint SAV Program (at which point, such SAVs for such Joint SAV Program shall cease to be Financial SAVs with no further action required by either Party)[***] (the “Non-Participation SAV Net Profit Share”).

16.2 General. Paragraphs 2 through 13 of this Exhibit E shall apply to a given Joint SAV Program and the Financial SAVs, mutatis mutandis.
D. Merck Cessation of Collaboration Activities for a Given SAV Program

The provisions of this Section D of Exhibit E (i.e., Paragraph 17 of this Exhibit E) shall apply only to Financial SAVs and shall be calculated on a Joint SAV Program-by-Joint SAV Program basis.

17. Allocation of Moderna Net Profits and Costs

17.1 In the event of a Merck Cessation Election for a given Joint SAV Program pursuant to Section 10.10 of the Agreement, then, for each subsequent year following the effective date of the Merck Cessation Election for such Joint SAV Program, Merck shall be entitled to the Moderna Net Profits of Financial SAVs for a given SAV up to an aggregate amount equal to the Merck SAV Program Costs (at which point, such SAVs for such Joint SAV Program shall cease to be Financial SAVs with no further action required by either Party; the “SAV Cessation Capped Net Profit Share”).

17.2 In the event of a Merck Cessation Election for a given Joint SAV Program pursuant to Section 10.10 of the Agreement, Merck shall be entitled to a portion of Moderna Net Profits of Financial SAVs for a given SAV (each “SAV Cessation Net Profit Share”).

17.3 In the event of a Merck Cessation Election for a given Joint SAV Program pursuant to Section 10.10 of the Agreement, then, for each subsequent year following the effective date of the Merck Cessation Election for such Joint SAV Program, Merck shall be entitled to a portion of Moderna Net Profits of Financial SAVs for a given SAV (each, a “SAV Cessation Net Profit Share” and together with each SAV Cessation Capped Net Profit Share and each SAV Cessation Net Profit Share, the “SAV Cessation Net Profit Share”).

17.4 SAV Cessation Net Profit Share Term. Payments to Merck related to the Moderna Net Profits of Financial SAVs under Paragraphs 17.1, 17.2 or 17.3 of this Exhibit E shall be payable following the effective date of the Merck Cessation Election, on the Moderna Net Profits of Financial SAVs and shall continue until the last day of the month following the effective date of the expiration of the Agreement.

17.5 General. Paragraph 2-13, 14.2 of this Exhibit E shall apply to a given Joint SAV Program and the Financial SAVs, mutatis mutandis; [***].

E. Business Combination.

[***]
1 Third Party In-Licenses.

(a) Moderna Pre-Existing In-Licenses. Promptly following the Amended Effective Date, the Parties shall discuss in good faith whether any Patents or Know-How in-licensed under a Moderna Pre-Existing In-License should be made available for use by the Parties, on a Program-by-Program basis, for the performance of Collaboration Activities under this Agreement, including the Research, Development, Manufacture or Commercialization of a Collaboration Product with respect to such Program pursuant to the terms of this Agreement and, if the Parties mutually agree in writing, then, subject to and in accordance with the terms of this Agreement and to the extent permitted under the applicable Moderna Pre-Existing In-License, the Patents and Know-How in-licensed under such Moderna Pre-Existing In-License shall be deemed to be Moderna Technology with respect to such Program and such Moderna Pre-Existing In-License shall be deemed an “Included Moderna Pre-Existing In-License” with respect to such Program.

(b) Moderna New In-Licenses.

(i) Negotiation and Disclosure of Moderna New In-Licenses. After the Amended Effective Date, if Moderna identifies any Patents or Know-How of a Third Party to which Moderna (and its Affiliates) does not have rights and that may be[***] for the performance of existing or future Collaboration Activities under this Agreement, including for the Research, Development, Manufacture or Commercialization of mRNA Cancer Vaccines pursuant to the terms of this Agreement, Moderna may independently negotiate and enter into an agreement to obtain a license or other rights to such Patents or Know-How (each such agreement, a “Moderna New In-License”); provided that (1) Moderna will[***] and (2) Moderna will use[***]. If Moderna (or its Affiliate) enters into such a Moderna New In-License, Moderna will disclose to Merck the terms of such Moderna New In-License (including by providing a copy of such Moderna New In-License to Merck), subject to applicable confidentiality obligations and reasonable redaction of provisions that do not relate to the potential use of Patents and Know-How in-licensed under such Moderna New In-License for the performance by the Parties of such existing or future Collaboration Activities, including the Research, Development, Manufacture or Commercialization of any mRNA Cancer Vaccines, and otherwise provide Merck with[***] to assess whether or not any Patents or Know-How in-licensed under such Moderna New In-License should made available for use as set forth herein.

(ii) Included Moderna New In-Licenses. Subject to Section 1(d) of this Exhibit F, if the Parties mutually agree in writing that any Patents or Know-How in-licensed under a given Moderna New In-License should be made available for use by the Parties for the performance of any Collaboration Activities under this Agreement with respect to any Program, including for the Research, Development, Manufacture or Commercialization of any Collaboration Product subject to and in accordance with the terms of this Agreement and to the extent permitted under such Moderna New In-License, then such Patents or Know-How, as applicable, will be deemed Moderna Technology with respect to such Program (but subject to
and such Moderna New In-License shall be deemed an “Included Moderna New In-License” with respect to such Program. If the Parties cannot agree whether any Patent or Know-How licensed to Moderna or its Affiliate pursuant a Moderna New In-License should be made available for use by either Party for the performance of Collaboration Activities, or made available for the Research, Development, Manufacture or Commercialization of any Collaboration Product, in each case, pursuant to the terms of this Agreement then (1) the Patents and Know-How in-licensed under such Moderna New In-License [***], (2) such Moderna New In-License [***], (3) [***], (4) Merck will not [***], and (5) Merck will have no [***].

(c) **Merck In-Licenses.** In the event that, during the Collaboration Term for a given Program, Merck identifies any Patents or Know-How of a Third Party to which Merck (and its Affiliates) does not have rights and that may be [***] for the performance of Collaboration Activities under this Agreement for such Program, including the Research, Development, Manufacture or Commercialization of any Collaboration Product as a part of such Program pursuant to this Agreement, Merck may independently negotiate and enter into an agreement to obtain a license or other rights to such Patents or Know-How (each such agreement, a “Merck In-License”) provided that (1) Merck will [***] and (2) Merck will use [***]. In addition, if Merck (or its Affiliates) has other Patents or Know-How that may be [***] for the performance of Collaboration Activities for a given Program under this Agreement, including the Research, Development, Manufacture or Commercialization of any Collaboration Product pursuant to this Agreement and that Merck desires to bring into the Collaboration for such Program, such Patents or Know-How are licensed to Merck (or its Affiliate) from a Third Party pursuant to an agreement between Merck (or its Affiliate) and such Third Party (even if the agreement with the Third Party was entered into prior to the Effective Date), then, such agreement shall also be considered a “Merck In-License”. Solely to the extent Merck determines that the rights in-licensed under a Merck In-License should be made available for use by the Parties for the performance of Collaboration Activities for a given Program under this Agreement, including for the Research, Development, Manufacture or Commercialization of any Collaboration Product pursuant to this Agreement, Merck will provide Moderna written notice thereof, which written notice shall include the terms of such Merck In-License, subject to applicable confidentiality obligations and reasonable redaction of provisions that do not relate to the potential use of Patents and Know-How in-licensed under such Merck In-License for the performance by the Parties of such Collaboration Activities with respect to a Program, including the Research, Development, Manufacture or Commercialization of any Collaboration Product as a part of such Program, and otherwise provide Moderna with [***] to assess whether or not any Patents or Know-How in-licensed under such Merck In-License should be made available for use as set forth herein. Following Moderna’s receipt of such notice from Merck disclosing a given Merck In-License, the Parties shall discuss in good faith whether any Patents or Know-How in-licensed under such Merck In-License should be made available for use by the Parties for the performance of Collaboration Activities with respect to a Program under this Agreement, including for the Research, Development, Manufacture or Commercialization of any Collaboration Product as a Party of such Program and, if the Parties mutually agree in writing, then, in each case, pursuant to the terms of this Agreement and to the extent permitted under the applicable Merck In-License, then such Patents and Know-How, as applicable, shall be deemed to be Merck Technology and such Merck In-License shall be deemed an “Included Merck In-License”.

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(d) **Permitted In-Licenses.** Notwithstanding anything to the contrary set forth herein, in the event that, during the POC Term for a given Program, to the extent Moderna reasonably determines that any Patents or Know-How in-licensed under a given Moderna New In-License [***] (such Moderna New In-License, a “Permitted In-License”) should be made available for use by either Party for the performance of Collaboration Activities for such Program, including for the Research, Development, Manufacture or Commercialization of any Collaboration Product as a part of such Program under this Agreement, subject to and in accordance with the terms of this Agreement and to the extent permitted under such Permitted In-License, then Moderna shall notify Merck in writing, which notice shall include a copy of the applicable Permitted In-License (subject to confidentiality obligations and reasonable redaction) and specifically identify the applicable Patents or Know-How to be made available for use by the Parties for such use and, upon Merck’s receipt of such notice, then such Patents or Know-How (as applicable) will be deemed Moderna Technology (subject to any limitations set forth in such Permitted In-License as disclosed by Moderna in such notice to Merck) with respect to such Program and such Permitted In-License shall be deemed an “Included Permitted In-License” with respect to such Program, unless [***].

(e) **Included In-License Requirements.**

(i) **Scope.** The sublicenses granted under any Included In-License (and further rights to sublicense) shall be [***].

(ii) **Sublicense Party.** Each Party will abide, and will cause all its Affiliates and applicable Sublicensees to abide, by all requirements of each Included In-License under which it is granted a sublicense hereunder (including with respect to the Research, Development, Manufacture or Commercialization of any Collaboration Products) in all material respects [***], to the extent applicable to sublicensees thereunder and to the extent disclosed by the contracting Party to the other Party pursuant to Section 1(b), Section 1(c) or Section 1(d) of this Exhibit F, as applicable, prior to the Parties’ determination as to whether such In-License should be an Included In-License, with the understanding that disclosure by a Party of any In-License to the other Party will be deemed disclosure of such requirements of such In-License so disclosed to such other Party.

(iii) **Maintenance of Included In-Licenses.** The contracting Party to any Included In-License (the “Contracting Party”) (A) will duly perform and observe all of its obligations under such Included In-Licenses in all material respects and maintain in full force and effect such Included In-License and (B) will not, without the other Party’s prior written consent (such consent not to be unreasonably withheld, conditioned or delayed), [***] in each case ((A) and (B)) to the extent such action [***] would reasonably be expected to materially adversely affect the Research, Development, Manufacture or Commercialization of any Collaboration Product hereunder or the rights of the other Party under this Agreement. The Contracting Party to any Included In-License will provide the other Party with written notice as promptly as practicable after becoming aware of any of the following: [***]. If the Contracting Party fails to pay any amounts due under such Included In-License and if such nonpayment would permit the counterparty to such Included In-License to terminate or suspend the same or any rights thereunder, then, to the extent permitted under the Included In-License, the other Party will have the right, but not the obligation, in its sole discretion, to pay such amounts on the
Contracting Party’s behalf, and any amounts so paid by the other Party may, to the extent that, as between the Parties, the Contracting Party is responsible for payment of such amounts in accordance with Section 2 and Section 3 of this **Exhibit F**, be taken by such other Party as [***].

(f) [***]

(g) [***]

2 Upfront Payments for New In-Licenses.

(a) [***] The Parties acknowledge that if the Contracting Party to a given New In-License has, prior to the date that such New In-License becomes an Included In-License hereunder, paid to the licensor party thereto an upfront fee or other license fee to acquire rights to the applicable Included In-License IP (an “In-License Upfront Payment”), then, prior to including such New In-License as an Included In-License hereunder, the Parties will agree on [***] of such In-License Upfront Payment [***].

(b) [***] In addition to [***] set forth in Section 2(a) of this **Exhibit F**, prior to including such In-License as an Included In-License hereunder, the Parties will agree on [***].

3 Included In-License Payments. Except as set forth above in Section 2 of this **Exhibit F**:

(a) **POC Program**. With respect to a given POC Program, if and to the extent that any Included In-License Payments become due during the POC Term for such POC Program, the Contracting Party will pay the same; provided that, (1) if Merck exercises the Merck Participation Election for such POC Program, then the amount(s) of any [***], will, in each case [***], as of the Merck Participation Election Date for such Program at Merck’s election, be deemed [***], unless the non-Contracting Party elects to [***], and (2) if Merck does not exercise the Merck Participation Election for such POC Program, then [***] Program will, in each case [***].

(b) **Joint Development Programs – Allowable Development Costs**. If and to the extent that any Included In-License Payment becomes due with respect to activities under a Joint Development Program or an Additional Research Plan, the Contracting Party will pay the same, and such amount will be [***].

(c) **Independent Additional Studies**. If and to the extent that any Included In-License Payment becomes due with respect to activities under an Independent Additional Study Development Plan, the Party sponsoring or conducting such Independent Additional Study will pay the same, and such amount will be [***].

(d) **Commercialization**. If and to the extent that any Included In-License Payment becomes due with respect to the performance of Commercialization Activities in the Territory, the Contracting Party will pay the same and such payment will be treated as [***].

(e) **Manufacturing**. If and to the extent that any Included In-License Payment becomes due with respect to Manufacturing activities undertaken pursuant to the activities described in clause (a), (b), (c) or (d) above, then the Parties’ respective responsibilities for such Included In-License Payment will be as set forth in such clause (a), (b), (c) or (d), as applicable.
EXHIBIT G

Confidential CMC Document Review Procedures

1. In connection with any review conducted pursuant to Section 6.1(d), the Merck Representatives (as defined below) shall have the right to review (***)(i) Confidential CMC Data or (ii) (***) (collectively, "Confidential CMC Documents"), solely for the purposes of assisting Merck in determining (***). Merck’s participation in any such review of Confidential CMC Documents is strictly limited to the Merck Representatives. In no event will Merck permit any Merck personnel other than the Merck Representatives to participate in any such review of any Confidential CMC Documents. For the purposes of this Exhibit G, “Merck Representatives” shall mean Merck employees that (***).

2. At Merck’s election, Confidential CMC Documents (***) for review pursuant to this Exhibit G will be made available for review by the Merck Representatives either in (***).

3. (***)

4. Except as otherwise set forth herein, in no event will (a) the Merck Representatives disclose or make available (directly or indirectly) any information learned from such review of, or otherwise pertaining to, the Confidential CMC Documents to anyone other than providing to Merck’s (or its Affiliate’s) employees that (***), and (b) any Merck personnel who have received or who have access to (directly or indirectly) any such information pursuant to this Exhibit G use such information for any purpose other than to (***). Merck will ensure that any such individual having access to such information will be made aware of its highly confidential nature and will cause such individuals to comply with this Exhibit G.

G-1
To the extent there is a technology transfer, such technology transfer shall include the following: [***]

H-1
EXHIBIT I

Form Press Release

(See attached)

I-1
CONFIDENTIAL

Not For Distribution

Moderna and Merck Expand mRNA Cancer Vaccines Collaboration

Expansion Includes the Joint Development of Moderna’s KRAS Oncogene Program and Other Potential mRNA Cancer Vaccines; Merck Makes Equity Investment in Moderna

CAMBRIDGE, Mass. and KENILWORTH N.J. April __, 2018 — Moderna Therapeutics and Merck (NYSE:MRK), known as MSD outside the United States and Canada, today announced an expansion of their 2016 collaboration to develop and commercialize novel personalized messenger RNA (mRNA) cancer vaccines to now include shared antigen mRNA cancer vaccines including mRNA-5671, Moderna’s mRNA KRAS cancer vaccine.

Moderna developed mRNA-5671 starting in 2017. The two companies will now advance jointly mRNA-5671 in human studies and plan to conduct combination studies with additional immuno-oncology therapies.

“Augmentation of immune responses offers great promise in cancer therapy, as our work with the PD-1-specific antibody KEYTRUDA has shown,” said Dr. Roger M. Perlmutter, President, Merck Research Laboratories. “We now look forward to expanding our exploration of mRNA cancer vaccines, working in concert with our colleagues at Moderna.”

Under the expanded agreement, Merck will be responsible for clinical development of mRNA-5671 and associated costs while Moderna will be responsible for clinical supply and associated costs. Following the completion of human proof-of-concept (hPOC) studies, Merck may opt-in on further development and commercialization of mRNA-5671 upon payment of an undisclosed fee to Moderna. Following opt-in, the parties will share equally the global net profits and costs associated with mRNA-5671. As part of this agreement, the parties may also initiate and collaborate on other shared antigen mRNA cancer vaccines programs. In addition, Merck made a $125 million investment in preferred equity in a newly priced series H round of financing. Moderna closed a $500 million series G round earlier this year.

“We are excited to advance our novel mRNA KRAS cancer vaccine approach with Merck, which further extends our mRNA platform in immuno-oncology,” said Stephane Bancel, Moderna’s Chief Executive Officer. “Along with our initial collaboration to take on the challenge of transforming the treatment of cancer by combining Merck’s KEYTRUDA with Moderna’s mRNA-based personalized cancer vaccines, we believe there is a real opportunity to also pursue a shared cancer vaccine to specifically target patients with KRAS mutations.”
KRAS is one of the most frequently mutated oncogenes in human cancer, occurring in approximately 30 percent of certain cancer types. KRAS mutations are found principally in non-small cell lung cancer (NSCLC), colorectal cancer and pancreatic cancer, and are associated with worse outcomes. Hotspots of KRAS mutations are found in different tumor types and can serve as tumor rejection epitopes. Presentation of these epitopes to the immune system may elicit an anti-tumor response. mRNA-5671 encodes for the four most commonly found KRAS mutations, and is designed to target most of the KRAS mutations that occur in NSCLC, colorectal cancer and pancreatic cancer.

The Moderna KRAS mRNA program utilizes tumor sequencing to identify suitable patients with specific mutations in KRAS in order to personalize their therapy, and complements the other personalized mRNA cancer vaccines in the collaboration.

**About the Updated Collaboration**

The alliance further builds on an initial strategic collaboration agreed to in June 2016 to jointly develop personalized mRNA cancer vaccines, combining Merck’s established leadership in immuno-oncology with Moderna’s pioneering mRNA vaccine platform and GMP manufacturing capabilities, to advance individually tailored cancer vaccines for patients across a spectrum of cancers. Merck made an upfront cash payment to Moderna of $200 million, which Moderna is using to lead all research and development efforts through proof of concept.

In November, 2017 the companies announced a key milestone with the first-in-human dosing of mRNA-4157, an mRNA personalized cancer vaccine. The Phase 1 open-label, dose escalation, multicenter study in the United States (KEYNOTE-603) will assess the safety, tolerability and immunogenicity of mRNA-4157 alone in subjects with resected solid tumors and in combination with KEYTRUDA® (pembrolizumab), an anti-PD-1 therapy, in subjects with unresectable solid tumors.

**About KEYTRUDA® (pembrolizumab) Injection 100mg**

KEYTRUDA is an anti-PD-1 therapy that works by increasing the ability of the body’s immune system to help detect and fight tumor cells. KEYTRUDA is a humanized monoclonal antibody that blocks the interaction between PD-1 and its ligands, PD-L1 and PD-L2, thereby activating T lymphocytes which may affect both tumor cells and healthy cells.

Merck has the industry’s largest immuno-oncology clinical research program, which currently involves more than 700 trials studying KEYTRUDA across a wide variety of cancers and treatment settings. The KEYTRUDA clinical program seeks to understand the role of KEYTRUDA across cancers and the factors that may predict a patient’s likelihood of benefitting from treatment with KEYTRUDA, including exploring several different biomarkers.

**KEYTRUDA® (pembrolizumab) Indications and Dosing**

**Melanoma**

KEYTRUDA is indicated for the treatment of patients with unresectable or metastatic melanoma at a fixed dose of 200 mg every three weeks until disease progression or unacceptable toxicity.

**Lung Cancer**

KEYTRUDA, as a single agent, is indicated for the first-line treatment of patients with metastatic non-small cell lung cancer (NSCLC) whose tumors have high PD-L1 expression [tumor proportion score (TPS) ≥50%] as determined by an FDA-approved test, with no EGFR or ALK genomic tumor aberrations.
KEYTRUDA, as a single agent, is also indicated for the treatment of patients with metastatic NSCLC whose tumors express PD-L1 (TPS ≥ 1%) as determined by an FDA-approved test, with disease progression on or after platinum-containing chemotherapy. Patients with EGFR or ALK genomic tumor aberrations should have disease progression on FDA-approved therapy for these aberrations prior to receiving KEYTRUDA.

KEYTRUDA, in combination with pemetrexed and carboplatin, is indicated for the first-line treatment of patients with metastatic nonsquamous NSCLC. This indication is approved under accelerated approval based on tumor response rate and progression-free survival. Continued approval for this indication may be contingent upon verification and description of clinical benefit in the confirmatory trials.

In metastatic NSCLC, KEYTRUDA is administered at a fixed dose of 200 mg every three weeks until disease progression, unacceptable toxicity, or up to 24 months in patients without disease progression.

When administering KEYTRUDA in combination with chemotherapy, KEYTRUDA should be administered prior to chemotherapy when given on the same day. See also the Prescribing Information for pemetrexed and carboplatin.

**Head and Neck Cancer**

KEYTRUDA is indicated for the treatment of patients with recurrent or metastatic head and neck squamous cell carcinoma (HNSCC) with disease progression on or after platinum-containing chemotherapy. This indication is approved under accelerated approval based on tumor response rate and durability of response. Continued approval for this indication may be contingent upon verification and description of clinical benefit in the confirmatory trials. In HNSCC, KEYTRUDA is administered at a fixed dose of 200 mg every three weeks until disease progression, unacceptable toxicity, or up to 24 months in patients without disease progression.

**Classical Hodgkin Lymphoma**

KEYTRUDA is indicated for the treatment of adult and pediatric patients with refractory classical Hodgkin lymphoma (cHL), or who have relapsed after three or more prior lines of therapy. This indication is approved under accelerated approval based on tumor response rate and durability of response. Continued approval for this indication may be contingent upon verification and description of clinical benefit in the confirmatory trials. In adults with cHL, KEYTRUDA is administered at a fixed dose of 200 mg every three weeks until disease progression or unacceptable toxicity, or up to 24 months in patients without disease progression. In pediatric patients with cHL, KEYTRUDA is administered at a dose of 2 mg/kg (up to a maximum of 200 mg) every three weeks until disease progression or unacceptable toxicity, or up to 24 months in patients without disease progression.

**Urothelial Carcinoma**

KEYTRUDA is indicated for the treatment of patients with locally advanced or metastatic urothelial carcinoma who are not eligible for cisplatin-containing chemotherapy. This indication is approved under accelerated approval based on tumor response rate and duration of response. Continued approval for this indication may be contingent upon verification and description of clinical benefit in the confirmatory trials.

KEYTRUDA is also indicated for the treatment of patients with locally advanced or metastatic urothelial carcinoma who have disease progression during or following platinum-containing chemotherapy or within 12 months of neoadjuvant or adjuvant treatment with platinum-containing chemotherapy.
In locally advanced or metastatic urothelial carcinoma, KEYTRUDA is administered at a fixed dose of 200 mg every three weeks until disease progression or unacceptable toxicity, or up to 24 months in patients without disease progression.

**Microsatellite Instability-High (MSI-H) Cancer**

KEYTRUDA is indicated for the treatment of adult and pediatric patients with unresectable or metastatic microsatellite instability-high (MSI-H) or mismatch repair deficient (dMMR)

- solid tumors that have progressed following prior treatment and who have no satisfactory alternative treatment options, or
- colorectal cancer that has progressed following treatment with fluoropyrimidine, oxaliplatin, and irinotecan.

This indication is approved under accelerated approval based on tumor response rate and durability of response. Continued approval for this indication may be contingent upon verification and description of clinical benefit in the confirmatory trials. The safety and effectiveness of KEYTRUDA in pediatric patients with MSI-H central nervous system cancers have not been established.

In adult patients with MSI-H cancer, KEYTRUDA is administered at a fixed dose of 200 mg every three weeks until disease progression, unacceptable toxicity, or up to 24 months in patients without disease progression. In children with MSI-H cancer, KEYTRUDA is administered at a dose of 2 mg/kg (up to a maximum of 200 mg) every three weeks until disease progression or unacceptable toxicity, or up to 24 months in patients without disease progression.

**Gastric Cancer**

KEYTRUDA is indicated for the treatment of patients with recurrent locally advanced or metastatic gastric or gastroesophageal junction (GEJ) adenocarcinoma whose tumors express PD-L1 [Combined Positive Score (CPS) ≥1] as determined by an FDA-approved test, with disease progression on or after two or more prior lines of therapy including fluoropyrimidine- and platinum-containing chemotherapy and if appropriate, HER2/neu-targeted therapy. This indication is approved under accelerated approval based on tumor response rate and durability of response. Continued approval for this indication may be contingent upon verification and description of clinical benefit in the confirmatory trials. The recommended dose of KEYTRUDA is 200 mg every three weeks until disease progression, unacceptable toxicity, or up to 24 months in patients without disease progression.

**Selected Important Safety Information for KEYTRUDA®**

KEYTRUDA can cause immune-mediated pneumonitis, including fatal cases. Pneumonitis occurred in 94 (3.4%) of 2799 patients receiving KEYTRUDA, including Grade 1 (0.8%), 2 (1.3%), 3 (0.9%), 4 (0.3%), and 5 (0.1%) pneumonitis, and occurred more frequently in patients with a history of prior thoracic radiation (6.9%) compared to those without (2.9%). Monitor patients for signs and symptoms of pneumonitis. Evaluate suspected pneumonitis with radiographic imaging. Administer corticosteroids for Grade 2 or greater pneumonitis. Withhold KEYTRUDA for Grade 2; permanently discontinue KEYTRUDA for Grade 3 or 4 pneumonitis.

KEYTRUDA can cause immune-mediated colitis. Colitis occurred in 48 (1.7%) of 2799 patients receiving KEYTRUDA, including Grade 2 (0.4%), 3 (1.1%), and 4 (<0.1%) colitis. Monitor patients for signs and symptoms of colitis. Administer corticosteroids for Grade 2 or greater colitis. Withhold KEYTRUDA for Grade 2 or 3; permanently discontinue KEYTRUDA for Grade 4 colitis.

KEYTRUDA can cause immune-mediated hepatitis. Hepatitis occurred in 19 (0.7%) of 2799 patients receiving KEYTRUDA, including Grade 2 (0.1%), 3 (0.4%), and 4 (<0.1%) hepatitis. Monitor patients for changes in liver function. Administer corticosteroids for Grade 2 or greater hepatitis and, based on severity of liver enzyme elevations, withhold or discontinue KEYTRUDA.
KEYTRUDA can cause hypophysitis. Hypophysitis occurred in 17 (0.6%) of 2799 patients receiving KEYTRUDA, including Grade 2 (0.2%), 3 (0.3%), and 4 (<0.1%) hypophysitis. Monitor patients for signs and symptoms of hypophysitis (including hypopituitarism and adrenal insufficiency). Administer corticosteroids and hormone replacement as clinically indicated. Withhold KEYTRUDA for Grade 2; withhold or discontinue for Grade 3 or 4 hypophysitis.

KEYTRUDA can cause thyroid disorders, including hyperthyroidism, hypothyroidism, and thyroiditis. Hyperthyroidism occurred in 96 (3.4%) of 2799 patients receiving KEYTRUDA, including Grade 2 (0.8%) and 3 (0.1%) hyperthyroidism. Hypothyroidism occurred in 237 (8.5%) of 2799 patients receiving KEYTRUDA, including Grade 2 (6.2%) and 3 (0.1%) hypothyroidism. The incidence of new or worsening hypothyroidism was higher in patients with HNSCC, occurring in 28 (15%) of 192 patients with HNSCC, including Grade 3 (0.5%) hypothyroidism. Thyroiditis occurred in 16 (0.6%) of 2799 patients receiving KEYTRUDA, including Grade 2 (0.3%) thyroiditis. Monitor patients for changes in thyroid function (at the start of treatment, periodically during treatment, and as indicated based on clinical evaluation) and for clinical signs and symptoms of thyroid disorders. Administer replacement hormones for hypothyroidism and manage hyperthyroidism with thionamides and beta-blockers as appropriate. Withhold or discontinue KEYTRUDA for Grade 3 or 4 hyperthyroidism.

KEYTRUDA can cause type 1 diabetes mellitus, including diabetic ketoacidosis, which have been reported in 6 (0.2%) of 2799 patients. Monitor patients for hyperglycemia or other signs and symptoms of diabetes. Administer insulin for type 1 diabetes, and withhold KEYTRUDA and administer antihyperglycemics in patients with severe hyperglycemia.

KEYTRUDA can cause immune-mediated nephritis. Nephritis occurred in 9 (0.3%) of 2799 patients receiving KEYTRUDA, including Grade 2 (0.1%), 3 (0.1%), and 4 (<0.1%) nephritis. Monitor patients for changes in renal function. Administer corticosteroids for Grade 2 or greater nephritis. Withhold KEYTRUDA for Grade 2; permanently discontinue KEYTRUDA for Grade 3 or 4 nephritis.

Immune-mediated rashes, including Stevens-Johnson syndrome (SJS), toxic epidermal necrolysis (TEN) (some cases with fatal outcome), exfoliative dermatitis, and bullous pemphigoid, can occur. Monitor patients for suspected severe skin reactions and based on the severity of the adverse reaction, withhold or permanently discontinue KEYTRUDA and administer corticosteroids. For signs or symptoms of SJS or TEN, withhold KEYTRUDA and refer the patient for specialized care for assessment and treatment. If SJS or TEN is confirmed, permanently discontinue KEYTRUDA.

KEYTRUDA can cause other clinically important immune-mediated adverse reactions. These immune-mediated reactions may occur in any organ system. For suspected immune-mediated adverse reactions, ensure adequate evaluation to confirm etiology or exclude other causes. Based on the severity of the adverse reaction, withhold KEYTRUDA and administer corticosteroids. Upon improvement to Grade 1 or less, initiate corticosteroid taper and continue to taper over at least 1 month. Based on limited data from clinical studies in patients whose immune-related adverse reactions could not be controlled with corticosteroid use, administration of other systemic immunosuppressants can be considered. Resume KEYTRUDA when the adverse reaction remains at Grade 1 or less following corticosteroid taper. Permanently discontinue KEYTRUDA for any Grade 3 immune-mediated adverse reaction that recurs and for any life-threatening immune-mediated adverse reaction.

The following clinically significant immune-mediated adverse reactions occurred in less than 1% (unless otherwise indicated) of 2799 patients: arthritis (1.5%), uveitis, myositis, Guillain-Barré syndrome, myasthenia gravis, vasculitis, pancreatitis, hemolytic anemia, and partial seizures arising in a patient with inflammatory foci in brain parenchyma. In addition, myelitis and myocarditis were reported in other clinical trials, including classical Hodgkin lymphoma, and postmarketing use.
Solid organ transplant rejection has been reported in postmarketing use of KEYTRUDA. Treatment with KEYTRUDA may increase the risk of rejection in solid organ transplant recipients. Consider the benefit of treatment with KEYTRUDA vs the risk of possible organ rejection in these patients.

KEYTRUDA can cause severe or life-threatening infusion-related reactions, including hypersensitivity and anaphylaxis, which have been reported in 6 (0.2%) of 2799 patients. Monitor patients for signs and symptoms of infusion-related reactions, including rigors, chills, wheezing, pruritus, flushing, rash, hypotension, hypoxemia, and fever. For Grade 3 or 4 reactions, stop infusion and permanently discontinue KEYTRUDA.

Immune-mediated complications, including fatal events, occurred in patients who underwent allogeneic hematopoietic stem cell transplantation (HSCT) after being treated with KEYTRUDA. Of 23 patients with cHL who proceeded to allogeneic HSCT after treatment with KEYTRUDA on any trial, 6 patients (26%) developed graft-versus-host disease (GVHD), one of which was fatal, and 2 patients (9%) developed severe hepatic veno-occlusive disease (VOD) after reduced-intensity conditioning, one of which was fatal. Cases of fatal hyperacute GVHD after allogeneic HSCT have also been reported in patients with lymphoma who received a PD-1 receptor-blocking antibody before transplantation.

These complications may occur despite intervening therapy between PD-1 blockade and allogeneic HSCT. Follow patients closely for early evidence of transplant-related complications such as hyperacute GVHD, severe (Grade 3 to 4) acute GVHD, steroid-requiring febrile syndrome, hepatic VOD, and other immune-mediated adverse reactions, and intervene promptly.

In clinical trials in patients with multiple myeloma, the addition of KEYTRUDA to a thalidomide analogue plus dexamethasone resulted in increased mortality. Treatment of these patients with a PD-1 or PD-L1 blocking antibody in this combination is not recommended outside of controlled clinical trials.

Based on its mechanism of action, KEYTRUDA can cause fetal harm when administered to a pregnant woman. If used during pregnancy, or if the patient becomes pregnant during treatment, apprise the patient of the potential hazard to a fetus. Advise females of reproductive potential to use highly effective contraception during treatment and for 4 months after the last dose of KEYTRUDA.

In KEYNOTE-006, KEYTRUDA was discontinued due to adverse reactions in 9% of 555 patients with advanced melanoma; adverse reactions leading to discontinuation in more than one patient were colitis (1.4%), autoimmune hepatitis (0.7%), allergic reaction (0.4%), polyneuropathy (0.4%), and cardiac failure (0.4%). Adverse reactions leading to interruption of KEYTRUDA occurred in 21% of patients; the most common (21%) was diarrhea (2.5%). The most common adverse reactions with KEYTRUDA vs ipilimumab were fatigue (28% vs 28%), diarrhea (26% with KEYTRUDA), rash (24% vs 23%), and nausea (21% with KEYTRUDA). Corresponding incidence rates are listed for ipilimumab only for those adverse reactions that occurred at the same or lower rate than with KEYTRUDA.

In KEYNOTE-010, KEYTRUDA monotherapy was discontinued due to adverse reactions in 8% of 682 patients with metastatic NSCLC. The most common adverse event resulting in permanent discontinuation of KEYTRUDA was pneumonitis (1.8%). Adverse reactions leading to interruption of KEYTRUDA occurred in 23% of patients; the most common (21%) were diarrhea (1%), fatigue (1.3%), pneumonia (1%), liver enzyme elevation (1.2%), decreased appetite (1.3%), and pneumonitis (1%). The most common adverse reactions occurring in at least 20% of patients and at a higher incidence than with docetaxel were decreased appetite (25% vs 23%), dyspnea (23% vs 20%), and nausea (20% vs 18%).

In KEYNOTE-021(G1), when KEYTRUDA was administered in combination with carboplatin and pemetrexed (carbo/pem) in advanced nonsquamous NSCLC, KEYTRUDA was discontinued in 10% of 59 patients. The most common adverse reaction resulting in discontinuation of KEYTRUDA (2%) was acute kidney injury (3.4%). Adverse reactions leading to interruption of KEYTRUDA occurred in 39% of
In KEYNOTE-012, KEYTRUDA was discontinued due to adverse reactions in 17% of 192 patients with HNSCC. Serious adverse reactions occurred in 45% of patients. The most frequent serious adverse reactions reported in at least 2% of patients were pneumonia, dyspnea, confusional state, vomiting, pleural effusion, and respiratory failure. The most common adverse reactions (reported in at least 20% of patients) were fatigue, decreased appetite, and dyspnea. Adverse reactions occurring in patients with HNSCC were generally similar to those occurring in patients with melanoma or NSCLC, with the exception of increased incidences of facial edema (10% all Grades; 2.1% Grades 3 or 4) and new or worsening hypothyroidism.

In KEYNOTE-087, KEYTRUDA was discontinued due to adverse reactions in 5% of 210 patients with cHL, and treatment was interrupted due to adverse reactions in 26% of patients. Fifteen percent (15%) of patients had an adverse reaction requiring systemic corticosteroid therapy. Serious adverse reactions occurred in 16% of patients. The most frequent serious adverse reactions (≥1%) included pneumonia, pneumonitis, pyrexia, dyspnea, GVHD, and herpes zoster. Two patients died from causes other than disease progression; one from GVHD after subsequent allogeneic HSCT and one from septic shock. The most common adverse reactions (occurring in ≥20% of patients) were fatigue (26%), pyrexia (24%), cough (24%), musculoskeletal pain (21%), diarrhea (20%), and rash (20%).

In KEYNOTE-052, KEYTRUDA was discontinued due to adverse reactions in 11% of 370 patients with locally advanced or metastatic urothelial carcinoma. The most common adverse reactions (≥20% of patients) were fatigue (38%), musculoskeletal pain (24%), decreased appetite (22%), constipation (21%), rash (21%), and diarrhea (20%). Eighteen patients (5%) died from causes other than disease progression. Five patients (1.4%) who were treated with KEYTRUDA experienced sepsis which led to death, and 3 patients (0.8%) experienced pneumonia which led to death. Adverse reactions leading to interruption of KEYTRUDA occurred in 22% of patients; the most common (≥1%) were liver enzyme increase, diarrhea, urinary tract infection, acute kidney injury, fatigue, joint pain, and pneumonia. Serious adverse reactions occurred in 42% of patients, the most frequent (≥2%) of which were urinary tract infection, hematuria, acute kidney injury, pneumonia, and urosepsis.

In KEYNOTE-045, KEYTRUDA was discontinued due to adverse reactions in 8% of 266 patients with locally advanced or metastatic urothelial carcinoma. The most common adverse reaction resulting in permanent discontinuation of KEYTRUDA was pneumonitis (1.9%). Adverse reactions leading to interruption of KEYTRUDA occurred in 20% of patients; the most common (≥1%) were urinary tract infection (1.5%), diarrhea (1.5%), and colitis (1.1%). The most common adverse reactions ≥20% in patients who received KEYTRUDA vs those who received chemotherapy were fatigue (38% vs 56%), musculoskeletal pain (32% vs 27%), pruritus (23% vs 6%), decreased appetite (21% vs 21%), nausea (21% vs 29%), and rash (20% vs 13%). Serious adverse reactions occurred in 39% of KEYTRUDA-treated patients, the most frequent (≥2%) of which were urinary tract infection, pneumonia, anemia, and pneumonitis.
It is not known whether KEYTRUDA is excreted in human milk. Because many drugs are excreted in human milk, instruct women to discontinue nursing during treatment with KEYTRUDA and for 4 months after the final dose.

There is limited experience in pediatric patients. In a study, 40 pediatric patients (16 children aged 2 years to younger than 12 years and 24 adolescents aged 12 years to 18 years) with advanced melanoma, lymphoma, or PD-L1–positive advanced, relapsed, or refractory solid tumors were administered KEYTRUDA 2 mg/kg every 3 weeks. Patients received KEYTRUDA for a median of 3 doses (range 1–17 doses), with 34 patients (85%) receiving KEYTRUDA for 2 doses or more. The safety profile in these pediatric patients was similar to that seen in adults treated with KEYTRUDA. Toxicities that occurred at a higher rate (≥15% difference) in these patients when compared to adults under 65 years of age were fatigue (45%), vomiting (38%), abdominal pain (28%), hypertransaminasemia (28%), and hyponatremia (18%).

About Merck

For more than a century, Merck, a leading global biopharmaceutical company known as MSD outside of the United States and Canada, has been inventing for life, bringing forward medicines and vaccines for many of the world’s most challenging diseases. Through our prescription medicines, vaccines, biologic therapies and animal health products, we work with customers and operate in more than 140 countries to deliver innovative health solutions. We also demonstrate our commitment to increasing access to health care through far-reaching policies, programs and partnerships. Today, Merck continues to be at the forefront of research to advance the prevention and treatment of diseases that threaten people and communities around the world—including cancer, cardio-metabolic diseases, emerging animal diseases, Alzheimer’s disease and infectious diseases including HIV and Ebola. For more information, visit www.merck.com and connect with us on Twitter, Facebook, Instagram, YouTube and LinkedIn.

About Moderna Therapeutics

Moderna pioneers the discovery and development of messenger RNA (mRNA) therapeutics and vaccines, an entirely new class of medicines that directs the body’s cells to produce intracellular or secreted proteins that can have a therapeutic or preventive benefit for both patients and healthy individuals. With its breakthrough platform, Moderna is creating mRNA medicines for a wide range of diseases and conditions, in many cases by addressing currently undruggable targets or underserved areas of medical need. Moderna is developing its innovative mRNA medicines for infectious diseases, immuno-oncology, rare diseases, and cardiovascular diseases, through solely controlled programs and collaborations with strategic partners.

Headquartered in Cambridge, Mass., privately held Moderna currently has strategic relationships with AstraZeneca, Plc. (AZ), Merck (MRK) and Vertex Pharmaceuticals (VRTX), as well as the Defense Advanced Research Projects Agency (DARPA), an agency of the U.S. Department of Defense; the Biomedical Advanced Research and Development Authority (BARDA), a division of the Office of the Assistant Secretary for Preparedness and Response (ASPR) within the U.S. Department of Health and Human Services (HHS); and the Bill & Melinda Gates Foundation. In 2017 Moderna was ranked a top biopharma industry employer by Science Magazine and a Top Places to Work by the Boston Globe. To learn more, visit www.modernatx.com.
Forward-looking Statement of Merck & Co., Inc., Kenilworth, N.J., USA

This news release of Merck & Co., Inc., Kenilworth, N.J., USA (the “company”) includes “forward-looking statements” within the meaning of the safe harbor provisions of the U.S. Private Securities Litigation Reform Act of 1995. These statements are based upon the current beliefs and expectations of the company’s management and are subject to significant risks and uncertainties. There can be no guarantees with respect to pipeline products that the products will receive the necessary regulatory approvals or that they will prove to be commercially successful. If underlying assumptions prove inaccurate or risks or uncertainties materialize, actual results may differ materially from those set forth in the forward-looking statements.

Risks and uncertainties include but are not limited to, general industry conditions and competition; general economic factors, including interest rate and currency exchange rate fluctuations; the impact of pharmaceutical industry regulation and health care legislation in the United States and internationally; global trends toward health care cost containment; technological advances, new products and patents attained by competitors; challenges inherent in new product development, including obtaining regulatory approval; the company’s ability to accurately predict future market conditions; manufacturing difficulties or delays; financial instability of international economies and sovereign risk; dependence on the effectiveness of the company’s patents and other protections for innovative products; and the exposure to litigation, including patent litigation, and/or regulatory actions.

The company undertakes no obligation to publicly update any forward-looking statement, whether as a result of new information, future events or otherwise. Additional factors that could cause results to differ materially from those described in the forward-looking statements can be found in the company’s 2017 Annual Report on Form 10-K and the company’s other filings with the Securities and Exchange Commission (SEC) available at the SEC’s Internet site (www.sec.gov).

1.1 Composition. The IP Committee shall comprise [***] representatives of Merck and [***] representatives of Moderna. Each Party may change its representatives to the IP Committee from time to time in its sole discretion, effective upon notice to the other Party of such change. These representatives shall have appropriate expertise, seniority, decision-making authority and ongoing familiarity with the Collaboration, and each Party’s representatives collectively will have relevant expertise in intellectual property portfolio management and licensing matters. With the consent of the other Party (such consent not to be unreasonably withheld, delayed or conditioned), each Party may invite employees and consultants to attend meetings of the IP Committee, subject to their agreement to be bound to the same extent as a permitted subcontractor under Section 10.4. The IP Committee may change its size from time to time by mutual consent of its members; provided that the IP Committee will consist at all times of an equal number of representatives of each of Merck and Moderna.

1.2 Meetings. The IP Committee will meet as necessary to carry out its duties under Paragraph 1.1, but at least [***] per Calendar Quarter during the Collaboration Term, unless otherwise agreed by its members. The IP Committee will meet in-person at Moderna or Merck or, alternatively, by means of teleconference, videoconference or other similar communications equipment.

1.3 IP Committee Responsibilities. The IP Committee will provide input regarding the strategy of Prosecuting and Maintaining [***] with respect to a given Program, including the following activities:

1.3.1 [***]
1.3.2 [***]
1.3.3 [***]
1.3.4 [***]
1.3.5 [***]
1.3.6 [***]
1.3.7 [***]
1.3.8 [***]
1.3.9 [***]
1.3.10 [***]
1.4 Decision-Making Authority. The IP Committee will be an advisory committee for the Collaboration and to the Parties and will make recommendations by consensus. The IP Committee will not have any final decision-making power, and its discussions with not be subject to review or approval by the JSC.

2. Prosecution and Maintenance.

2.1 Moderna Patents.

2.1.1 Moderna General Patents and Moderna Agent Technology. Moderna shall have the sole right, but not the obligation, at its own expense and through counsel of its own choosing, to Prosecute and Maintain the Moderna General Patents and any Patents within the Moderna Agent Technology worldwide.

2.1.2 [***]

2.1.3 [***]

2.1.4 [***]

2.2 Merck Patents.

2.2.1 Merck General Patents and Merck Agent Technology. Merck shall have the sole right, but not the obligation, at its own expense and using counsel of its own choosing, to Prosecute and Maintain the Merck General Patents and any Patents within the Merck Agent Technology worldwide.

2.2.2 [***]

2.3 Patent Costs. Patent and Trademark Expenses incurred by the prosecuting Party in connection with Prosecuting and Maintaining [***], as applicable (but not any [***]), shall be treated in accordance with this Exhibit J or Exhibit D or Exhibit E, as follows:

2.3.1 for such Patent and Trademark Expenses accrued by the Parties during the applicable POC Term, if (a) Merck exercises the Merck Participation Election for a given Program, then [***], and (b) if Merck does not exercise the Merck Participation Election for the PCV Program, then [***];

2.3.2 such Patent and Trademark Expenses incurred by or on behalf of each Party (or its Affiliates) during the Merck Participation Term for a given Program will be treated as [***];

2.3.3 such Patent and Trademark Expenses incurred by or on behalf of each Party (or its Affiliates) in the event of a Merck Non-Participation for the PCV Program or a Merck Cessation Election for the PCV Program will be treated as [***]

J-2
2.3.4 such Patent and Trademark Expenses incurred by or on behalf of a Party (or its Affiliates) in the event of a Merck Non-Participation for a given SAV Program or a Merck Cessation Election for a given SAV Program will be [***].

2.4 Cooperation. The Parties agree to cooperate fully in the Prosecution and Maintenance of the Moderna Patents and Merck Patents in the Territory under this Agreement. Cooperation shall include:

2.4.1 executing all papers and instruments, or requiring its employees or contractors to execute such papers and instruments, so as to (a) effectuate the ownership of intellectual property set forth in Section 11; (b) enable the other Party to apply for and to prosecute Patent applications in the Territory; and (c) obtain and maintain any Patent extensions, supplementary protection certificates, and the like with respect to the Moderna Patents and Merck Patents in the Territory, in each case, to the extent provided for in this Agreement;

2.4.2 consistent with this Agreement, assisting in any license registration processes with applicable governmental authorities that may be available in the Territory for the protection of a Party’s interests in this Agreement; and

2.4.3 promptly informing the other Party of any matters coming to such Party’s attention that may materially affect the Prosecution and Maintenance of any such Moderna Patents or Merck Patents in the Territory.

3. Patent Extensions. With respect to any election for patent term restoration or extension, supplemental protection certificate or any of their equivalents, (a) Merck will have the sole right to make any such decision relating to the Merck Patents; provided that [***]; (b) Moderna will have the right to make any such decision relating to the Moderna Patents; provided that, [***] and (c) if either Party requests that the other Party make any election for patent term restoration or extension, supplemental protection certificate or any of their equivalents with respect to which such other Party has sole decision making authority pursuant to this Paragraph 2, the Parties shall discuss and such other Party shall consider in good faith any such request.

4. Patent Listings. With respect to any filings made to Regulatory Authorities with respect to the Moderna Patents or Merck Patents for any Collaboration Product, including as required or allowed in connection with in the United States, the FDA's Orange Book, if applicable, or outside the United States, other international equivalents, [***] will have the sole right to make any such decision. Upon the request by [***], [***] will reasonably cooperate in the implementation of decisions regarding the filing and listing pursuant to this Paragraph 3.


5.1 Notice. With respect to a given Program, each Party will promptly notify the other Party, in writing, upon learning of any [***] (in each case [***], a “Competitive Infringement”), or of [***], would amount to Competitive Infringement, and will, along with such notice, provide any evidence in its possession pertaining thereto, subject to Third Party confidentiality obligations.
5.2 Competitive Infringement.

5.2.1 [***]

5.2.2 General Patents. [***]

5.2.3 [***]

5.2.4 Neither Party will exercise any of its enforcement rights under Paragraph 5.2.1 without first consulting with the other Party, provided that this consultation requirement will not limit either Party’s rights under this Paragraph 5.2.

5.3 Defense.

5.3.1 [***]

5.3.2 [***]

5.3.3 [***]

5.4 Withdrawal, Cooperation and Participation. With respect to any infringement or defensive action identified above in Paragraphs 5.2 or 5.3:

5.4.1 If the controlling Party ceases to pursue or withdraws from such action, it will promptly notify the other Party (in sufficient time to enable the other Party to meet any deadlines by which any action must be taken to preserve any rights in such infringement or defensive action) and such other Party may substitute itself for the withdrawing Party and proceed under the terms and conditions of [***].

5.4.2 The non-controlling Party will cooperate with the Party controlling any such action (as may be reasonably requested by the controlling Party), including [***]. The Party controlling any such action will keep the non-controlling Party updated with respect to any such action, including providing copies of all documents received or filed in connection with any such action.

5.4.3 Each Party will have the right to participate or otherwise be involved in any such action controlled by the other Party, in each case at the non-controlling Party’s sole cost and expense. If a Party elects to so participate or be involved, the controlling Party will provide the non-controlling Party and its counsel with an opportunity to consult with the controlling Party and its counsel regarding the prosecution of such action (including reviewing the contents of any correspondence, legal papers or other documents related thereto), and the controlling Party will take into account reasonable requests of the non-controlling Party regarding such enforcement or defense.

5.4.4 In all cases, prior to the commencement of any infringement or defensive action identified above in Paragraphs 5.2 or 5.3, the Parties shall reasonably consult with respect thereto, including a discussion of the relevant Patents to be included in any such action.
5.5 **Damages.** Unless otherwise agreed by the Parties, all monies recovered upon the final judgment or settlement of any such action will be treated. Unless otherwise agreed by the Parties, all monies recovered upon the final judgment or settlement of any such action shall be treated.

5.6 **Agent Technology.** Notwithstanding anything in this Agreement to the contrary, Moderna has the sole right to enforce and defend all Patents within the Moderna Agent Technology, and Merck has the sole right to enforce and defend all Patents within the Merck Agent Technology.

5.7 [***]

6. **Third Party Rights.** Notwithstanding the foregoing provisions of this Exhibit J, each Party’s rights and obligations under this Exhibit J will be subject to the Third Party rights and obligations under any Included In-License.

7. **Matters involving General Patents and Agent Technology.** Notwithstanding anything in this Agreement to the contrary, as between the Parties and irrespective of Committee involvement or otherwise, (a) Moderna shall have final decision making authority with respect to any and all matters involving the Moderna General Patents and any Patents within the Moderna Agent Technology, and (b) Merck shall have final decision making authority with respect to any and all matters involving Merck General Patents and any Patents within the Merck Agent Technology.

8. **Third Party Rights.** To the extent that a Third Party licensor under a Moderna Included In-License has retained any right to [***], Moderna will use Commercially Reasonable Efforts to cause such Third Party licensor to take the actions specified by this Exhibit J in a manner consistent with the Moderna Included In-License applicable thereto, but Moderna will not be deemed to be in breach of its obligations under this Exhibit J if, after using such Commercially Reasonable Efforts, it is unable to comply with such obligations because of actions taken or not taken by such Third Party licensor.

9. **Matters involving Joint Patents.** The Prosecution and Maintenance, and the enforcement and defense, of any Joint Patents shall be [***].

10. **Immune Potentiator Patent Application.** [***]
EXHIBIT K

Supply Terms

[***]

K-1
EXHIBIT L

Subcontractors and Sublicensing

L-1
EXHIBIT L-2

Certain Sublicensing/Subcontracting Examples

[***]

L-7
EXHIBIT M

Terms for PCV Clinical Supply Agreement and SAV Clinical Supply Agreement

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EXHIBIT N

Supply Terms for Merck Internal SAV Programs

a. [***]

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Moderna Background Patents

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[***]
Initial KRAS Transition Plan

[***]
SCHEDULE 6.1(d)(iv)

Required Manufacturing Items

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Amended and Restated Option Agreement

by and between

ModernaTx, Inc.,

and

AstraZeneca AB

June 15, 2018
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Amended and Restated Option Agreement

This Amended and Restated Option Agreement (this “A&R Option Agreement”) is made on the Amendment Effective Date by and between ModernaTx, Inc., a Delaware corporation (“Moderna”) and AstraZeneca AB, a company incorporated in Sweden under no. 556011-7482 with offices at SE-431 83 Mölndal, Sweden (“AstraZeneca”). Each of Moderna and AstraZeneca may be referred to herein as a “Party” or together as the “Parties.”

WHEREAS, Moderna has developed technology useful for the discovery, development, Manufacture, characterization, or use of therapeutic products that function using mRNA;

WHEREAS, AstraZeneca is a biopharmaceutical company focused on identifying, Developing and Commercializing innovative therapeutic products;

WHEREAS, AstraZeneca and Moderna entered into an Option Agreement made as of March 20, 2013 as amended on January 10, 2015, April 10, 2018 and May 14, 2018 (the “Original Option Agreement”), pursuant to which AstraZeneca has exclusive options (but not obligations) to purchase the rights to certain mRNA Constructs [***] up to forty (40) Polypeptides for certain Targets;

WHEREAS, further, pursuant to the Original Option Agreement Moderna granted AstraZeneca certain licenses under Moderna’s intellectual property, to assist AstraZeneca in determining whether or not to exercise Options under the Original Option Agreement;

WHEREAS, there is one Optioned Product Candidate under the Original Option Agreement; and

WHEREAS, the Parties wish to amend and restate the Original Option Agreement as set forth herein.

NOW, THEREFORE, in consideration of the mutual covenants contained herein, and for other good and valuable consideration, the amount and sufficiency of which are hereby acknowledged, the Parties hereby agree as follows:

1. Definitions.

The following terms and their correlatives will have the following meanings. Capitalized terms used but not defined herein have the meanings ascribed to such terms in the other Transaction Agreements.

1.1 “Activity” means with respect to a Target and a particular indication, that there is [***].

1.2 “A&R Services and Collaboration Agreement” means that Amended and Restated Services and Collaboration Agreement entered into by the Parties as of the Amendment Effective Date.

1.3 “AstraZeneca” has the meaning set forth in the Preamble.
1.4 “AstraZeneca CV Target” means each Target listed on Exhibit A, unless it becomes a Discontinued Target.

1.5 “AstraZeneca Exclusive Target” means the Target listed on Exhibit B [***], unless it becomes a Discontinued Target.

1.6 “AstraZeneca Exclusive Target Development Polypeptide” means the Polypeptide [***] the [***] Optioned Product Candidate.

1.7 “AstraZeneca Field” means:
   (a) for [***] AstraZeneca Exclusive Target, [***];
   (b) for [***] AstraZeneca CV Target and any Collaboration mRNA Construct [***] a Research Polypeptide or a Development Polypeptide for an AstraZeneca CV Target, the CV Field; and
   (c) for [***] AstraZeneca Oncology Target and any Collaboration mRNA Construct [***] a Research Polypeptide or a Development Polypeptide for the AstraZeneca Oncology Target, the Oncology Field.

1.8 “AstraZeneca Expanded Field Target” means [***] AstraZeneca CV Targets other than [***].

1.9 “AstraZeneca Oncology Target” means the Target listed on Exhibit C [***], unless it becomes a Discontinued Target.

1.10 “AstraZeneca Indemnitees” has the meaning set forth in Section 12.6(b).

1.11 [***]

1.12 “AstraZeneca Option Notice” has the meaning set forth in Section 6.6.

1.13 “Bankruptcy Code” has the meaning set forth in Section 3.8.

1.14 “Biosimilar Application” means an application submitted to the FDA under subsection (k) of Section 351 of the PHSA, or any analogous application submitted to a Regulatory Authority in the United States or in another country in the Territory.

1.15 “CMC” has the meaning set forth in Section 8.4.

1.16 “[***] Product” means a Product that contains a [***] Product Candidate.

1.17 “[***] Product Candidate” means a product candidate that [***] For clarity, upon nomination of a [***] Product Candidate as a Product Candidate pursuant to Section 4.1, such Product Candidate will continue to be a [***] Product Candidate for all purposes under the Transaction Agreements.
“[***] Target” with respect to a [***] Product Candidate, means the [***]. For clarity, [***].

“Commercialization” means (a) any and all activities directed to the Manufacturing, marketing, detailing, promotion and securing of reimbursement of a product after Regulatory Approval has been obtained (including making, having made, using, importing, selling and offering for sale such product), and will include post-approval clinical studies, post-launch marketing, promoting, detailing, marketing research, distributing, customer service, administering commercially selling, having sold or otherwise disposing or offering to dispose of such product, importing, exporting or transporting such product for commercial sale, and all regulatory compliance with respect to the foregoing, and (b) otherwise marketing, selling or exploiting commercially a product.

“Commercialization Schedules” means Schedule A and the Product Commercialization Schedule, together.

“Competitive Infringement” means [***].

“Contingent Deferred Option Purchase Payment” has the meaning set forth in Section 6.3(b).

“Contingent Event” has the meaning set forth in Paragraph 2.2 (Schedule A).

“Contingent Event Option Exercise Payment” has the meaning set forth in Paragraph 2.2 (Schedule A).

“CV Field” means (a) the treatment, prevention, palliation, or prophylaxis in humans of cardiovascular and cardiometabolic diseases, including [***]. The CV Field does not include vaccines. Notwithstanding the foregoing, the Parties acknowledge and agree that, solely for the Exploitation of [***] Product Candidates and [***] Products [***].

“Development Pool” has the meaning set forth in Section 4.1(a).

“Development Pool Candidate” means with respect to a Development Polypeptide that AstraZeneca has designated for inclusion in the Development Pool in accordance with Section 4.1(a), all Collaboration mRNA Constructs [***] such Development Polypeptide, and that is not a Discontinued Product Candidate.

“Development Polypeptide” means a Polypeptide for which a Product Candidate has been selected in accordance with Section 4.1, and that is not a Discontinued Polypeptide. A Polypeptide will cease to be a Research Polypeptide on becoming a Development Polypeptide.

“Distributor” has the meaning set forth in Section 3.10.

“EU” has the meaning set forth in Paragraph 1.1 (Schedule A).

[***]
1.32 “Exempt Payments” has the meaning set forth in Section 7.1.

1.33 “Exercise Price” means, for each Option exercise for an Optioned Product Candidate, the Initial Payment plus the payments to be made by AstraZeneca to Moderna pursuant to Schedule A.

1.34 “Existing Know-How” has the meaning set forth in Section 12.2(b).

1.35 “Existing Patents” has the meaning set forth in Section 12.2(a).

1.36 “FIM Date” means with respect to each Research Target and Development Polypeptide, the date of the [***] in the first Phase 1 Study for the first Product incorporating a Collaboration mRNA Construct [***] such Development Polypeptide for such Research Target.

1.37 “First Commercial Sale” has the meaning set forth in Paragraph 1.2 (Schedule A).

1.38 “Generic Product” has the meaning set forth in Paragraph 1.3 (Schedule A).

1.39 “Included Payments” has the meaning set forth in Section 7.2.

1.40 “[***] Option Agreement Effective Date” means, with respect to a Product Candidate (or any other associated Development Pool Candidate), the date of [***], or, if earlier, [***] such Product Candidate, in either case by or on behalf of AstraZeneca or any of its Affiliates or Sublicensees.

1.41 “IND” means an investigational new drug application as defined in 21 U.S.C. § 312 (as amended or replaced), or any foreign equivalent thereof.

1.42 “Indemnification Claim Notice” has the meaning set forth in Section 12.6(c).

1.43 “Indemnified Party” has the meaning set forth in Section 12.6(c).

1.44 “Indirect Taxes” means VAT, sales taxes, consumption taxes and other similar taxes required by law to be disclosed on the invoice.

1.45 “Initial Options Purchase Price” has the meaning set forth in Section 6.3(a).

1.46 “Initial Payment” has the meaning set forth in Section 6.5(b).

1.47 “In-License Payments” means any amounts paid or payable under any Moderna Collaboration In-License that are incurred by Moderna as a result of the grant of [***] under this A&R Option Agreement. Any such payments will include (a) any amounts paid or payable under any Moderna Collaboration In-License as a result of the grant of [***], but excluding (i) any payments resulting from [***], (ii) any payment based on any payments [***], and (iii) any payments based on [***], and (b) costs of[***].

1.48 “IP Matters” has the meaning set forth in Section 10.1(a).
1.49 [***]

1.50 “Joint Patent Committee” or “JPC” has the meaning set forth in Section 10.1(a).

1.51 “Losses” has the meaning set forth in Section 12.6(a).

1.52 [***]

1.53 [***]

1.54 “Moderna” has the meaning set forth in the Preamble.

1.55 “Moderna General Background Patents” means any and all Moderna Background Patents that are not [***].

1.56 [***]

1.57 “Moderna Indemnitees” has the meaning set forth in Section 12.6(a).

1.58 [***]

1.59 [***]

1.60 [***]

1.61 [***]

1.62 [***]

1.63 “Net Sales” has the meaning set forth in Paragraph 1.4 (Schedule A).

1.64 “Nominated CV Field” means with respect to each Product Candidate [***] Development Polypeptide for an AstraZeneca CV Target (and all associated Development Pool Candidates), the indications in the CV Field identified by AstraZeneca for such Product Candidate in accordance with Section 4.1(a), [***].

1.65 “Nominated Oncology Field” means with respect to each Product Candidate [***] Development Polypeptide for the AstraZeneca Oncology Target (and all associated Development Pool Candidates), the indications in the Oncology Field identified by AstraZeneca for such Product Candidate in accordance with Section 4.1(a), [***].

1.66 “Nominated ROA” means with respect to each Product Candidate (and all associated Development Pool Candidates), the route(s) of administration (as defined by [***] for such Product Candidate identified by AstraZeneca in accordance with Section 4.1(a), in each case, [***].
1.67 “Oncology Field” means (a) the treatment, prevention, palliation, or prophylaxis in humans of cancer, and (b) companion diagnostics specific to any Product Candidate or Product. The Oncology Field does not include vaccines.

1.68 “Option” has the meaning set forth in Section 6.2.

1.69 “Option Exercise Earn-Out” has the meaning set forth in Paragraph 2.3(a) (Schedule A).

1.70 “Option Agreement Term” has the meaning set forth in Section 13.1.

1.71 “Option Exercise Period” has the meaning set forth in Section 6.4.

1.72 “Optioned Product Candidate” means a Product Candidate (including any [***] Product Candidate) for which AstraZeneca has (i) properly provided Moderna an AstraZeneca Option Notice in the proper form, and (ii) properly paid Moderna the Initial Payment.

1.73 “Option Purchase Price” has the meaning set forth in Section 6.3(b)(ii).

1.74 “Original Option Agreement” has the meaning set forth in the Preamble.

1.75 “Party” and “Parties” has the meaning set forth in the Preamble.

1.76 “Phase 1 Study” means a clinical trial of a product, the principal purpose of which is preliminary determination of safety in healthy individuals or patients as described under 21 C.F.R. §312.21(a) (as amended or any replacement thereof), or a similar clinical study prescribed by the Regulatory Authorities in a foreign country.

1.77 “Phase 2 Study” has the meaning set forth in Paragraph 1.5 (Schedule A).

1.78 “Phase 3 Study” has the meaning set forth in Paragraph 1.6 (Schedule A).

1.79 “PHSA” has the meaning set forth in Paragraph 1.7 (Schedule A).

1.80 [***]

1.81 “Product Candidate” means with respect to a Polypeptide, the Collaboration mRNA Construct constituting a Development Pool Candidate and [***] such Polypeptide that has been selected for further Development pursuant to Section 4.1(a) and that is not a Discontinued Product Candidate. For clarity, subject to the adjustments provided for in Section 4.4, upon nomination of a [***] Product Candidate as a Product Candidate pursuant to Section 4.1, such [***] Product Candidate will be a Product Candidate (but will continue to be a [***] Product Candidate).

1.82 “Regulatory Exclusivity Period” means with respect to a Product in a country, the period of time during which (a) AstraZeneca or any of its Affiliates or Sublicensees has been granted the exclusive legal right by a Regulatory Authority (or is otherwise entitled to the exclusive legal right by operation of Law) in such country to market and sell the Product, or (b) the data and
information submitted by AstraZeneca or any of its Affiliates or Sublicensees to the relevant Regulatory Authority in such country for purposes of obtaining Regulatory Approval may not be disclosed, referenced or relied upon in any way by such Regulatory Authority (including by relying upon the Regulatory Authority’s previous findings regarding the safety or effectiveness of the Product) to support the Regulatory Approval or marketing of any product by a Third Party in such country.

1.83 “Research Polypeptide” means any Polypeptide for a Research Target that has been selected for evaluation as a part of the Services Program in accordance with Section 2 of the A&R Services and Collaboration Agreement, and that is not a Development Polypeptide or a Discontinued Polypeptide.

1.84 “Research Targets” means the AstraZeneca CV Targets, the AstraZeneca Oncology Target and the AstraZeneca Exclusive Target, and will not include any Discontinued Targets (and further, any Target definitions that underlie the definitions of the AstraZeneca Exclusive Target, the AstraZeneca CV Targets or the AstraZeneca Oncology Target will not include any Discontinued Targets).

1.85 “Research Tool” means any technology which is designed, developed and used solely for performing research and drug discovery activities, excluding (a) research and drug discovery activities directed to mRNA Technology and (b) the diagnosis, treatment, prevention, palliation, or prophylaxis of human diseases and conditions.

1.86 “Selling Party” has the meaning set forth in Paragraph 1.8 (Schedule A).

1.87 “Tax” and “Taxation” means any form of tax or taxation, levy, duty, charge, social security charge, contribution, or withholding of whatever nature (including any related fine, penalty, addition to tax, surcharge or interest) imposed by, or payable to, a Tax Authority. Notwithstanding anything herein to the contrary, Taxes will not include any Indirect Taxes.

1.88 “Tax Authority” or “Tax Authorities” means any government, state or municipality, or any local, state, federal or other fiscal, revenue, customs, or excise authority, body or official anywhere in the world, authorized to levy tax.

1.89 “Territory” means worldwide.

1.90 “Third Party Claims” has the meaning set forth in Section 12.6(a).

1.91 “Valid Claim” has the meaning set forth in Paragraph 1.9 (Schedule A).

1.92 “[***] Optioned Product Candidate” means the Optioned Product Candidate [***] for a Polypeptide for [***] existing as of the Amended Effective Date.

2. Research Targets.

2.1 Research Targets as of the Amendment Effective Date.

(a) The AstraZeneca Exclusive Target. [***] AstraZeneca Exclusive Target as of the Amendment Effective Date is set forth in Exhibit B.

(b) AstraZeneca CV Targets. [***] AstraZeneca CV Targets as of the Amendment Effective Date are set forth on Exhibit A.

(c) AstraZeneca Oncology Target. [***] AstraZeneca Oncology Target as of the Amendment Effective Date is set forth on Exhibit C.

(d) Research Targets. As of the Amendment Effective Date, there are [***] Research Targets: the AstraZeneca Exclusive Target, [***] AstraZeneca CV Targets and the AstraZeneca Oncology Target. Each of these Targets will remain a Research Target unless and until it becomes a Discontinued Target in accordance with the Transaction Agreements. Following the Amendment Effective Date AstraZeneca does not have any rights to nominate (or re-nominate) any other Target as a Research Target. For certain purposes in connection with [***] Product Candidates, [***] Research Targets will be treated as [***] Research Targets as set out in Section 4.4.
2.2 Discontinuation of Research Targets

(a) Subject as provided in Section 4.4, a Research Target may become a Discontinued Target under the Transaction Agreements as follows (as well as otherwise expressly provided in any of the Transaction Agreements, including Section 2.2(c) of the A&R Services & Collaboration Agreement), with the consequences set forth in Section 3.4 and elsewhere in the Transaction Agreements:

(i) If a Research Target is excluded from the scope of the Services Program before [***] pursuant to Section 2.2(c) of the A&R Services & Collaboration Agreement, such Research Target will automatically become a Discontinued Target (and all Research Polypeptides for such Discontinued Target will become Discontinued Polypeptides and all Collaboration mRNA Constructs [***] such Research Polypeptides for such Discontinued Target will become Discontinued Product Candidates); and

(ii) If (A) no Product Candidate [***] a Research Polypeptide for a Research Target is included by AstraZeneca in the Development Pool before the [***], or (B) a Development Polypeptide for a Research Target is no longer included in the Development Pool, then in each case ((A) and (B)), such Research Target will automatically become a Discontinued Target (and all Research Polypeptides or Development Polypeptides, as applicable, for such Discontinued Target will become Discontinued Polypeptides and all Collaboration mRNA Constructs, Product Candidates, Development Pool Candidates [***] such Research Polypeptide or Development Polypeptide, as applicable, will become Discontinued Product Candidates), unless for such Research Target there is (1) a different Research Polypeptide then in the Services Program; (2) another Development Polypeptide then in the Development Pool or (3) an Optioned Product Candidate.

(b) The license grants set forth in Section 3.1(a) and 3.1(b) will no longer apply with respect to any Discontinued Target, Discontinued Polypeptide or Discontinued Product Candidate and Moderna will be free to Exploit any and all mRNA Constructs and associated products for any Polypeptide for a Discontinued Target alone or with others with no obligation to AstraZeneca.
(c) For clarity, notwithstanding the provisions of this Section 2.2, nothing in the Transaction Agreements is intended to prevent AstraZeneca from Exploiting any Discontinued Target or Discontinued Polypeptide or any mRNA Construct (other than a Collaboration mRNA Construct) coding for a Discontinued Polypeptide (subject to Sections 5.2(a) and 5.2(b)), or any other Polypeptide for such Discontinued Target outside of the Transaction Agreements; provided, that any such Exploitation does not use Moderna Technology except as expressly permitted by the Transaction Agreements.

2.3 Expiration of Services Program with respect to certain Targets. The Parties hereby acknowledge and agree that the Services Program with respect to the Targets listed in Exhibit D has been prior to the Amendment Effective Date or will be with effect on the Amendment Effective Date, terminated and that each such Target is a Discontinued Target (and, for clarity, all Research Polypeptides for such Discontinued Targets are Discontinued Polypeptides and all Collaboration mRNA Constructs [***] such Research Polypeptides are Discontinued Product Candidates); provided that the Parties agree that they wish to continue collaborating with respect to the Discontinued Targets [***] that until the earlier to occur of (a) [***] and (b) the expiration of the Services Program Term, notwithstanding such Targets are Discontinued Targets, each Party will not (1) and will ensure that its Affiliates will not, itself or with or for any Third Party, or (2) [***].

3. License Grants.

3.1 Licenses by Moderna.

(a) Subject to the terms and conditions of this A&R Option Agreement, including Section 4.4, Moderna hereby grants to AstraZeneca a [***] (except as set forth in Section 13.5), worldwide, royalty-bearing right and license, with the right to grant sublicenses pursuant to Section 3.6 only, under the Moderna Technology, to Exploit:

(i) with respect to the AstraZeneca Exclusive Target, mRNA Constructs [***] any and all Polypeptides for the AstraZeneca Exclusive Target for use in the applicable AstraZeneca Field;

(ii) on a Target-by-Target basis, with respect to each AstraZeneca CV Target (and separately with respect to any [***] Target) and the AstraZeneca Oncology Target, Collaboration mRNA Constructs [***] Research Polypeptides for such Target for use in the applicable AstraZeneca Field; and

(iii) on a Product Candidate-by-Product Candidate basis, Collaboration mRNA Constructs comprising such Product Candidate (and all associated Development Pool Candidates) for use in the AstraZeneca Field for such Product Candidate.

The licenses set forth in Section 3.1(a) are (A) co-exclusive with Moderna (solely to the extent necessary for Moderna to exercise its retained rights pursuant to Section 3.1(b) with respect to the Manufacture of such Collaboration mRNA Constructs), and (B) exclusive (including with respect
to Moderna and its Affiliates) with respect to all other Exploitation of such Collaboration mRNA Constructs, in each case in the applicable AstraZeneca Field. For clarity, Discontinued Targets, Discontinued Polypeptides and Discontinued Product Candidates are excluded from the scope of the licenses set forth in this Section 3.1(a).

(b) Notwithstanding the exclusive licenses granted to AstraZeneca pursuant to Section 3.1(a), Moderna retains rights under the [***] to perform the Services, to Manufacture pursuant to the Transaction Agreements and the Master Supply Agreements and to undertake the Development activities as set forth in Sections 5.1 and 5.2. For clarity, (i) subject to the exclusive licenses granted to AstraZeneca pursuant to Section 3.1(a) and subject to Section 5, Moderna may Exploit (alone or with other(s) by license or otherwise) any mRNA Constructs other than Collaboration mRNA Constructs outside the scope of the Transactions Agreements, and (ii) Moderna may Manufacture under the co-exclusive license grant only (A) for AstraZeneca and (B) to exercise its rights pursuant to this Section 3.1(b).

(c) With respect to the foregoing grants under the [***], AstraZeneca agrees that:

(i) it will not, and will not sublicense or otherwise authorize its Affiliates or Sublicensees to, Commercialize any Collaboration mRNA Construct [***] a Polypeptide for a Research Target (including Manufacture of such Collaboration mRNA Constructs for Commercialization) unless and until AstraZeneca has (x) identified a Product Candidate [***] such Polypeptide in a properly provided AstraZeneca Option Notice in the proper form, and (y) properly paid Moderna ten million dollars (US$ 10,000,000) whereupon the Commercialization Schedules will apply to the Commercialization of such Product Candidate (and associated Products) and the other items specified thereon;

(ii) it will not, and it will not sublicense or otherwise authorize its Affiliates or Sublicensees to, clinically Develop any Collaboration mRNA Construct for a Research Polypeptide; and

(iii) it will not, and it will not sublicense or otherwise authorize its Affiliates or Sublicensees to, practice the license to Manufacture Modena mRNA API except in the circumstances described in Section 4.1 of the A&R Services and Collaboration Agreement.

(d) [***]

3.2 Development License by AstraZeneca. Subject to the terms and conditions of the Transaction Agreements, AstraZeneca hereby grants to Moderna a [***], non-exclusive, worldwide, royalty-free right and license in the applicable AstraZeneca Field, with the right to grant sublicenses pursuant to Section 3.6, under the AstraZeneca Background Technology and AstraZeneca Collaboration Technology, solely to perform the Services and Development Pool Services in accordance with the terms of the Transaction Agreements.

3.3 AstraZeneca [***] Technology Licenses by AstraZeneca. Subject to the terms and conditions of the Transaction Agreements, AstraZeneca hereby grants to Moderna a [***], non-exclusive, worldwide right and license, with the right to grant sublicenses pursuant to Section 3.6 only, under the AstraZeneca [***] Technology, to Exploit any mRNA Constructs other than any mRNA Construct [***] a Polypeptide for a Research Target. If Moderna grants a sublicense to a Third Party, Modena will [***].

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3.4 Data and Results for Discontinued Targets; Assignments and Licenses to Discontinued Targets by AstraZeneca.

(a) With respect to each Discontinued Target as of the Amendment Effective Date or, with respect to any Target that becomes a Discontinued Target after the Amendment Effective Date, promptly (but in any event within [***] Business Days) following the Amendment Effective Date, or the date on which such Discontinued Target becomes a Discontinued Target, respectively, AstraZeneca will, to the extent it has not done so previously, provide Moderna with a copy of all data and results generated by or on behalf of AstraZeneca in the course of AstraZeneca’s performance of the Services Program with respect to such Discontinued Target and the applicable Discontinued Polypeptides. With respect to each Discontinued Target as of the Amendment Effective Date and, with respect to any Target that becomes a Discontinued Target after the Amendment Effective Date, AstraZeneca does hereby assign and will assign to Moderna all right, title and interest in and to any Patents within the AstraZeneca Collaboration Technology that relate solely to such Discontinued Target (including the data and results that relate solely to such Discontinued Target provided pursuant to this Section 3.4(a)), to the extent it has not done so previously.

(b) With respect to each Discontinued Target (and subject to Section 2.2(b)), AstraZeneca will grant (and does hereby grant), to Moderna a [***], non-exclusive, worldwide, royalty-free right and license, with the right to grant sublicenses pursuant to Section 3.6 only, under the AstraZeneca Collaboration Technology (other than the AstraZeneca Collaboration Technology assigned pursuant to Section 3.4(a), but including all other data and results with respect to such Discontinued Target provided pursuant to Section 3.4(a) and under the AstraZeneca [***] Technology, to Exploit any mRNA Construct for a Polypeptide to such Discontinued Target (including any Discontinued Product Candidates or Discontinued Polypeptides for such Discontinued Target) in any field.

3.5 [***]

(a) [***]

(b) [***]

(c) [***]

(d) [***]
3.6 **Sublicenses.**

(a) **Sublicensing Rights.** Each Party will have the right to grant sublicenses, through multiple tiers of sublicensees, under the licenses granted in Sections 3.1, 3.2, 3.3, and 3.4, in full or in part, to its Affiliates or a Third Party, provided, that as a condition precedent to and requirement of any such sublicense:

(i) In the case of a sublicense to a Third Party, any such sublicense to a Third Party must be pursuant to a written agreement. The Party granting the sublicense will provide the other Party with a redacted copy of any sublicense agreement with a Sublicensee within [***] days of execution thereof;

(ii) The Party granting the sublicense will remain responsible for (i) its obligations under the Transaction Agreements (including with respect to the Commercialization Schedules) even if such obligations are to be performed by a Sublicensee and (ii) adherence by such Sublicensee of any provisions of the Transaction Agreements applicable to the activities of such Third Party as a sublicensee of such Party;

(iii) Any such Sublicensee will agree in writing to be bound by substantially similar obligations as the Party granting the sublicense hereunder with respect to the activities of such Sublicensee within the scope of the license to such Party hereunder (and not with respect to any other activities), including Know-How disclosure obligations of such Party hereunder with respect to the activities of such Sublicensee hereunder; and

(iv) To the extent that a Party grants a sublicense under any intellectual property subject to a Third Party in-license, such sublicense (and such sublicensee) will be subject to such Third Party in-license.

(b) **Transfer.** The licenses granted in Sections 3.1, 3.2, 3.3, 3.4 and 3.5 are transferable only upon a permitted assignment of this A&R Option Agreement in accordance with Section 14.13.

3.7 **Third-Party Agreements; Third-Party Payment Obligations.**

(a) [***]

(b) [***]
3.8 **AstraZeneca Rights in Bankruptcy.** All rights and licenses granted pursuant to any section of this A&R Option Agreement are, and will be deemed to be, licenses of rights to "intellectual property" (as defined in Section 101(35A) of title 11 of the United States Code, 11 U.S.C. § 101, et seq (the “Bankruptcy Code”)) and of any similar provisions of applicable Laws under any other jurisdiction. Moderna agrees that AstraZeneca, as a licensee of such rights and licenses under this A&R Option Agreement, will retain and may fully exercise all of its rights and elections under the Bankruptcy Code (including under Section 365(n) of the Bankruptcy Code).

(a) **Embodiments of Intellectual Property.** AstraZeneca will have all rights to embodiments of the intellectual property licensed to AstraZeneca under this A&R Option Agreement, as set forth in Section 365(n) of the Bankruptcy Code.

(b) **Effect of Bankruptcy Filing.** The Parties further agree that, in the event of the commencement of a bankruptcy proceeding by or against Moderna under the Bankruptcy Code or analogous provisions of applicable Law outside of the United States, then unless or until this A&R Option Agreement is rejected or deemed rejected, Moderna or its trustee, pursuant to Section 365(n) of the Bankruptcy Code and upon the written request of AstraZeneca:

   (i) will perform this A&R Option Agreement; or

   (ii) [***]

(c) **Reservation of Rights.** Nothing in this Section 3.8 will limit or restrict, or will be construed to limit or restrict, the rights of AstraZeneca under Section 365(n) of the Bankruptcy Code, all of which rights are hereby expressly reserved.

3.9 **No Implied Rights.** No license, sublicense or other right is or will be created or granted hereunder by implication, estoppel or otherwise. Any licenses, sublicenses or rights will be granted only as expressly provided in the Transaction Agreements. Neither Party nor any of its Affiliates will use or practice any Know-How, Materials or Patents licensed or provided to such Party or any of its Affiliates outside the scope of or otherwise not in compliance with the rights and licenses granted to such Party and its Affiliates under the Transaction Agreements. For clarity, neither Party will be subject to any non-use or non-disclosure obligations with respect to Know-How or Materials if and to the extent that Section 7.1(c) of the A&R Services and Collaboration Agreement applies to such Know-How or Materials.

3.10 **Distributors.** AstraZeneca will have the right, in its sole discretion, to appoint its Affiliates, and AstraZeneca and its Affiliates will have the right, in their sole discretion, to appoint any other Persons in the Territory or in any country of the Territory, to distribute, market and sell the Products (with or without packaging rights), in circumstances where the Person purchases its requirements of Products from AstraZeneca or its Affiliates but does not otherwise make any royalty or other payment to AstraZeneca with respect to its intellectual property rights or Products (including Moderna Technology). Where AstraZeneca or its Affiliates appoints such a Person and such Person is not an Affiliate of AstraZeneca, that Person will be a “Distributor” for purposes of the Transaction Agreements. The term “packaging rights” in this Section 3.10 will mean the right for the Distributor to package Products supplied in unpackaged bulk form into individual ready-for-sale packs and a Distributor for Moderna will have a corresponding meaning.

4.1 Designation of Product Candidates.

(a) Subject to Section 4.2, and Section 4.4 with respect to [***] Product Candidates, on a Research Polypeptide-by-Research Polypeptide basis, prior to the expiration of the Services Period for such Research Polypeptide, AstraZeneca may elect by written notice to Moderna to designate one Collaboration mRNA Construct [***] such Research Polypeptide as a Product Candidate for further Development under this A&R Option Agreement, provided that such Collaboration mRNA Construct has satisfied the applicable [***] Criteria for such Research Polypeptide, and on such designation such Research Polypeptide will cease to be a Research Polypeptide and will become a Development Polypeptide. Such designation will identify the (i) Product Candidate (including [***]), (ii) Research Target, (iii) Development Polypeptide, (iv) the indications in the CV Field or Oncology Field, as applicable, which have Activity with respect to the applicable Research Target and for which AstraZeneca reasonably believes could be addressed by a Product incorporating such Product Candidate (or any associated Development Pool Candidate), and (v) the route(s) of administration (as defined [***] for which AstraZeneca intends on Developing a Product incorporating such Product Candidate. Upon any such designation, each such Product Candidate, and all other Collaboration mRNA Constructs [***] such Development Polypeptide, will each be a “Development Pool Candidate” hereunder, and all Development Polypeptides, Product Candidates and other Development Pool Candidates existing at any one time until the [***] anniversary of the Implementation Date are collectively referred to herein as the “Development Pool.” If for a Research Polypeptide, a Product Candidate [***] such Research Polypeptide is not included by AstraZeneca in the Development Pool before the end of the applicable Services Period for such Research Polypeptide, then such Research Polypeptide will automatically become a Discontinued Polypeptide and all mRNA Constructs [***] such Research Polypeptide will automatically become Discontinued Product Candidates.

(b) Upon termination of this A&R Option Agreement or the [***] anniversary of the Implementation Date, (i) the Development Pool will end and any Development Pool Candidates remaining therein and their associated Development Polypeptides will automatically become Discontinued Product Candidates and Discontinued Polypeptides, respectively, and (ii) those Research Targets having a Development Polypeptide in the Development Pool will become Discontinued Targets, except for any such Research Target that has an Optioned Product Candidate.

4.2 Development Pool Limit.

(a) The number of Development Polypeptides (and the number of Product Candidates therefor) in the Development Pool each may not exceed [***] at any one time unless otherwise agreed by Moderna.
(b) During the Services Program Term, AstraZeneca may, on written notice to Moderna, (i) elect to [***], or (ii) elect to [***]. If AstraZeneca makes an election under the preceding clause (ii), subject to Section 4.2(a), AstraZeneca can [***].

4.3 Development Pool Diligence. On a Development Polypeptide-by-Development Polypeptide basis, for as long as such Development Polypeptide is in the Development Pool, AstraZeneca, directly or through one or more of its Affiliates or permitted subcontractors, will use Commercially Reasonable Efforts to Develop a Product Candidate for such Development Polypeptide so as to achieve the [***] Option Agreement Effective Date. The Parties acknowledge that the principal Development activities with respect to each Development Polypeptide during such period will be [***].

4.4 Products [***] Collaboration mRNA Constructs and Product Candidates [***].

This Section 4.4 will modify how the terms of the Transaction Agreements, including the Options and Schedule A, are applied with respect to certain Research Targets, Research Polypeptides, Development Polypeptides, Collaboration mRNA Constructs, Products and Product Candidates.

(a) Prior to the expiration of the Services Program Term, AstraZeneca may elect to Exploit a [***] Product Candidate that contains [***] Collaboration mRNA Constructs, [***], as follows:

(i) AstraZeneca may elect to Develop [***] as a [***] Product Candidate by providing written notice to Moderna of same, which notice will include the Collaboration mRNA Constructs to be included in such [***] Product Candidate, which may be [***].

(ii) Each [***] a Collaboration mRNA Construct in such [***] Product Candidate will be treated as [***] Research Polypeptide for all purposes under the Transaction Agreements, (including [***]).

(iii) [***] must be a Research Target but with respect to a [***] Product Candidate, the [***] addressed by such [***] Product Candidate will be a [***] Target and treated as [***] Research Target for all purposes under the Transaction Agreements (except [***]). For example, [***], provided that if [***]. Development Pool Candidates will be used in connection with [***] Product Candidate for [***] AstraZeneca Exclusive Target.

(iv) If AstraZeneca selects for Development a [***] Product Candidate comprised of [***], on and following the selection of such [***], (A) [***] and (B) [***].

(v) If AstraZeneca elects to Develop a [***] Product Candidate comprised of [***], upon such [***] Product Candidate [***], (A) the [***] and (B) the [***].

(b) AstraZeneca may elect to [***], as follows:

(i) [***]

(ii) [***]
(c) With respect to any [***] Product Candidate or [***] Product, the following will apply:

(i) Subject to clause (iv) below, to have the right to Develop and Commercialize a [***] Product Candidate and [***] Product after the [***] Option Agreement Effective Date, AstraZeneca will be required to [***].

(ii) Subject to clause (iv) below, the Contingent Event Option Exercise Payments under Paragraph 2.2 (Schedule A) and the Option Exercise Earn-Out payments under Paragraph 2.3 (Schedule A) after Option exercise will be [***]; and

(iii) Subject to clause (iv) below, the exclusivity obligations in Section 5, and the license grants in Section 3.1 will be [***];

(iv) If AstraZeneca wishes to Develop a [***] Product Candidate, but also wishes to [***], AstraZeneca may by written notice to Moderna [***], elect to [***] under the Transaction Agreements, [***], the following will apply:

(A) To have the right to Develop and Commercialize after the [***] Option Agreement Effective Date, a [***] Product Candidate comprised [***]. AstraZeneca will be required to exercise an Option (and for clarity, pay the Initial Payment for such Option exercise as provided in this A&R Option Agreement) for [***], but will not be required to exercise an Option for [***] Product Candidate [***].

(B) Each Contingent Event Option Exercise Payment under Paragraph 2.2 (Schedule A) will be payable for each [***], provided that [***]. For example, [***].

(C) With respect to [***], the license grants and exclusivity obligations under the Transaction Agreements for [***] will apply to [***]. With respect to [***], the license grants and exclusivity obligations under the Transaction Agreements [***] will apply only to the [***] Product Candidate.

4.5 Development Pool Meetings and Reports.

(a) [***] during each Contract Year until the end of the [***] Contract Year, within [***] days of Moderna’s written request, the Parties will meet in person [***] for AstraZeneca to provide Moderna with an update on the Development of Product Candidates in the Development Pool. During such meeting, AstraZeneca will disclose to Moderna a summary of all material information regarding such Development.

(b) AstraZeneca will prepare and maintain, and will cause its Affiliates to prepare and maintain, reasonably complete and accurate records regarding the Development of Product Candidates in the Development Pool. AstraZeneca will provide to Moderna a reasonably detailed report regarding such efforts at least [***] each Calendar Quarter every Contract Year from the Implementation Date while the Development Pool is in existence. Such report will contain sufficient detail to enable Moderna to assess AstraZeneca’s compliance with its Development obligations in Section 4.3, including summary information relating to [***]. In addition to the foregoing, AstraZeneca will provide Moderna with interim information regarding any such activities as Moderna may reasonably request from time to time.
4.6 Permitted Subcontracting. Subject to the other terms of the Transaction Agreements, including Section 2.12 of the A&R Services and Collaboration Agreement, Moderna may subcontract the Development Pool Services (if any) to a Third Party, AstraZeneca may subcontract any Development activities to a Third Party, and each Party may otherwise subcontract any of its activities to be performed under this A&R Option Agreement to an Affiliate, in each case provided that (a) no such permitted subcontracting shall relieve the subcontracting Party of any of its obligations (except to the extent satisfactorily performed by such subcontractor) and (b) any such Third Party will have entered into a written agreement with such Party that includes terms and conditions protecting and limiting use and disclosure of Confidential Information and Materials and Know-How at least to the same extent as under this A&R Option Agreement and the A&R Services and Collaboration Agreement, and requiring such Third Party and its personnel to assign to such Party all right, title and interest in and to any Patents, Know-How and Materials created, conceived or developed in connection with the performance of subcontracted activities to the extent required to Develop and Commercialize Product Candidates. Any such subcontracting activities will be [***]. To the extent that any subcontractor needs a sublicense to perform the Development Pool Services, Section 3.6 will apply.

5. Exclusivity.

5.1 [***] AstraZeneca Exclusive Target. From the Implementation Date until the earlier of (a) [***] and (b) the date on which [***] AstraZeneca Exclusive Target becomes a Discontinued Target, Moderna will not [***]. This Section 5.1 will not preclude Moderna (alone or by or with other(s) by license or otherwise) from conducting such assays or other research as reasonably necessary to maintain compliance with this Section 5.1.

5.2 AstraZeneca CV Targets and the AstraZeneca Oncology Target.

(a) On an AstraZeneca CV Target-by-AstraZeneca CV Target basis or with respect to the AstraZeneca Oncology Target, until the earlier to occur of (i) [***] with respect to a Product Candidate [***] a Development Polypeptide for such Target and (ii) the date on which such Target becomes a Discontinued Target, each Party will not [***] for such Research Target for use in the CV Field (with respect to AstraZeneca CV Targets) or the Oncology Field (with respect to the AstraZeneca Oncology Target), in each case other than, with respect to Moderna, as a part of the Services, Development Pool Services (if applicable) and Manufacturing activities and, with respect to AstraZeneca, as a part of the Exploitation of Collaboration mRNA Constructs, in each case as provided for in the Transaction Agreements.

(b) On an AstraZeneca CV Target-by-AstraZeneca CV Target basis or with respect to the AstraZeneca Oncology Target, from [***] with respect to a Product Candidate [***] a Development Polypeptide for such Target until the earlier to occur of (i) [***] and (ii) the date on which such Target becomes a Discontinued Target, each Party will not [***] for [***] AstraZeneca CV Target or AstraZeneca Oncology Target, as applicable for use in (A) the Nominated CV Field (with respect to AstraZeneca CV Targets) or the Nominated Oncology Field (with respect to the
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5.3 Development Polypeptides. On a Polypeptide-by-Polypeptide basis, from the date on which a Polypeptide becomes a Development Polypeptide, until the earlier to occur of (i) [***] and (ii) the date on which such Development Polypeptide becomes a Discontinued Polypeptide, each Party will not [***] such Development Polypeptide for use in any field, in each case other than, with respect to Moderna, as a part of the Services, Development Pool Services (if applicable) and Manufacturing activities and, with respect to AstraZeneca, as a part of the Exploitation of Collaboration mRNA Constructs, in each case as provided for in the Transaction Agreements.

5.4 [***]. For each Research Target (other than the AstraZeneca Exclusive Target), AstraZeneca will, on or before (but no earlier than [***] days before) [***] for any Product [***] a Development Polypeptide for such Target [***]. At Moderna’s request AstraZeneca will provide Moderna with such information and data as is necessary for Moderna to [***]. If there is a dispute as to [***], Moderna shall provide AstraZeneca with written notice thereof within [***] after Moderna’s receipt of AstraZeneca’s update and the Parties will discuss and attempt to resolve the dispute at the next meeting of the JSC. In the event the JSC is unable to resolve the dispute, [***] shall apply.


6.1 Grant of Options. On the Implementation Date, Moderna granted to AstraZeneca pursuant to the Original Option Agreement, forty (40) identical Options to purchase a Product Candidate (and all associated Development Pool Candidates) in exchange for the Option Purchase Price for each such Option.

6.2 Definition of Options. AstraZeneca will have the right to Develop and Commercialize up to forty (40) Product Candidates (and all associated Development Pool Candidates) in the applicable AstraZeneca Field if (i) AstraZeneca provides Moderna with the AstraZeneca Option Notice and (ii) AstraZeneca pays Moderna the Exercise Price pursuant to Section 6.5, whereupon the Commercialization Schedules will apply (each an “Option” and collectively the “Options”). As of the Amendment Effective Date, AstraZeneca has exercised one Option to purchase a Product Candidate for [***] and there are thirty-nine remaining Option under this A&A Option Agreement.

6.3 Option Purchase Price.

(a) Initial AstraZeneca Payment for the Options. Under the Original Option Agreement, AstraZeneca paid to Moderna, a one-time payment of [***] for each of the forty (40) Options, for an aggregate amount equal to [***] (such aggregate amount, the “Initial Options Purchase Price”). Such payments are non-refundable and non-creditable and not subject to set-off.
(b) *Contingent Deferred Option Purchase Payments.*

(i) AstraZeneca has made two payments to Moderna totaling One Hundred Twenty Million Dollars (U.S.$120,000,000) upon the occurrence of two Development Events (as defined and pursuant to the Original Option Agreement) related to [***] (each such payment, a "Contingent Deferred Option Purchase Payment").

(ii) *Definition.* The "Option Purchase Price" for each of the forty (40) Options will be equal to the sum of (1) [***] plus (2) the fair market value of the right to receive [***] of the Contingent Deferred Option Purchase Payments paid under the Original Option Agreement.

6.4 *Option Exercise Period.* With respect to any Development Polypeptide, each Option may be exercised by AstraZeneca during the period commencing on the date that a Development Polypeptide and associated Product Candidate is included in the Development Pool until [***] days after the [***] Option Agreement Effective Date for the first Product Candidate (or any other Collaboration mRNA Construct) [***] such Development Polypeptide (the applicable "Option Exercise Period" for such Development Polypeptide), subject to Section 6.9.

6.5 *Option Exercise Price.*

(a) *Exercise Price.* AstraZeneca will pay to Moderna the Exercise Price upon the exercise of each Option, as further set forth in Section 6.5(b) and Schedule A for the Optioned Product Candidate (and associated other Development Pool Candidates) subject to such Option.

(b) *Initial Payment of the Exercise Price.* For each Option, within [***] of AstraZeneca’s issuance of an AstraZeneca Option Notice, AstraZeneca will pay to Moderna Ten Million Dollars (U.S.$10,000,000) (the “Initial Payment” for each Option exercised). Such payment will be non-refundable and non-creditable and not subject to set-off, subject to Section 11.16 of the A&R Services and Collaboration Agreement. As of the Amendment Effective Date, AstraZeneca has paid Moderna [***] in connection with the exercise of [***] to purchase [***] (and associated other Development Pool Candidates) for the AstraZeneca Exclusive Target.

6.6 *Option Exercise.* Upon AstraZeneca (a) providing notice to Moderna in writing which Product Candidate is being selected by AstraZeneca to be an Optioned Product Candidate hereunder (along with all associated Development Pool Candidates), and identifying the applicable Product Candidate and Development Polypeptide and the applicable AstraZeneca Field ("AstraZeneca Option Notice"), and (b) paying to Moderna the Initial Payment, whereupon the Commercialization Schedules will apply to the Commercialization of such Product Candidate and the other items specified thereon, an Option will be exercised. Moderna will only have the right to object to an AstraZeneca Option Notice if the Product Candidate selected by AstraZeneca does not satisfy the definition of a Product Candidate in Section 1.81 or the AstraZeneca Option Notice does not otherwise comply with the notice requirements in this Section 6.6. If Moderna properly objects to such AstraZeneca Option Notice in writing within [***] of receipt thereof, the Parties will discuss Moderna’s objections. If Moderna fails to properly object to such AstraZeneca Option Notice in writing within [***] of receipt thereof, AstraZeneca may proceed with the Product Candidate selected. A separate AstraZeneca Option Notice and payment of the Initial
Payment will be required for each Development Polypeptide and the first Product Candidate with respect thereto optioned by AstraZeneca pursuant to this Section 6.6. If AstraZeneca does not issue an AstraZeneca Option Notice and pay the Initial Payment with respect to a Product Candidate [***] a Development Polypeptide during the Option Exercise Period for such Development Polypeptide, the right to exercise an Option and other rights granted to AstraZeneca under this A&R Option Agreement and the other Transaction Agreements with respect to such Product Candidate will terminate in full and will no longer be exercisable and such Development Polypeptide and the Product Candidate and other Development Pool Candidates for such Development Polypeptide will be automatically re-designated as a Discontinued Polypeptide and Discontinued Product Candidates, respectively.

6.7 Purchasing a Product Candidate. If AstraZeneca wishes to file an IND for a Product Candidate but at the time of such filing forty (40) Product Candidates [***] forty (40) Development Polypeptides are being further Developed or Commercialized in accordance with the Commercialization Schedules, the Parties will discuss in good faith how AstraZeneca may purchase the right to continue to Develop and Commercialize an additional Product Candidate for a purchase price equal to the fair market value of such Product Candidate (which purchase price will include at a minimum an initial payment of [***])). There will not be more than [***] of such purchases.

6.8 Commercialization Provisions.

(a) Immediately upon AstraZeneca’s delivery of an AstraZeneca Option Notice with respect to a Development Pool Candidate, and AstraZeneca paying Moderna the Initial Payment with respect to a Product Candidate, AstraZeneca (or an Affiliate designated by AstraZeneca) will have the right to Commercialize such Optioned Product Candidate (and all associated Development Pool Candidates) in accordance with the Commercialization Schedules. If an Option is exercised for a Development Polypeptide, the Development Polypeptide and Development Pool Candidates [***] such Development Polypeptide will cease to be in the Development Pool, but the applicable Research Target will not become a Discontinued Target. AstraZeneca will not have the right to Commercialize a Product Candidate or any other mRNA Construct for a Polypeptide under any of the Transaction Agreements unless and until AstraZeneca has (x) properly provided an AstraZeneca Option Notice in the proper form identifying a Collaboration mRNA Construct [***] such Polypeptide, and (y) properly paid Moderna the Initial Payment with respect to such Product Candidate.

(b) Prior to selection of a Product Candidate for the AstraZeneca Oncology Target, the Parties will negotiate in good faith on reaching agreement and will update this A&R Option Agreement to address the following:

(i) For those Products [***] a Polypeptide for the AstraZeneca Oncology Target, the Contingent Event Option Exercise Payments in Paragraph 2.2 of Schedule A as of the Signing Date assume that [***]. Consequently, for those Products [***] a Polypeptide for the AstraZeneca Oncology Target that will not be [***]:

(A) [***]

(B) [***]

(C) [***]
6.9 [***] Internal Revenue Code of 1986, as amended (the “Code”) [***]

6.10 Option Termination on [***] Anniversary. Notwithstanding anything in any of the Transaction Agreements to the contrary, all unexercised Options, and the right to exercise any and all Options if not previously exercised, will automatically terminate on the [***] anniversary of the Implementation Date.

7. **Tax Matters.**

7.1 [***]

7.2 [***]

7.3 **Indirect Taxes.** Notwithstanding anything to the contrary contained in Section 7.2 or elsewhere in this A&R Option Agreement, the following will apply with respect to Indirect Taxes. All payments hereunder are exclusive of Indirect Taxes. If any Indirect Taxes are chargeable in respect of any such payments, AstraZeneca will pay such Indirect Taxes at the applicable rate in respect of any such payments following the receipt, where applicable, of an Indirect Taxes invoice issued by Moderna in respect of those payments, such Indirect Taxes to be payable on the due date of the payment of the payments to which such Indirect Taxes relate or at the time such Indirect Taxes are required to be collected by Moderna, in the case of payment of Indirect Taxes to Moderna. The Parties will issue invoices for all goods and services supplied under this A&R Option Agreement consistent with Indirect Tax requirements, and to the extent any invoice is not initially issued in an appropriate form, AstraZeneca will promptly inform Moderna and will cooperate with Moderna to provide such information or assistance as may be necessary to enable the issuance of such invoice consistent with Indirect Tax requirements.

8. **Regulatory Responsibilities.**

8.1 **In General.** As set forth in greater detail below in this Section 8, AstraZeneca will lead and have sole control of all regulatory efforts for Collaboration mRNA Constructs, Product Candidates, and Products worldwide, including with respect to preparing and filing the relevant Regulatory Filings and all communications with Regulatory Authorities.

8.2 **Regulatory Filings.** AstraZeneca will be responsible for preparing and submitting all Regulatory Filings related to Collaboration mRNA Constructs, Product Candidates, and Products, including all applications for Regulatory Approval. All applications for Regulatory Approval, the Regulatory Approvals, and other Regulatory Filings (including all INDs) relating to Collaboration mRNA Constructs, Product Candidates, and Products will be the property of AstraZeneca and held in the name of AstraZeneca or its designees.

8.3 **Interactions with Regulatory Authorities.** AstraZeneca will have the sole right to conduct all communications with the Regulatory Authorities, including all meetings, conferences and discussions (including advisory committee meetings), with regard to Collaboration mRNA Constructs, Product Candidates, and Products in the Territory.
8.4 Moderna Regulatory Responsibilities Related to Manufacture. Consistent with the provisions of Section 4.10 of the A&R Services and Collaboration Agreement, Moderna will, at its sole cost and expense, obtain and maintain all approvals, licenses, registrations, or authorizations (other than the Regulatory Approval for a Product) that are necessary or useful in connection with the Manufacture of Collaboration mRNA Constructs, Product Candidates, and Products by or on behalf of Moderna. In addition, [***], Moderna will, when and as requested by AstraZeneca, prepare the Chemistry, Manufacturing, and Controls ("CMC") and other Manufacturing provisions with respect to all Regulatory Filings for, or that are otherwise necessary to obtain and maintain, Regulatory Approvals for the Products, including with respect to any Manufacture and supply of Collaboration mRNA Constructs, Product Candidates, and Products by or on behalf of Moderna pursuant to Section 4 of the A&R Services and Collaboration Agreement, including any amendments with respect thereto as AstraZeneca may request from time to time. As set forth in greater detail in Section 4.10 of the A&R Services and Collaboration Agreement, the CMC section of a Regulatory Approval for a Product may reference Moderna’s DMF for such Product.


The Parties acknowledge and agree that the provisions of Section 2.5 of the A&R Services and Collaboration Agreement will govern the ownership of Patents, Know-How and other intellectual property generated by or on behalf of a Party under or in connection with this A&R Option Agreement.


10.1 Joint Patent Committee.

(a) As soon as practicable (but not later than [***] days) following the Implementation Date, the Parties will establish a joint patent committee (the “Joint Patent Committee” or “JPC”), comprised of an equal number of members from each Party of which (i) at least one member from each Party will have experience in the prosecution, enforcement and defense of intellectual property rights in the biopharmaceutical field, and (ii) one or members may be consultants or counsel to a Party. The JPC will serve as the primary contact and forum for discussion between the Parties with respect to the [***] Collaboration Technology and have the particular responsibilities set forth in this Section 10 (“IP Matters”). Without limitation, the JPC will:

(i) (A) oversee and coordinate the Prosecution and Maintenance of [***]; (B) facilitate the extension of [***]; (C) facilitate the listing of [***]; and (D) facilitate and coordinate [***];

(ii) determine whether [***], for clarity, it is understand and agreed that [***];

(iii) seek to resolve disputes between the Parties regarding [***];
(iv) implement procedures in order to comply with applicable Law in any country in the Territory with respect to actions taken by the Parties with respect to Biosimilar Applications under Section 10.5, including procedures necessary to comply with more rigorous timing requirements than those set forth in Section 10.5(b)(ii);

(v) consider ownership and Prosecution and Maintenance of jointly owned Collaboration Technology;

(vi) keep the JSC reasonably informed of all material matters relating to IP Matters; and

(vii) [***].

(b) The JPC will meet as often as agreed by them (and at least [***]) to enable the Parties to carry out their rights and obligations under this Section 10.1. The JPC will determine by unanimous consent the JPC operating procedures at its first meeting, including the JPC’s policies for replacement of JPC members, and the location of meetings. Such procedures will be recorded in the written minutes of the first JPC meeting and will be updated as agreed by the JPC.

(c) The JPC members will use reasonable efforts to reach agreement on all IP Matters, but if a matter within the jurisdiction of the JPC cannot be reached by the JPC within [***] after the JPC first considers such matter (or such shorter period as may be reasonable in the circumstances), then, upon the written request of a Party, such matter will be referred to the Executive Officers (or their designees, which designee is required to have decision-making authority on behalf of such Party), who will attempt in good faith to resolve such dispute by negotiation and consultation for a [***] period following receipt of such written notice. If, despite such efforts, agreement on a particular matter cannot be reached by the Executive Officers within such [***] period, the matter will be resolved pursuant to [***].

(d) With respect to any IP Matter not resolved pursuant to Section 10.1(c), either Party may elect to have such dispute be finally settled by [***].

10.2 Prosecution and Maintenance.

(a) Moderna General Background Patents.

(i) Moderna will have the sole right, but not the obligation, in consultation with the JPC and using counsel of its choosing, to Prosecute and Maintain all Moderna General Background Patents throughout the Territory.

(ii) [***]

(iii) Moderna will be solely responsible for the Patent Costs incurred by Moderna in connection with this Section 10.2(a).
(b) [***]
   (i) [***]
   (ii) [***]
   (iii) [***]
(c) [***]
   (i) [***]
   (ii) [***]
   (iii) [***]
   (iv) [***]
(d) [***]
   (i) [***]
   (ii) [***]
   (iii) [***]
(e) [***]
   (i) [***]
   (ii) [***]
   (iii) [***]
(f) [***]
   (i) [***]
   (ii) [***]
   (iii) [***]
(g) [***]
(h) [***]
10.3 **Patent Extensions.** With respect to any election for patent term restoration or extension, supplemental protection certificate or any of their equivalents, (a) AstraZeneca will have the sole right to make any such decision relating to the [***]; (b) Moderna will have the right to make any such decision relating to the [***] and (c) AstraZeneca will have the right to make any such decision relating to the [***]. Upon the request by a Party, such other Party through the JPC will reasonably cooperate in the implementation of such requesting Party’s decisions under this Section 10.3.

10.4 **Patent Listings.** With respect to any filings made to Regulatory Authorities with respect to the [***] for any Product, including as required or allowed in connection with in the United States, the FDA’s Orange Book, if applicable, or outside the United States, other international equivalents: (a) AstraZeneca will have the sole right to make all decisions regarding such filings relating to the [***]; and (b) each Party may make such listings regarding any [***] as each Party deems is appropriate. Upon the request by a Party, such other Party will reasonably cooperate in the implementation of such requesting Party’s decisions regarding the filing and listing of [***] pursuant to this Section 10.4.

10.5 **Enforcement and Defense.**

(a) **Notice.** Each Party will promptly notify, in writing, the other Party through the JPC upon learning of any actual or suspected Competitive Infringement by a Third Party, [***], and will, along with such notice, supply Moderna with any evidence in its possession pertaining thereto, and, subject to the terms of this Section 10.5, the JPC will discuss in good faith strategies for abating such Competitive Infringement.

(b) **Enforcement.**

(i) As between the Parties, [***].

(ii) If either Party receives a copy of a Biosimilar Application naming a Product as a reference product or otherwise becomes aware that such a Biosimilar Application has been filed (such as in an instance described in Section 351(l)(9)(C) of the PHSA), if the Exploitation of such Product as described in such Biosimilar Application would amount to Competitive Infringement, the remainder of this Section 10.5(b)(ii) will apply; otherwise, Section 10.5(b)(iv) will apply. [***] Such Party will, within [***], notify the other Party through the JPC. Moderna will then seek permission to view the application and related confidential information from the filer of the Biosimilar Application under Section 351(l)(1)(B)(iii) of the PHSA. If either Party receives any equivalent or similar certification or notice in the United States or any other jurisdiction, either Party will, within [***], notify and provide the other Party through the JPC copies of such communication. Regardless of the Party that is the “reference product sponsor” for purposes of such Biosimilar Application:

(A) [***]

(B) [***]

(C) [***]

(D) [***]

(E) [***]
(iii) The Parties recognize that procedures other than those set forth above in Section 10.5(b)(ii) may be applicable to Biosimilar Applications that are not governed by the PHSA. As a result, in the event that the JPC determines that certain provisions of Law in the United States or in any other country in the Territory are applicable to actions taken by the Parties with respect to Biosimilar Applications under Section 10.5(b)(ii) in such country, the Parties will comply with any such applicable Law in such country (and any relevant and reasonable procedures established by the JPC) in exercising their rights and obligations with respect to Biosimilar Applications under Section 10.5(b)(ii).

(iv) For that Competitive Infringement that is field limited per the definition thereof, if [***] is not [***] then [***].

(c) Defense. As between the Parties, [***].

(d) Withdrawal, Cooperation and Participation. With respect to any infringement or defensive action identified above in this Section 10.5 and subject to the terms of this Section 10.5:

(i) If the controlling Party ceases to pursue or withdraws from such action, it will promptly notify the other Party through the JPC (in sufficient time to enable the other Party to meet any deadlines by which any action must be taken to preserve any rights in such infringement or defensive action (including any such period of time as is required to comply with the provisions of Section 10.5(b)(ii))) and such other Party may substitute itself for the withdrawing Party and proceed under the terms and conditions of this Section 10.5.

(ii) The non-controlling Party will cooperate with the Party controlling any such action (as may be reasonably requested by the controlling Party), including [***]. The Party controlling any such action will keep the other Party updated with respect to any such action, including providing copies of all documents received or filed in connection with any such action.

(iii) Each Party will have the right to participate or otherwise be involved in any such action controlled by the other Party, in each case at the participating Party’s sole cost and expense and by counsel of its choosing. If a Party elects to so participate or be involved, the controlling Party will provide the participating Party and its counsel with an opportunity to consult with the controlling Party and its counsel regarding the prosecution of such action (including reviewing the contents of any correspondence, legal papers or other documents related thereto), and the controlling Party will take into account reasonable requests of the participating Party regarding such enforcement or defense.

(e) Settlement. With respect to any infringement or defensive action identified above in this Section 10.5, the Party controlling such action will have the right to settle or otherwise dispose of such action on such terms as such Party will determine in its sole discretion, including, [***]; provided that, notwithstanding the foregoing, no such settlement or other disposition will (i) impose any restriction or obligation on or admit fault of the other Party and (ii) adversely affect the scope, validity or enforcement of any [***], in each case (i) and (ii) without the prior written consent of the other Party (such consent not to be unreasonably withheld, delayed or conditioned).
(f) **Damages.** Unless otherwise agreed by the Parties, all monies recovered upon the final judgment or settlement of any action described in Section 10.5(b) or any action described in Section 10.5(c) will be used first to reimburse each of the Parties on a pro rata basis for each of their out-of-pocket costs and expenses relating to the action, with the balance of any such recovery to be divided as follows:

(i) To the extent such recovery reflects [***];

(ii) To the extent such recovery reflects [***]; and

(iii) For the remainder of any such recovery, [***].

10.6 **Third Party Rights.** Notwithstanding the foregoing provisions of this Section 10, each Party’s rights and obligations with respect to the [***] will be subject to the Third Party rights and obligations under any Third Party agreements under which either Party enters into pursuant to Section 2.6 of the A&R Services & Collaboration Agreement or is otherwise applicable to the [***]; provided, however, that, [***].

10.7 [***]

11. **Confidentiality.**

The Parties acknowledge and agree that terms of this A&R Option Agreement and all Confidential Information transferred, disclosed or made available by a Disclosing Party to a Receiving Party (or behalf of the Receiving Party to its Affiliates or a Third Party) under this A&R Option Agreement will be subject to the provisions of Section 7 of the A&R Services and Collaboration Agreement.

12. **Representations and Warranties; Covenants; Limitations of Liability; Indemnification.**

12.1 **Representations and Warranties of Each Party.** Each Party represents, warrants and covenants to the other as of the Signing Date and the Amendment Effective Date that:

(a) Such Party is duly organized, validly existing and in good standing under the laws of the jurisdiction in which it is organized.

(b) Such Party (i) has the legal right and power to enter into this A&R Option Agreement, to extend the rights granted or to be granted to the other in this A&R Option Agreement, and to fully perform its obligations hereunder, and (ii) has taken all requisite action on its part to authorize the execution and delivery of this A&R Option Agreement and the performance of its obligations hereunder. This A&R Option Agreement has been duly executed and delivered on behalf of such Party, and constitutes a legal, valid and binding obligation, enforceable against such Party in accordance with its terms, except as may be limited by bankruptcy, insolvency, reorganization or other laws affecting creditors’ rights generally and by general equitable principles.
(c) Neither such Party nor its Affiliates has been debarred or is subject to debarment. Neither it nor its Affiliates will use in any capacity, in connection with the services to be performed under the Transaction Agreements, any person who has been debarred pursuant to Section 306 of the FFDCA, or who is the subject of a conviction described in such section. In addition, neither it nor its Affiliates has used in any capacity, in connection with any Development activities with respect to the mRNA Technology or any Polypeptide carried out prior to the Signing Date, any person who has been debarred or was the subject of a conviction described in Section 306. Such Party agrees to inform the other Party in writing immediately if it or any person who is performing services under the Transaction Agreements is debarred or is the subject of a conviction described in Section 306, or if any action, suit, claim, investigation or legal or administrative proceeding is pending or, to the best of such Party’s or its Affiliates’ Knowledge, is threatened, relating to the debarment or conviction of such Party or any person performing services under the Transaction Agreements, or if such Party becomes aware that it or any person performing Development activities with respect to an mRNA Construct, Polypeptide, Product Candidate or Product carried out prior to the Signing Date was debarred or was the subject of a conviction described in Section 306.

(d) All necessary consents, approvals and authorizations of all governmental authorities and other Persons required to be obtained by such Party to enter into, or perform its obligations under, this A&R Option Agreement have been obtained.

(e) The execution and delivery of this A&R Option Agreement and the performance of such Party’s obligations hereunder (i) will not conflict with or violate any requirement of applicable Law or orders of governmental bodies except as individually or in the aggregate would not be reasonably expected to have a material adverse effect on or a material adverse change in the ability of such Party to perform its obligations under or with respect to this A&R Option Agreement, and (ii) do not conflict with, or constitute a default under, any contractual obligation of such Party, except as individually or in the aggregate would not have a material adverse effect on or a material adverse change in the ability of such Party to perform its obligations under or with respect to this A&R Option Agreement.

(f) Each Party covenants to the other Party that it will conduct its business in the ordinary course, consistent with past practices, during the period from the Signing Date until the Implementation Date. Each Party covenants to the other Party that it will use its reasonable efforts to ensure that its representations and warranties set forth in this Section 12.1 remain true and correct at and as of the Implementation Date as if such representations and warranties were made at and as of the Signing Date.

12.2 Representations and Warranties of Moderna. Moderna hereby represents, warrants and covenants to AstraZeneca as follows:

(a) All Patents which are owned or in which Moderna has an ownership interest existing as of the Signing Date (the “Existing Patents”) are listed on Schedule 1.101 of the A&R Services and Collaboration Agreement and all Existing Patents are owned solely or jointly by Moderna and are Controlled to the extent owned by Moderna; Existing Patents that are jointly owned are marked on such Schedule.
(b) Moderna is the sole and exclusive owner of, or is solely and exclusively licensed to, the entire right, title and interest in all the
Know-How (other than (i) [***], (ii) [***], and (iii) [***]) used by Moderna in connection with the Exploitation of mRNA Constructs as of the Signing
Date (the “Existing Know-How”), and all Existing Know-How is Controlled by Moderna.

(c) As of the Signing Date, Moderna is entitled to grant the rights and licenses set forth in the Transaction Agreements. As of the Signing
Date, the Existing Patents and the Existing Know-How are not subject to any encumbrance or lien or, or to the Knowledge of Moderna, claim of
ownership by any Third Party. Neither Moderna nor any of its Affiliates has before the Signing Date entered into any agreement, whether written or
oral, with respect to, or otherwise assigned, transferred, licensed, conveyed, or otherwise encumbered its right, title, or interest in or to [***], and it will
not after the Signing Date enter into any such agreements, grant any such right, title, or interest to any Person that is in conflict with the rights and
licenses granted to AstraZeneca under the Transaction Agreements.

(d) To the Knowledge of Moderna, (i) the Existing Patents are subsisting as of the Signing Date; and (ii) the conception, development and
reduction to practice of the Existing Know-How and the Existing Patents, in each case as of the Signing Date, [***].

(e) The pending applications included in the Existing Patents are as of the Signing Date being diligently prosecuted in good faith before
the respective patent offices in accordance with applicable Law, and Moderna and its Affiliates have presented to the extent required as of the Signing
Date all relevant references, documents and information of which it and the inventors are aware to the respective patent offices. As of the Signing Date,
the Existing Patents have been filed and maintained and all applicable fees have been paid on or before the due date for payment. [***]

(f) As of the Signing Date, to the Knowledge of Moderna, there is [***]. The trade secrets used by Moderna as of the Signing Date has
been kept confidential or has been disclosed to Third Parties only under terms of confidentiality and, to the Knowledge of Moderna and its Affiliates,
no breach of such confidentiality has been committed by any Third Party.

(g) As of the Signing Date, no Third Party claim or litigation has been brought or threatened by any Person alleging that (i) the Existing
Patents or the Existing Know-How are invalid or unenforceable, or (ii) the conception, development, reduction to practice, disclosing, copying,
making, assigning, or licensing of the Existing Patents or the Existing Know-How, or the Exploitation of mRNA Constructs, Product Candidates or
Products as contemplated in the Transaction Agreements, violates, infringes, constitutes misappropriation or otherwise conflicts or interferes with, or
would violate, infringe, or otherwise conflict or interfere with, any intellectual property or proprietary right of any Person.

(h) [***]

(i) All current and former officers, employees, agents and consultants of Moderna or any of its Affiliates who are inventors of or have
otherwise contributed in a material manner to the creation or development of any Existing Patent or Existing Know-How or who are or will be
performing activities on behalf of Moderna hereunder or who otherwise have access to any

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Confidential Information of AstraZeneca have executed and delivered to Moderna an obligation to assign or an assignment of rights (or are bound [* ***]) to any and all Patents, Know-How or other information that relate to mRNA Constructs and are generated pursuant to and during the time of such person’s relationship with Moderna or its Affiliate, such that AstraZeneca will, by virtue of the Transaction Agreements, receive from Moderna, without payments beyond those required by the Transaction Agreements, the licenses and other rights granted to AstraZeneca under the Transaction Agreements. To Moderna’s Knowledge, as of the Signing Date, no current officer, employee, agent, or consultant of Moderna or any of its Affiliates is in violation of any term of any assignment or other agreement regarding the protection of Patents or other intellectual property or proprietary information of Moderna or such Affiliate or of any employment contract or any other contractual obligation relating to the relationship of any such Person with Moderna.

(j) The inventions claimed or covered by the Existing Patents (i) were not discovered, developed, or otherwise made in connection with any research activities funded, in whole or in part, by [* ***], and (ii) [* ***], and (c) are not [* ***].

(k) There are no license agreements or other agreements as of the Signing Date pursuant to which Moderna is sublicensing the [* ***] to AstraZeneca.

(l) As of the Signing Date, neither Moderna nor any of its Affiliates, nor any of its or their respective officers, employees, consultants or agents has made an untrue statement of material fact or fraudulent statement to the FDA or any other Regulatory Authority with respect to the mRNA Technology or the Development of mRNA Constructs, failed to disclose a material fact required to be disclosed to the FDA or any other Regulatory Authority with respect to the mRNA Technology or the Development of mRNA Constructs.

(m) [* ***]

12.3 Moderna Corporate Covenants.

(a) [* ***]

(b) [* ***]

(c) [* ***]

(d) This Section 12.3 will terminate, and be of no further force or effect (a) immediately before the consummation of Moderna’s (or its Affiliate’s) first underwritten public offering of its Common Stock under the Securities Act of 1933, as amended, and the rules and regulations promulgated thereunder, (b) when Moderna first becomes subject to the periodic reporting requirements of Section 12(g) or 15(d) of the Securities Exchange Act of 1934, as amended, and the rules and regulations promulgated thereunder, or (c) immediately before a Business Combination of Moderna.

12.4 Disclaimers. Without limiting the respective rights and obligations of the Parties expressly set forth herein, each Party specifically disclaims any guarantee that an Optioned Product Candidate will be successful, in whole or in part. EXCEPT AS OTHERWISE EXPRESSLY
Provided in this A&R Option Agreement, the parties make no representations and extend no warranty of any kind, either express or implied, with respect to any Moderna technology, product candidates, or materials, including warranties of validity or enforceability of any patents, title, quality, merchantability, fitness for a particular use or purpose, performance, and noninfringement of any third party patents or other intellectual property rights.

12.5 No Consequential Damages. Notwithstanding anything in this A&R Option Agreement, except for damages due to the fraud or willful misconduct of the liable party, neither party will be liable to the other or any third party with respect to any subject matter of this A&R Option Agreement for any indirect, punitive, special or consequential damages, even if such party has been informed or should have known of the possibility of such damages; provided that this section 12.5 will not apply to the parties’ indemnification rights and obligations under the A&R Services and Collaboration Agreement.

12.6 Indemnification.

(a) Indemnification by AstraZeneca. AstraZeneca will indemnify Moderna, its Affiliates and their respective directors, officers, employees, Third Party licensors under the Existing In-License Agreements and agents, and their respective successors, heirs and assigns (collectively, “Moderna Indemnitees”), and defend and save each of them harmless, from and against any and all losses, damages, liabilities, costs and expenses (including reasonable attorneys’ fees and expenses) (collectively, “Losses”) in connection with any and all suits, investigations, claims or demands of Third Parties (collectively, “Third Party Claims”) arising from or occurring as a result of: [***], except in each case for those Losses for which Moderna has an obligation to indemnify AstraZeneca pursuant to Section 12.6(b), the A&R Services and Collaboration Agreement or the Original Agreements (or would have had such Third Party Claim been made against AstraZeneca), as to which Losses each Party will indemnify the other to the extent of their respective liability; provided, however, that AstraZeneca will not be obligated to indemnify Moderna Indemnitees for any Losses to the extent that such Losses arise as a result of gross negligence or willful misconduct on the part of a Moderna Indemnitee.

(b) Indemnification by Moderna. Moderna will indemnify AstraZeneca, its Affiliates and their respective directors, officers, employees and agents, and their respective successors, heirs and assigns (collectively, “AstraZeneca Indemnitees”), and defend and save each of them harmless, from and against any and all Losses in connection with any and all Third Party Claims arising from or occurring as a result of [***], except in each case for those Losses for which AstraZeneca has an obligation to indemnify Moderna pursuant to Section 12.6(a), the A&R Services and Collaboration Agreement or the Original Agreements (or would have had such Third Party Claim been made against Moderna), as to which Losses each Party will indemnify the other to the extent of their respective liability for the Losses; provided, however, that Moderna will not
be obligated to indemnify AstraZeneca Indemnitees for any Losses to the extent that such Losses arise as a result of (1) gross negligence or willful misconduct on the part of an AstraZeneca Indemnitee or (2) ***.

(c) Notice of Claim. All indemnification claims provided for in Section 12.6(a) and 12.6(b) will be made solely by such Party to this A&R Option Agreement (the “Indemnified Party”). The Indemnified Party will promptly notify the indemnifying Party (an “Indemnification Claim Notice”) of any Losses or the discovery of any fact upon which the Indemnified Party intends to base a request for indemnification under Section 12.6(a) or 12.6(b), but in no event will the indemnifying Party be liable for any Losses that result from any delay in providing such notice. Each Indemnification Claim Notice must contain a description of the claim and the nature and estimated amount of such Loss (to the extent that the nature and amount of such Loss is known at such time). The Indemnified Party will furnish promptly to the indemnifying Party copies of all papers and official documents received in respect of any Losses and Third Party Claims.

(d) Defense, Settlement, Cooperation and Expenses.

(i) Control of Defense. At its option, the indemnifying Party may assume the defense of any Third Party Claim by giving written notice to the Indemnified Party within *** days after the indemnifying Party’s receipt of an Indemnification Claim Notice. The assumption of the defense of a Third Party Claim by the indemnifying Party will not be construed as an acknowledgment that the indemnifying Party is liable to indemnify the Indemnified Party in respect of the Third Party Claim, nor will it constitute a waiver by the indemnifying Party of any defenses it may assert against the Indemnified Party’s claim for indemnification. Upon assuming the defense of a Third Party Claim, the indemnifying Party may appoint as lead counsel in the defense of the Third Party Claim any legal counsel selected by the indemnifying Party (the indemnifying Party will consult with the Indemnified Party with respect to a possible conflict of interest of such counsel retained by the indemnifying Party). In the event the indemnifying Party assumes the defense of a Third Party Claim, the Indemnified Party will immediately deliver to the indemnifying Party all original notices and documents (including court papers) received by the Indemnified Party in connection with the Third Party Claim. Should the indemnifying Party assume the defense of a Third Party Claim, except as provided in Section 12.6(d)(ii), the indemnifying Party will not be liable to the Indemnified Party for any legal costs or expenses subsequently incurred by such Indemnified Party in connection with the analysis, defense or settlement of the Third Party Claim. ***

(ii) Right to Participate in Defense. Without limiting Section 12.6(d)(i), any Indemnified Party will be entitled to participate in, but not control, the defense of such Third Party Claim and to employ counsel of its choice for such purpose; provided, however, that such employment will be at the Indemnified Party’s own cost and expense unless ***.

(iii) Settlement. With respect to any Third Party Claims that relate solely to the payment of money damages in connection with a Third Party Claim and that will not result in the Indemnified Party’s becoming subject to injunctive or other relief or otherwise adversely affecting the business of the Indemnified Party in any manner, and as to which the indemnifying Party will have acknowledged in writing the obligation to indemnify the Indemnified Party hereunder, the
indemnifying Party will have the sole right to agree to the entry of any judgment, enter into any settlement or otherwise dispose of such Loss, on such terms as the indemnnifying Party, in its sole discretion, will deem appropriate. With respect to all other Losses in connection with Third Party Claims, where the indemnifying Party has assumed the defense of the Third Party Claim in accordance with Section 12.6(d)(i), the indemnifying Party will have authority to agree to the entry of any judgment, enter into any settlement or otherwise dispose of such Loss provided it obtains the prior written consent of the Indemnified Party (such consent not to be unreasonably withheld, delayed or conditioned). The indemnifying Party will not be liable for any settlement or other disposition of a Loss by an Indemnified Party that is reached without the prior written consent of the indemnifying Party. Regardless of whether the indemnifying Party chooses to defend or prosecute any Third Party Claim, no Indemnified Party will admit any liability with respect to or settle, compromise or discharge, any Third Party Claim without the prior written consent of the indemnifying Party, such consent not to be unreasonably withheld, delayed or conditioned.

(iv) Cooperation. If the indemnifying Party chooses to defend or prosecute any Third Party Claim, the Indemnified Party will, and will cause each other Indemnified Party to, cooperate in the defense or prosecution thereof and will furnish such records, information and testimony, provide such witnesses and attend such conferences, discovery proceedings, hearings, trials and appeals as may be reasonably requested in connection therewith. Such cooperation will include access during normal business hours afforded to indemnifying Party to, and reasonable retention by the Indemnified Party of, records and information that are reasonably relevant to such Third Party Claim, and making Indemnified Parties and other employees and agents available on a mutually convenient basis to provide additional information and explanation of any material provided hereunder, and the indemnifying Party will reimburse the Indemnified Party for all its reasonable out-of-pocket costs and expenses in connection therewith.

(v) Costs and Expenses. Except as provided above in this Section 12.6(d), the reasonable and verifiable costs and expenses, including attorneys’ fees and expenses, incurred by the Indemnified Party in connection with any claim will be reimbursed on a Calendar Quarter basis by the indemnifying Party, without prejudice to the indemnifying Party’s right to contest the Indemnified Party’s right to indemnification and subject to refund in the event the indemnifying Party is ultimately held not to be obligated to indemnify the Indemnified Party.

13. Term and Termination.

13.1 Option Agreement Term. This A&R Option Agreement will commence as of the Amendment Effective Date and on such date will replace and supersede the Original Option Agreement in its entirety; provided that [***]. The term of this A&R Option Agreement, unless sooner terminated in accordance with the terms hereof or by mutual written consent, will be deemed to have commenced on the Signing Date and will continue until the entire Exercise Price for each Optioned Product Candidate (and associated Development Pool Candidates) is paid in full (the “Option Agreement Term”).

13.2 Termination by Moderna. Moderna will have the right to terminate this A&R Option Agreement in full upon delivery of written notice to AstraZeneca in the event of any material breach by AstraZeneca of any terms and conditions of this A&R Option Agreement [***].
provided, that to the extent that any such breach is limited to Collaboration mRNA Constructs [***] a particular Research Polypeptide or Development Polypeptide, Moderna will have the right to terminate this A&R Option Agreement only with respect to such Collaboration mRNA Constructs, and (a) such Collaboration mRNA Constructs will become Discontinued Product Candidates, (b) the Polypeptide [***] such Collaboration mRNA Constructs will become a Discontinued Polypeptide and (c) the Research Target [***] such Discontinued Polypeptide will become a Discontinued Research Target unless for such Research Target there is an Optioned Product Candidate [***] a Development Polypeptide for such Research Target. For clarity, for the purposes of such discontinuance, [***]. Notwithstanding the foregoing, any such termination under this Section 13.2 will not be effective if such breach has been cured within [***] days after written notice thereof is given by Moderna to AstraZeneca specifying the nature of the alleged breach (or, if such default cannot be cured within such [***]-day period, such longer period as reasonably required to cure such breach, provided that AstraZeneca commences actions to cure such default within such [***]-day period and thereafter diligently continues such actions); provided, that to the extent such material breach involves the failure to make an undisputed payment when due, such breach must be cured within [***] days after written notice thereof is given by Moderna to AstraZeneca. [***]

13.3 Termination by AstraZeneca.
   (a) Breach. AstraZeneca will have the right to terminate this A&R Option Agreement in full upon delivery of written notice to Moderna in the event of any material breach by Moderna of any terms and conditions of this A&R Option Agreement [***], provided, that to the extent that any such breach is limited to a particular Polypeptide (and Collaboration mRNA Constructs [***] such Polypeptide), AstraZeneca will have the right to terminate this A&R Option Agreement only with respect to such Polypeptide (and Collaboration mRNA Constructs [***] such Polypeptide).
   Notwithstanding the foregoing, any such termination under this Section 13.3(a) will not be effective if such breach has been cured within [***] days after written notice thereof is given by AstraZeneca to Moderna specifying the nature of the alleged breach (or, if such default cannot be cured within such [***]-day period, such longer period as reasonably required to cure such breach, provided that Moderna commences actions to cure such default within such [***]-day period and thereafter diligently continues such actions); provided, that to the extent such material breach involves the failure to make an undisputed payment when due, such breach must be cured within [***] days after written notice thereof is given by AstraZeneca to Moderna. [***]

   (b) Discretionary Termination. AstraZeneca will have the right to terminate this A&R Option Agreement in full ninety (90) days after delivery of written notice to Moderna if the Executive Officer of AstraZeneca concludes due to scientific, technical, regulatory or commercial reasons, including [***].

13.4 Alternative to Termination Under Section 13.3(a). If AstraZeneca has the right to terminate this A&R Option Agreement or this A&R Option Agreement with respect to a particular Polypeptide that is [***] an Optioned Product Candidate (or Subject Construct or Product) under Section 13.3(a) (including expiration of all applicable cure periods thereunder), in lieu of exercising such termination right, AstraZeneca may elect once by written notice to Moderna before the end of such applicable cure period to have this A&R Option Agreement continue in full force and effect, in which case the following will apply:

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(a) Starting immediately after the end of such applicable cure period, any payments for Contingent Event Option Exercise Payment and Option Exercise Earn-Out payments hereunder payable following such date that AstraZeneca has the right to terminate this A&R Option Agreement under Section 13.3(a) will be reduced by [***], provided that such reduction will not apply if and to the extent [***]; provided that if such right of termination is limited to a particular Optioned Product, Subject Construct or Product, then such [***] reduction will apply to such Optioned Product Candidate, Subject Construct or Product and will not apply more generally.

(b) The following provisions will cease to apply: [***] of the Product Commercialization Schedule; provided that [***].

13.5 Effects of Termination or Expiration. Upon termination or expiration of this A&R Option Agreement for any reason:

(a) The license grants (including Section 3.1) will terminate, other than [***];

(b) Any unpaid Exercise Price attributable to those Optioned Product Candidate (and associated Development Pool Candidates) will remain due and payable to Moderna, pursuant to the applicable Schedule A; and

(c) All unexercised Options will automatically terminate;

Provided that, in the event that either Party terminates this A&R Option Agreement with respect to a particular Optioned Product Candidate, Subject Construct or Product, the provisions of Section 6.3 of the Product Commercialization Schedule will apply.

13.6 Survival. In addition to the termination consequences set forth in Section 13.5, the following provisions will survive termination or expiration of this A&R Option Agreement: [***]. Termination or expiration of this A&R Option Agreement will not relieve the Parties of any liability or obligation which accrued hereunder prior to the effective date of such termination or expiration nor preclude either Party from pursuing all rights and remedies it may have hereunder or at law or in equity with respect to any breach of this A&R Option Agreement nor prejudice either Party’s right to obtain performance of any obligation. All other rights and obligations will terminate upon expiration of this A&R Option Agreement.

13.7 Integrated Agreements. The Parties acknowledge that the Transaction Agreements, together, constitute an integrated set of agreements entered into as part of the same transaction that collectively govern the subject matter covered by the Transaction Agreements. Early termination of any one of the Transaction Agreements without the others would fundamentally alter the intended allocation of rights and obligations intended by the Parties in entering into the Transaction Agreements. Thus, if a Party (or its bankruptcy trustee) has the right to reject any of the Transaction Agreements under the U.S. Bankruptcy Code or any analogous provision under any other law in any country outside the United States, such Party (or the applicable bankruptcy trustee) will either reject all of the Transaction Agreements or assume all of the Transaction Agreements, but may not reject one Transaction Agreement without rejecting the others.
14. **General Provisions.**

14.1 **Dispute Resolution.** Disputes arising under or in connection with this A&R Option Agreement will be resolved in accordance with Section 11.1 of the A&R Services and Collaboration Agreement.

14.2 **Cumulative Remedies and Irreparable Harm.** All rights and remedies of the Parties hereunder will be cumulative and in addition to all other rights and remedies provided hereunder or available by agreement, at law or otherwise. Each Party acknowledges and agrees that breach of any of the terms or conditions of this A&R Option Agreement would cause irreparable harm and damage to the other and that such damage may not be ascertainable in money damages and that as a result thereof the non-breaching Party would be entitled to seek on an interim basis from a court and on a permanent basis from an arbitral tribunal equitable or injunctive relief restraining any breach or future violation of the terms contained herein by the breaching Party without the necessity of proving actual damages or posting bond. Such right to equitable relief is in addition to whatever remedies either Party may be entitled to as a matter of law or equity, including money damages.

14.3 **Business Combination and Exclusivity.** The Parties acknowledge and agree that the provisions of 11.3 of the A&R Services and Collaboration Agreement will govern the Parties rights and obligations with respect to a Business Combination under this A&R Option Agreement.

14.4 **Relationship of Parties.** Nothing in this A&R Option Agreement is intended or will be deemed to constitute a partnership, agency, employer-employee or joint venture relationship between the Parties. No Party will incur any debts or make any commitments for the other, except to the extent, if at all, specifically provided therein. There are no express or implied third party beneficiaries hereunder.

14.5 **Anti-Bribery and Corruption Compliance.** The Parties acknowledge and agree that the provisions of Section 11.4 of the A&R Services and Collaboration Agreement will govern anti-bribery and corruption compliance under this A&R Option Agreement.

14.6 **Compliance with Law.** Each Party will perform or cause to be performed any and all of its obligations or the exercise of any and all of its rights hereunder in good scientific manner and in compliance with all applicable Law.

14.7 **Governing Law.** This A&R Option Agreement will be governed by and construed in accordance with the Laws of the state of New York, without respect to its conflict of laws rules or principles that might otherwise refer construction or interpretation of this A&R Option Agreement to the substantive Law of another jurisdiction; provided, however, that any dispute relating to the scope, validity, enforceability or infringement of any Patents will be governed by, and construed and enforced in accordance with, the substantive Laws of the jurisdiction in which such Patents apply. The Parties agree to exclude the application to this A&R Option Agreement of the United Nations Convention on Contracts for the International Sale of Goods.
14.8 **Counterparts; Facsimiles.** This A&R Option Agreement may be executed in one or more counterparts, each of which will be deemed an original, and all of which together will be deemed to be one and the same instrument. Facsimile or PDF execution and delivery of this A&R Option Agreement by either Party will constitute a legal, valid and binding execution and delivery of this A&R Option Agreement by such Party.

14.9 **Headings.** All headings in this A&R Option Agreement are for convenience only and will not affect the meaning of any provision hereof.

14.10 **Waiver of Rule of Construction.** Each Party has had the opportunity to consult with counsel in connection with the review, drafting and negotiation of this A&R Option Agreement. Accordingly, the rule of construction that any ambiguity in this A&R Option Agreement will be construed against the drafting party will not apply.

14.11 **Interpretation.** Whenever any provision of this A&R Option Agreement uses the term “including” (or “includes”), such term will be deemed to mean “including without limitation” (or “includes without limitations”). “Herein,” “hereby,” “hereunder,” “hereof” and other equivalent words refer to this A&R Option Agreement as an entirety and not solely to the particular portion of this A&R Option Agreement in which any such word is used. Except where the context otherwise requires, whenever used, the singular will include the plural, the plural the singular, the use of any gender will be applicable to all genders and the word “or” is used in the inclusive sense (and/or). Unless otherwise provided, all references to Sections, Exhibits and Schedules in this A&R Option Agreement are to Sections, Exhibits and Schedules of this A&R Option Agreement. References to any Sections include Sections and subsections that are part of the related Section (e.g., a section numbered “Section 2.1” would be part of “Section 2”, and references to “Section 2.1” would also refer to material contained in the subsection described as “Section 2.1(a)”).

14.12 **Binding Effect.** This A&R Option Agreement will inure to the benefit of and be binding upon the Parties, their Affiliates, and their respective lawful successors and assigns.

14.13 **Assignment.** This A&R Option Agreement may not be assigned by either Party, nor may either Party delegate its obligations or otherwise transfer any rights created by this A&R Option Agreement, except as expressly permitted hereunder or otherwise without the prior written consent of the other Party, which consent will not be unreasonably withheld, delayed or conditioned; provided that either Party may assign this A&R Option Agreement to an Affiliate or to such Party’s successor in connection with the merger, consolidation, sale of all or substantially all of its assets or that portion of its business pertaining to the subject matter of this A&R Option Agreement, or any Business Combination of such Party. Notwithstanding the foregoing, neither Party may assign this A&R Option Agreement unless such assignment also includes an assignment of all of the Transaction Agreements to the same Affiliate or Third Party successor, as applicable. The rights and obligations of the Parties under this A&R Option Agreement will be binding upon and inure to the benefit of the successors and permitted assigns of the Parties, and the name of a Party appearing herein will be deemed to include the name of such Party’s successors and permitted assigns to the extent necessary to carry out the intent of this Section 14.13.
14.14 Amendment and Waiver. This A&R Option Agreement may be amended, supplemented, or otherwise modified only by means of a written instrument signed by both Parties; provided that any unilateral undertaking or waiver made by one Party in favor of the other will be enforceable if undertaken in a writing signed by the Party to be charged with the undertaking or waiver. Any waiver of any rights or failure to act in a specific instance will relate only to such instance and will not be construed as an agreement to waive any rights or fail to act in any other instance, whether or not similar.

14.15 Severability. In the event that any provision of this A&R Option Agreement will, for any reason, be held to be invalid or unenforceable in any respect, and if the rights or obligations of either Party under this A&R Option Agreement will not be materially and adversely affected thereby, (a) such provisions will be given no effect by the Parties and will not form part of this A&R Option Agreement, (b) all other provisions of this A&R Option Agreement will remain in full force and effect, and (c) the Parties will negotiate in good faith to modify this A&R Option Agreement to preserve (to the extent possible) their original intent.

14.16 Entire Agreement. This A&R Option Agreement, along with the other Transaction Agreements (and any agreements entered into pursuant to the Original Agreements), are the sole agreements with respect to the subject matter hereof and except as provided in Section 13.1, supersede all other agreements and understandings between the Parties with respect to same (including the Confidentiality Agreement).

[Remainder of this Page Intentionally Left Blank]
IN WITNESS WHEREOF, the Parties have caused this A&R Option Agreement to be executed by their respective duly authorized officers as of the Amendment Effective Date.

MODERNA Tx, INC.

By: /s/ Stéphane Bancel  
(Signature)
Name: Stéphane Bancel  
Title: CEO  
Date: June 15, 2018
ASTRAZENECA AB

By: /s/ Jesper Bergkvist
   (Signature)

Name: Jesper Bergkvist
Title: Legal Director
Date: June 15, 2018
Exhibit A

The AstraZeneca CV Targets

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Exhibit B

The AstraZeneca Exclusive Target
[***]
Exhibit C
The AstraZeneca Oncology Target
[***] [***]
### Exhibit D

**Discontinued Targets as of the Amendment Effect Date**

Discontinued Targets (CV)

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Discontinued Targets (Oncology)

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Schedule A

Schedule of Exercise Price Payable for each Optioned Product Candidate
for each Option Exercise

This Schedule A will apply to each Optioned Product Candidate (and all associated Development Pool Candidates) on an Optioned Product Candidate-by-Optioned Product Candidate and Product-by-Product basis in all respects. For each such Optioned Product Candidate, Development Pool Candidates and Products, the Product Commercialization Schedule will also apply.

The following terms and their correlatives will have the meanings set forth below. Capitalized terms used, but not defined, herein will have the meanings ascribed to such terms in the body of the Option Agreement and the other Transaction Agreements.

1. Definitions.

1.1 “EU” means the organization of member states of the European Union as it may be constituted from time to time.

1.2 “First Commercial Sale” means the first arm’s length sale by AstraZeneca, its Affiliates, or its Sublicensees to a Third Party for end use or consumption by the general public of a Product in a country after all required Regulatory Approvals for commercial sale of such Product have been obtained by AstraZeneca, its Affiliates or its Sublicensees in such country; provided, however, that in no event will any sale or distribution of such Product for use in clinical trial or otherwise any sales prior to receipt of all Regulatory Approvals necessary to commence regular commercial sales (including so-called “treatment IND sales” and “compassionate use sales”) be deemed a First Commercial Sale.

1.3 “Generic Product” means, with respect to a Product in a given country, any generic or biosimilar product sold by a Third Party not licensed or otherwise authorized by or on behalf of AstraZeneca or any of its Affiliates or Sublicensees (a) that is a “biological product” (as defined in Section 351(i)(1) of the PHSA) that is subject to a license for administration to humans under Section 351(a) or 351(k) of the PHSA and (i) contains an active ingredient that is the same as the active ingredient of such Product (including any mRNA Constructs therein) or (ii) is “biosimilar” (as defined in Section 351(i)(2) of the PHSA) or “interchangeable” (as defined in Section 351(i)(3) of the PHSA) to the Product; or (b) that has received analogous Regulatory Approval from the applicable Regulatory Authority by referencing Regulatory Filings (and data therein) of such Product.

1.4 “Net Sales” means the gross invoiced amount on sales of a Product by AstraZeneca and its Affiliates and its Sublicensees to Third Parties (which will include Distributors but not Sublicensees) after deduction of the following amounts:

(a) [***]

(b) [***]
In the event that a Product is sold in any country in the form of a combination Product containing one or more therapeutically active ingredient(s), in addition to the applicable Optioned Product Candidate or any related Subject Constructs, (such product containing such other active ingredient, if sold separately, the “Other Product”), Net Sales of such combination Product will be determined as follows:

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Net Sales will be calculated using AstraZeneca’s internal audited systems used to report such sales as adjusted for any of items [***] above not taken into account in such systems. [***]. Sales and other transfer of Product between any of AstraZeneca, its Affiliates and Sublicensees will not give rise to Net Sales, but rather the subsequent sale of Product to Third Parties.

1.5 “Phase 2 Study” means a clinical trial of a Product the principal purpose of which is a determination of safety and an assessment of its efficacy in the target patient population as described under 21 C.F.R. §312.21(b) (as amended or any replacement thereof), or a similar clinical study prescribed by the Regulatory Authorities in a foreign country.

1.6 “Phase 3 Study” means a clinical trial of a Product on a sufficient number of subjects that is designed to establish that a Product is safe and efficacious for its intended use, and to determine warnings, precautions, and adverse reactions that are associated with such Product in the dosage range to be prescribed, which trial is intended to support Regulatory Approval of such Product, as described in 21 C.F.R. 312.21(c) (as amended or any replacement thereof), or a similar clinical study prescribed by the Regulatory Authorities in a foreign country.
1.7 “PHSA” means the United States Public Health Service Act, as amended.

1.8 “Selling Party” means AstraZeneca and its Affiliates and Sublicensees (excluding Distributors).

1.9 “Valid Claim” means, with respect to a particular country, [***].

2. **Exercise Price.**

2.1 **Initial Payment.** The Initial Payment is payable by AstraZeneca to Moderna pursuant to Section 6.5(b) of the Option Agreement.

2.2 **Contingent Event Option Exercise Payments.**

AstraZeneca will make a payment to Moderna upon the occurrence of each of the events (each, a “Contingent Event”) as set forth below in this Paragraph 2.2 (Schedule A) (each such payment, a “Contingent Event Option Exercise Payment”). AstraZeneca will give Moderna written notice within [***] days of the first achievement of each Contingent Event set forth below, whether achieved by or on behalf of AstraZeneca, its Affiliate, or Sublicensee. After receiving such written notice, Moderna will submit an invoice to AstraZeneca for the amount of the Contingent Event Option Exercise Payment, and AstraZeneca will pay Moderna the applicable Contingent Event Option Exercise Payment within [***][***] days after AstraZeneca’s receipt of such invoice. [***][***]

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2.3 **Option Exercise Earn-Out Payments.**

(a) **Rates.** Subject to the remainder of this Paragraph 2.3(a) (Schedule A), AstraZeneca will pay to Moderna an earn-out (the “Option Exercise Earn-Out”), [***], based on the total aggregate annual worldwide Net Sales by Selling Parties of such Product in a given calendar year at the following Option Exercise Earn-Out rates:

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<th>Annual Worldwide Net Sales of each Product</th>
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Annual worldwide Net Sales will be calculated by taking the aggregate sum of Net Sales of Products for all countries worldwide.

By way of example, in a given calendar year, if the aggregate annual worldwide Net Sales for a Product is [***], the following Option Exercise Earn-Out payment would be payable for those Net Sales under this Paragraph 2.3(a) (Schedule A): [***].

(b) **Option Exercise Earn-Out Term.** The Option Exercise Earn-Out under Paragraph 2.3(a) (Schedule A) will be payable, [***], on the Net Sales of such Product from the date of First Commercial Sale of such Product in such country for so long as at least one of the following [***] conditions apply:

(i) if one or more Valid Claims within [***];

(ii) Such Product in such country is covered by a Regulatory Exclusivity Period;

(iii) [***]

(iv) for [***] from the First Commercial Sale of such Product in such country.

(c) **Option Exercise Earn-Out Reductions.**

(i) **Option Exercise Earn-Out Reduction.** If a Product used to treat patients is subject to an Option Exercise Earn-Out payment only on account of [***], but not [***] or [***], then the Option Exercise Earn-Out rates set forth in Paragraph 2.3(a) (Schedule A) with respect to Net Sales attributable to Product will be reduced by [***].

(ii) **Third-Party Payments.** If, during the applicable Earn-Out Term, AstraZeneca [***], then, upon [***], and thereafter during the remainder of the period during which AstraZeneca owes Option Exercise Earn-Out payments to Moderna hereunder, AstraZeneca will have the right to deduct from the Option Exercise Earn-Out payments due to Moderna under Paragraph 2.3(a) (Schedule A) [***] of [***] (including [***]) by AstraZeneca to such Third Party; provided, however, that in no event will the Option Exercise Earn-Out amounts payable to Moderna in a particular Calendar Quarter be reduced as a result of this Paragraph 2.3(c)(ii) (Schedule A) to a rate lower than [***]; and provided, further, that [***].

(iii) **Generic Product Competition.** If, at any time, in a particular country in the Territory, with respect to a Product being sold in such country, (i) a Generic Product of such Product is sold by any Third Party in such country and (ii)[***], then for the purposes of calculating the Earn-Out payment of such Product owed to Moderna under Paragraph 2.3(a) (Schedule A), [***] will be disregarded for such Calendar Quarter. The calculation of the reduction under this Paragraph 2.3(c)(iii) (Schedule A) will be conducted separately for each Product in each country.
(iv) **Compulsory Licenses.** In the event that a court or a governmental agency of competent jurisdiction requires AstraZeneca or an AstraZeneca Affiliate or Sublicensee to grant a compulsory license to a Third Party permitting such Third Party to make and sell the Product in a country in the Territory, then for the purposes of calculating the Option Exercise Earn-Out payments of such Product under Paragraph 2.3(a) (Schedule A), [***] will be disregarded. The calculation of the Option Exercise Earn-Out reduction under this Paragraph 2.3(c)(iv) will be conducted separately for each Product.

(v) **In-License Payments.**

(A) **Moderna Collaboration In-Licenses.** If any In-License Payment becomes due under any Moderna Collaboration In-License with respect to the applicable Optioned Product Candidate prior to expiration of the Earn-Out Term for such Optioned Product Candidate, Moderna will pay same and, subject to [***] and Section 2.8(b) of the A&R Services and Collaboration Agreement, AstraZeneca will reimburse Moderna for [***] of [***] within [***] days of receipt of Moderna’s written invoice therefor. To the extent that any grant of a sublicense by AstraZeneca or any Sublicensees under an Moderna Collaboration In-License triggers a payment obligation under such Moderna Collaboration In-License, Moderna will pay same and AstraZeneca will reimburse Moderna for [***] of [***] within [***] days of receipt of Moderna’s written invoice therefor.

(B) **Moderna [***] In-Licenses.** Notwithstanding Paragraph 2.3(c)(v)(A), if during the Option Agreement Term, any In-License Payments become due under any Moderna Collaboration In-License that is [***] as a result of the grant of a sublicense thereunder to AstraZeneca or any further Sublicensees of AstraZeneca (including of AstraZeneca’s Affiliates that are granted sublicenses), (i) AstraZeneca will reimburse Moderna for [***] of [***] within [***] days of receipt of Moderna’s written invoice therefor, and (ii) any such In-License Payments (excluding [***]) will be subject to Paragraph 2.3(c)(ii) (Schedule A) to the extent applicable thereunder. Notwithstanding the foregoing, [***]. To the extent that any grant of a sublicense by AstraZeneca or any Sublicensees under an Moderna Collaboration In-License that is a [***] triggers a payment obligation under such Moderna Collaboration In-License, Moderna will pay same and AstraZeneca will reimburse Moderna for [***] of [***] within [***] days of receipt of Moderna’s written invoice therefor.

(d) **Payment Floor.** In no event will any credits, deductions or reductions permitted to be taken under this Schedule A, the Option Agreement or any other Transaction Agreement against any particular Contingent Event Option Exercise Payment or Option Exercise Earn-Out payment owed to Moderna under this Schedule A (including pursuant to Paragraph 2.3(c) (Schedule A)) act to reduce such payment by more than [***]; provided, that [***].

(e) **Additional Option Exercise Earn-Out Provisions.** The Option Exercise Earn-Out payable under Paragraph 2.3(a) (Schedule A) will be subject to the following:

(i) only one Option Exercise Earn-Out will be payable under this Schedule A with respect to each Product unit;
(ii) except as otherwise expressly provided in this Schedule A, the Option Agreement and the other Transaction Agreements, the Option Exercise Earn-Out when owed or paid under this Schedule A will be nonrefundable and non-creditable and not subject to set-off; and

(iii) except as expressly set forth in Paragraph 2.3(c) (Schedule A), no other Option Exercise Earn-Out credits, reductions or deductions are permitted under this Schedule A.

2.4 Payment Terms

(a) Manner of Payment. All payments to be made by AstraZeneca to Moderna under this Schedule A will be made in U.S. dollars. All payments to be made by AstraZeneca to Moderna under this Schedule A will be made by wire transfer in immediately available funds to such bank account as Moderna may designate by written notice to AstraZeneca.

(b) Reports and Payments. For as long as any Earn-Out payments are due under this Schedule A, AstraZeneca will furnish to Moderna a written report, after the end of each Calendar Quarter, showing the amount of Net Sales due for such Product, which report will be furnished within [***] days of the end of the Calendar Quarter for which the Earn-Out payments are due. Earn-Out payments for each Calendar Quarter will be due at the same time as such written reports for the Calendar Quarter. The reports will include, at a minimum, [***]. After receiving such written report, Moderna will submit an invoice to AstraZeneca for all Earn-Out payments, if requested by AstraZeneca (and any request or delivery of any such invoice will not extend the payment deadline specified above). AstraZeneca will provide to Moderna a form invoice for use by Moderna in issuing any invoice under the Transaction Agreements.

(c) Records and Audits. AstraZeneca will keep, and will cause each of the other Selling Parties, as applicable, to keep, and Moderna will keep, adequate books and records of accounting for the purpose of calculating all Exercise Price payable by Moderna to AstraZeneca under this Schedule A and ensuring Moderna’s compliance under this Schedule A. Such books and records will be maintained by AstraZeneca for at least [***] from the date of creation. During the Option Agreement Term, such books and records of accounting (including those of the other Selling Parties, as applicable) will be kept at each of their principal places of business. At the request of Moderna, AstraZeneca will, and AstraZeneca will cause each of the other Selling Parties to, permit an independent certified public accounting firm of nationally recognized standing selected by Moderna and reasonably acceptable to AstraZeneca, during normal business hours and upon reasonable notice, to examine the books and records maintained pursuant to this Paragraph 2.4(c) (Schedule A). Such examinations may not (i) be conducted for any calendar year after the end of the Option Agreement Term, (ii) be conducted more than [***] period and going back no more than [***] after receipt of the respective invoice and report or (iii) be repeated for any calendar year. Moderna will provide AstraZeneca with a copy of the accounting firm’s written report within [***] of completion of such report. Except as provided below, the cost of this examination will be borne by Moderna, unless the audit reveals a variance of more than [***] from the reported amounts for a calendar year, in which case AstraZeneca will bear the reasonable out-of-pocket cost of the audit.
provided such variance exceeds [***]. Unless disputed as described below, if such audit concludes that additional payments were owed or that excess payments were made during such period, AstraZeneca will pay the additional amounts or Moderna will reimburse such excess payments, with interest from the date originally due as provided in Paragraph 2.4(f) (Schedule A), within [***] days after the date on which a written report of such audit is delivered to the Parties. In the event of a dispute regarding such books and records, including the amount owed to Moderna under this Paragraph 2.4(c) (Schedule A), Moderna and AstraZeneca will work in good faith to resolve the disagreement. If the Parties are unable to reach a mutually acceptable resolution of any such dispute within [***] days, such dispute will be resolved in accordance with the dispute resolution procedures set forth in Section 11.1 of the A&R Services and Collaboration Agreement. The receiving Party will treat all information subject to review under this Paragraph 2.4(c) (Schedule A) in accordance with the confidentiality provisions of Section 11 of the Option Agreement, and AstraZeneca will cause any accounting firm, auditor or arbitrator to enter into a reasonably acceptable confidentiality agreement with AstraZeneca obligating such firm to retain all such financial information in confidence pursuant to such confidentiality agreement. Moderna may provide Third Parties to which Moderna owes payments on Products information in such audit report that are relevant and required to comply with such Third Party’s audit rights under the applicable license agreement between Moderna and such Third Party, provided that such Third Party is obligated to keep such information confidential.

(d) **Currency Exchange**. With respect to Net Sales invoiced in U.S. dollars, the Net Sales and the amounts due to Moderna under this Schedule A will be expressed in U.S. dollars. With respect to Net Sales invoiced in a currency other than U.S. dollars, payments will be converted from local currency to U.S. dollars by AstraZeneca in accordance with the rates of exchange for the relevant month for converting such other currency into U.S. dollars used by AstraZeneca’s internal accounting systems, which are independently audited on an annual basis and which are in accordance with generally accepted accounting principles, fairly applied and as employed on a consistent basis throughout AstraZeneca’s operations.

(e) **Blocked Payments**. In the event that, by reason of applicable Law in any country, it becomes impossible or illegal for AstraZeneca (or any other Selling Party) to transfer, or have transferred on its behalf, payments owed Moderna under this Schedule A, AstraZeneca will promptly notify Moderna of the conditions preventing such transfer and such payments will be deposited in local currency in the relevant country to the credit of Moderna in a recognized banking institution designated by Moderna or, if none is designated by Moderna within a period of [***] days, in a recognized banking institution selected by AstraZeneca or another Selling Party, as the case may be, and identified in a written notice given to Moderna.

(f) **Interest Due**. If any payment due to either Party under this Schedule A is overdue (and is not subject to a good faith dispute), then such paying Party will pay interest thereon [***] at an annual rate [***] of the lesser of (i) [***] and (ii) [***], such interest to run from the date upon which payment of such sum became due until payment thereof in full together with such interest.
2.5 Mutual Convenience of the Parties. The Exercise Price payment obligations set forth under this Schedule A have been agreed to by the Parties for the purpose of reflecting and advancing their mutual convenience, including the ease of calculating and paying amounts to Modera. AstraZeneca hereby stipulates to the fairness and reasonableness of such payments obligations and covenants not to allege or assert, nor to allow any of its Sublicensees or Affiliates to allege or assert, nor further to cause or support any other Third Parties to allege or assert, that any such payments obligations are unenforceable or illegal in any way.
Schedule B

Product Commercialization Schedule

This Product Commercialization Schedule will apply to each Optioned Product Candidate (and all associated Development Pool Candidates) on an Optioned Product Candidate-by-Optioned Product Candidate and Product-by-Product basis in all respects. For each such Optioned Product Candidate, Development Pool Candidates and Products, Schedule A will also apply.

1. Definitions.

The following terms will have the meanings set forth below. Capitalized terms used, but not defined herein, will have the meanings ascribed to such terms in the Option Agreement and the other Transaction Agreements.

1.1 “AstraZeneca Development & Commercialization Program” means a Development and Commercialization program for Product and the related Subject Constructs in the Subject Field.

1.2 “Earn-Out Term” has the meaning set forth in Section 6.1.

1.3 “Product Schedule Date” means the date on which a Product Candidate becomes an Optioned Product Candidate.

1.4 “Subject Constructs” means the Optioned Product Candidate and the Subject Development Pool Candidates.

1.5 “Subject Development Polypeptide” means the Polypeptide [***] by the Optioned Product Candidate, as set forth in the AstraZeneca Option Notice.

1.6 “Subject Development Pool Candidates” means, other than the Optioned Product Candidate, those Development Pool Candidates [***] the Subject Development Polypeptide, as set forth in the AstraZeneca Option Notice.

1.7 “Subject Field” means the applicable AstraZeneca Field, as set forth in the AstraZeneca Option Notice.

1.8 “Subject Research Target” means the Research Target for the Subject Development Polypeptide, as set forth in the AstraZeneca Option Notice.


2.1 Subject Research Target. The Subject Research Target will continue as a Research Target under the Transaction Agreements unless AstraZeneca’s rights to Product and the related Subject Constructs are terminated in accordance with Section 13.2 or Section 13.3 of the A&R Option Agreement or Section 2.2(c) or Section 6.2 hereof.
2.2 **Diligence.**

(a) As of and after the Product Schedule Date, AstraZeneca will have sole responsibility for, and control of, Exploiting Product and the related Subject Constructs in the Subject Field worldwide, and will establish an AstraZeneca Development & Commercialization Program for that purpose. Except as provided in the A&R Services and Collaboration Agreement or the Master Supply Agreements, as of and after the Product Schedule Date, AstraZeneca will have sole responsibility for all costs and expenses arising from Exploiting Product and the related Subject Constructs in the Subject Field worldwide.

(b) As of and after the Product Schedule Date, AstraZeneca, directly or through one or more of its Affiliates or Sublicensees, will use Commercially Reasonable Efforts (i) to Develop [***] in the Subject Field and to obtain Regulatory Approval therefor; and (ii) on obtaining Regulatory Approval, to Commercialize a Product in the Subject Field worldwide, provided that AstraZeneca will not be deemed to be in breach of its Commercially Reasonable Efforts under this clause (b) if [***]; provided, further, that [***].

(c) During the Earn-Out Term, AstraZeneca may, by advance written notice to Moderna of at least [***], elect to terminate all current and planned Development and Commercialization of Product and the related Subject Constructs with respect to a Subject Research Target, in which case Section 6.3 will apply with respect to such Product and the related Subject Constructs.

2.3 **Meetings and Reports.**

(a) [***] during each Contract Year from the Product Schedule Date until the first approval of a BLA (or equivalent Regulatory Approval) for Product, within [***] days of Moderna’s written request, the Parties will meet in person [***] for AstraZeneca to provide Moderna with an update on the Development and Commercialization of Product and the related Subject Constructs. During such meeting, AstraZeneca will disclose to Moderna a summary of all material information regarding such Development and Commercialization.

(b) AstraZeneca will prepare and maintain, and will cause its Affiliates and Sublicensees to prepare and maintain, reasonably complete and accurate records regarding the Development of Product and the related Subject Constructs, and the Commercialization of Product in the Subject Field worldwide after Regulatory Approval thereof. AstraZeneca will provide to Moderna a reasonably detailed report regarding such efforts at least [***] each Contract Year during the Earn-Out Term. Such report will contain sufficient detail to enable Moderna to assess AstraZeneca’s compliance with its Development and Commercialization obligations in Section 2.2, including [***]. AstraZeneca’s obligation to provide the information described in Section 2.3(b) to Moderna will terminate upon a Business Combination of Moderna.

3. **Regulatory Responsibilities.**

3.1 **In General.** AstraZeneca will lead and have sole control of all regulatory efforts for Product and the related Subject Constructs worldwide, including with respect to preparing and filing the relevant Regulatory Filings and all communications with Regulatory Authorities.
3.2 **Information Disclosure.** Moderna will, and will cause its Affiliates to, without additional compensation, disclose and make available to AstraZeneca [* ***] not otherwise provided to AstraZeneca under the Transaction Agreements, *provided* that Moderna and its Affiliates will not be required to disclose or make available information relating to any mRNA Construct (other than a Collaboration mRNA Construct) being Developed or Commercialized by Moderna (alone or with other(s) by license or otherwise).

3.3 **Regulatory Filings.** AstraZeneca will be responsible for preparing and submitting all Regulatory Filings related to Product and the related Subject Constructs for use in the Subject Field, including all applications for Regulatory Approval. All applications for Regulatory Approval, the Regulatory Approvals, and other Regulatory Filings (including all INDs) relating to Product and the related Subject Constructs will be the property of AstraZeneca and held in the name of AstraZeneca or its designees.

3.4 **Interactions with Regulatory Authorities.** AstraZeneca will have the sole right to conduct all communications with the Regulatory Authorities, including all meetings, conferences and discussions (including advisory committee meetings), with regard to Product and the Related Subject Constructs in the Territory.

3.5 **Cooperation.** Without limiting the provisions of Section 3.4 of the A&R Option Agreement, for a period of [* ***] after the Product Schedule Date, Moderna will cooperate with any reasonable requests for assistance from AstraZeneca with respect to obtaining any Regulatory Approval of Product and the related Subject Constructs and maintaining any Regulatory Approval of Product and the related Subject Constructs that is held by AstraZeneca, including by: [* ***]. Assistance provided by Moderna to AstraZeneca pursuant to this Section 3.5 [* ***], as agreed in advance by AstraZeneca. An estimate of such costs and expenses will be provided to AstraZeneca before the initiation of any agreed work.

3.6 **Adverse Event Reporting.** Unless otherwise agreed by the Parties, the rights and obligations of the Parties with respect to safety and related reporting activities with respect to Product and the related Subject Constructs will be set forth in a safety agreement to be entered into between the Parties (or their respective Affiliates) no later than the [* ***] of the Product Schedule Date (or such later date as the Parties may agree). Such agreement will set forth terms and conditions with respect to such activities that are reasonable and customary in the industry for agreements of that nature, and will be based on AstraZeneca’s standard form of safety agreement. Pursuant to the safety agreement, AstraZeneca will be responsible for adverse event reporting relating to Product and the related Subject Constructs to applicable Regulatory Authorities in the Territory, and will be responsible for maintaining the global safety database with respect to Product and the related Subject Constructs. Moderna will assist AstraZeneca by reporting and providing to AstraZeneca all information relating to adverse events to the extent that Moderna has any such data. Such data and other information will be provided in such a manner, time and format, and to such person(s) or department(s), as may be designated by AstraZeneca from time to time, so as to enable AstraZeneca to comply with applicable Law. Moderna and AstraZeneca will reasonably cooperate to ensure that Moderna’s adverse event reporting processes will efficiently communicate such adverse event information in such manner, time and format.
3.7 **Product Recalls.**

(a) In the event that any government agency or authority issues or requests a recall or takes similar action in connection with Product and the related Subject Constructs, or in the event either Party determines that an event, incident, or circumstance has occurred that may result in the need for a recall or market withdrawal, the Party notified of or desiring such recall or market withdrawal will promptly advise the other Party thereof by telephone or facsimile.

(b) With respect to Product and the related Subject Constructs, AstraZeneca will decide and have control of whether to conduct a recall or market withdrawal (except in the case of a government-mandated recall or withdrawal) in the Territory and the manner in which any such recall or market withdrawal will be conducted. The allocation of costs for any such recall or market withdrawal will be set forth in the Master Supply Agreements.

4. **Intellectual Property.**

4.1 **Ownership.** All Know-How, Materials and Patents conceived, discovered, developed or otherwise made, by or on behalf of either Party (or its Affiliates or Sublicensees) either alone or jointly with Third Party(ies) or by the Parties or their Affiliates jointly under or in connection with this Product Commercialization Schedule, whether or not conceived, discovered, developed or otherwise made at a facility owned or controlled by such Party and whether or not patented or patentable, and any and all Patent and other intellectual property rights with respect thereto will be owned in accordance with inventorship and in accordance with applicable law in the United States.

4.2 **Patent Marking.** AstraZeneca will mark, and will cause its Affiliates and Sublicensees to mark, Product with all Patents within the [***] in accordance with applicable Law, which marking obligation will continue for as long as (and only for as long as) required under applicable Law.

5. **Insurance.**

5.1 **Insurance.** Each Party will maintain at its sole cost and expense, an adequate liability insurance or self-insurance program (including product liability insurance) to protect against potential liabilities and risk arising out of activities to be performed under this Product Commercialization Schedule, and any agreement related hereto and upon such terms (including coverages, deductible limits and self-insured retentions) as are customary in the U.S. pharmaceutical industry for the activities to be conducted by such Party under this Product Commercialization Schedule. Subject to the preceding sentence, such liability insurance or self-insurance program will insure against all types of liability, including personal injury, physical injury or property damage arising out of the Manufacture, sale, use, distribution or marketing of Product and the related Subject Constructs. The coverage limits set forth herein will not create any limitation on a Party’s liability to the other under this Product Commercialization Schedule.
6. Term and Termination.

6.1 Term. This Product Commercialization Schedule will continue to apply to Product and the related Subject Constructs, unless the A&R Option Agreement is sooner terminated with respect to such Product and the related Subject Constructs in accordance with Section 13.2 or Section 13.3 of the Option Agreement or Section 2.2 or Section 6.2 hereof, on a country-by-country basis until there are no more Exercise Price payments owed Moderna on Product or the related Subject Constructs in such country based on the applicable Schedule A to the Option Agreement (the longest such period of time for the Product hereunder, the “Earn-Out Term”). Upon there being no more such payments hereunder for Product in such country, (a) the licenses contained in Section 3.1 of the A&R Option Agreement will become fully paid up, [***] and for clarity will remain exclusive with respect to Product and the related Subject Constructs in such country; and (b) this Product Commercialization Schedule will expire with respect to such Product and the related Subject Constructs in such country.

6.2 Termination for IP Challenge. Moderna will have the right to terminate this Product Commercialization Schedule with respect to a Product and the related Subject Constructs upon written notice to AstraZeneca in the event that AstraZeneca or any of its Affiliates or Sublicensees challenges or directs a Third Party to challenge in a legal or administrative proceeding the patentability, enforceability or validity of any Patents covering such Product or the related Subject Constructs (a “Patent Challenge”); provided that Moderna will not have the right to terminate this Product Commercialization Schedule under this Section 6.2 for any such Patent Challenge by any Sublicensee if such Patent Challenge is dismissed within [***] days of Moderna’s notice to AstraZeneca under this Section 6.2 and not thereafter continued.

6.3 Effects of Termination or Expiration. Upon termination (but not expiration pursuant to Section 6.1) of this Product Commercialization Schedule with respect to a Product and the related Subject Constructs for any reason:

(a) Wind Down. AstraZeneca will responsibly wind-down, in accordance with accepted pharmaceutical industry norms and ethical practices, any on-going clinical trials with respect to such Product and the related Subject Constructs for which it has responsibility hereunder in which patient dosing has commenced or, if reasonably practicable and requested by Moderna, AstraZeneca will transition such trials to Moderna or its designee. [***].

(b) Schedule A. Any unpaid yet accrued Exercise Price attributable to such Product or the related Subject Constructs will remain due and payable to Moderna, pursuant to Schedule A. Thereafter, the applicable Schedule A will immediately terminate and no further payments will be due thereunder with respect to such Product or the related Subject Constructs.

(c) Sublicenses. A termination of this Product Commercialization Schedule will not automatically terminate any sublicense or rights to use or reference granted by AstraZeneca pursuant to Section 3.6 of the A&R Option Agreement for Development or Commercialization rights with respect to a non-Affiliated Sublicensee, provided that (i) such Sublicensee is not then in material breach of any provision of this Product Commercialization Schedule or the applicable sublicense agreement and (ii) [***]. AstraZeneca will include in any sublicense agreement that relates to the Moderna Technology a provision in which said Sublicensee acknowledges its obligations to Moderna under this Section 6.3(c).
(d) **Cessation of Rights.** Except as otherwise expressly provided in Section 6.2, all rights and licenses granted by Moderna to AstraZeneca in Section 3.1 of the A&R Option Agreement with respect to such Product and the related Subject Constructs will terminate, and AstraZeneca and its Affiliates and Sublicensees will, except as otherwise provided herein or in the Transaction Agreements, cease all Exploitation of Product and the related Subject Constructs and the use of the Moderna Technology in connection therewith. In addition, (i) the Subject Constructs, the Subject Development Polypeptide, and Product will automatically become Discontinued Product Candidates, Discontinued Polypeptide and no longer a Product based on the definition thereof, respectively, and (ii) the Subject Research Target will automatically become a Discontinued Target, unless for such Subject Research Target there [***]. In addition, AstraZeneca will promptly return to Moderna (or as directed by Moderna, destroy and certify to Moderna in writing as to such destruction) all of Moderna’s Confidential Information that is solely related to Product or the related Subject Constructs and, provided Moderna reimburses AstraZeneca for the fully-burdened cost thereof, any inventory or samples of Product or related Subject Constructs that are in AstraZeneca’s or its Affiliates’ or Sublicensees’ possession or control, save that AstraZeneca will have the right to retain (A) one (1) copy of such tangible Confidential Information for legal purposes, and (B) any of the foregoing that AstraZeneca retains any license or other right hereunder or under the Option Agreement.

(e) **Regulatory.** Unless this Product Commercialization Schedule is terminated by AstraZeneca pursuant to Section 13.3(a) of the A&R Option Agreement, to the extent permitted by applicable Law, all Regulatory Approvals and other regulatory filings and communications to the extent Controlled by AstraZeneca and its Affiliates for such Product or the related Subject Constructs, as such items exist as of the effective date of such termination (including all completed and ongoing clinical trials that are solely related to such Product or the related Subject Constructs) will be assigned to Moderna, and AstraZeneca will provide to Moderna one (1) copy of the foregoing, together with the raw and summarized data for any clinical trials (and where reasonably available, electronic copies thereof) in such form as it is then in AstraZeneca’s possession. In the event of failure to obtain assignment, AstraZeneca hereby consents and grants to Moderna the right to access and reference (without any further action required on the part of AstraZeneca, whose authorization to file this consent with any Regulatory Authority (is hereby granted) any such item.

(f) **Licenses.** Unless this Product Commercialization Schedule is terminated by AstraZeneca pursuant to Section 13.3(a) of the Option Agreement with respect to a Product and the related Subject Constructs, AstraZeneca will grant to Moderna and its Affiliates, a worldwide, [***], royalty-free and fully paid-up, nontransferable (except in connection with a permitted assignment of this Product Commercialization Schedule in accordance with Section 14.13 of the A&R Option Agreement and the terms of this Product Commercialization Schedule), exclusive license, with the right to grant sublicenses through multiple tiers (subject to Section 3.6 of the A&R Option Agreement), under [***] to Exploit such Product, the related Subject Constructs and any other mRNA Constructs [***] the related Subject Development Polypeptide. [***]: provided that [***].
(g) Trademarks. Unless this Product Commercialization Schedule is terminated by AstraZeneca pursuant to Section 13.3(a) of the A&R Option Agreement with respect to a Product and the related Subject Constructs, AstraZeneca will exclusively license to Moderna any registered or unregistered trademarks or internet domain names that are specific to and solely used for such Product worldwide (it being understood that the foregoing will not include any trademarks or internet domain names that contain the corporate or business name(s) or other trademark of AstraZeneca).

6.4 Survival. In addition to the termination consequences set forth in Section 6.3, the following provisions will survive termination or expiration of this Product Commercialization Schedule: [***]. Termination or expiration of this Product Commercialization Schedule will not relieve the Parties of any liability or obligation which accrued hereunder prior to the effective date of such termination or expiration nor preclude either Party from pursuing all rights and remedies it may have hereunder or at law or in equity with respect to any breach of this Product Commercialization Schedule nor prejudice either Party’s right to obtain performance of any obligation. All other rights and obligations with respect to such Product and the related Subject Constructs will terminate upon expiration of this Product Commercialization Schedule with respect to such Product and the related Subject Constructs.

7. Assignment.

[***]
Amended and Restated Services and Collaboration Agreement

by and between

ModernaTx, Inc.,

and

AstraZeneca AB

June 15, 2018
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This Services and Collaboration Agreement (this “Agreement”), dated as of June 15, 2018 (the “Amendment Effective Date”), is made by and between ModernaTx, Inc., a Delaware corporation (“Moderna”) and AstraZeneca AB, a company incorporated in Sweden under no. 556011-7482 with offices at SE-431 83 Mölndal, Sweden (“AstraZeneca”). Each of Moderna and AstraZeneca may be referred to herein as a “Party” or together as the “Parties.”

WHEREAS, Moderna has developed expertise and technology useful for the discovery, development, Manufacture, characterization, or use of therapeutic products that function using mRNA;

WHEREAS, AstraZeneca is a biopharmaceutical company focused on identifying, Developing and Commercializing innovative therapeutic products;

WHEREAS, Moderna has provided certain Development and Manufacturing services under the Services and Collaboration Agreement made as of March 20, 2013 as amended on August 23, 2013, December 5, 2014, December 2, 2016, April 10, 2018 and May 14, 2018 (the “Original Services and Collaboration Agreement”), and the Parties have otherwise collaborated on the evaluation of mRNA Constructs [***] Polypeptides for certain Targets for the purpose of assisting AstraZeneca in determining whether or not to exercise its option rights under the original Option Agreement of the same date as amended on January 10, 2015, April 10, 2018 and May 14, 2018 with respect to certain mRNA Constructs, Polypeptides and Targets (the “Original Option Agreement” and together, the “Original Agreements”);

WHEREAS, under the Original Agreements AstraZeneca exercised one of its Options and nominated an Optioned Product Candidate for the Target VEGF-A [***];

WHEREAS, the Parties wish to extend the Service Program with respect to certain Targets subject to revised terms;

WHEREAS, the Parties wish to amend and restate the Original Services and Collaboration Agreement as set forth herein. [***]; and

WHEREAS, concurrent with the execution of this Agreement, AstraZeneca and Moderna are entering into an Amended and Restated Option Agreement (the “A&R Option Agreement”), pursuant to which AstraZeneca will have an exclusive option (but not obligation) to purchase the rights to certain mRNA Constructs [***] up to [***] Polypeptides for certain Targets ([***] having already been purchased under the Original Option Agreement).
NOW, THEREFORE, in consideration of the mutual covenants contained herein, and for other good and valuable consideration, the amount and sufficiency of which are hereby acknowledged, the Parties hereby agree as follows:

1. **Definitions.**

The following terms and their correlatives will have the following meanings. Capitalized terms used but not defined herein have the meanings ascribed to such terms in the Transaction Agreements.

1.1. **“A&R Option Agreement”** has the meaning set forth in Recitals.

1.2. **“Affiliate”** of a Person means any other Person which (directly or indirectly) is controlled by, controls or is under common control with such Person. For the purposes of this definition, the term “control” (including, with correlative meanings, the terms “controlled by” and “under common control with”) as used with respect to a Person means (a) in the case of a corporation, direct or indirect ownership of voting securities entitled to cast more than fifty percent (50%) of the votes in the election of directors or (b) in the case of a non-corporate Person, direct or indirect ownership of more than fifty percent (50%) of the equity interests with the power to direct the management and policies of such entity.

1.3. **“Agreement”** has the meaning set forth in Recitals.

1.4. **“Anti-Corruption Law”** has the meaning set forth in Section 11.4(b).

1.5. **“Approved Manufacturer”** has the meaning set forth in paragraph 3(k) of Exhibit A-1 or in Exhibit A-2.

1.6. **“AstraZeneca”** has the meaning set forth in Recitals.

1.7. **“AstraZeneca Anticipated Requirements”** has the meaning set forth in Section 4.4(a).

1.8. **“AstraZeneca Background Know-How”** means any and all Know-How Controlled by AstraZeneca or its Affiliates as of the Signing Date or as to which AstraZeneca or its Affiliates obtains Control during the Services Program Term or until such time as no more Development Pool Services are performed, if later, that [***] excluding any AstraZeneca Collaboration Know-How.

1.9. **“AstraZeneca Background Patents”** means those Patents that are Controlled by AstraZeneca or its Affiliates as of the Signing Date or as to which AstraZeneca or its Affiliates obtains Control during the Services Program Term or until such time as no more Development Pool Services are performed, if later, that [***].

1.10. **“AstraZeneca Background Technology”** means the AstraZeneca Background Know-How and the AstraZeneca Background Patents.

1.11. **“AstraZeneca Collaboration Know-How”** means any and all Collaboration Know-How owned by AstraZeneca [***], including AstraZeneca’s right and interest in any Joint Collaboration Know-How.

1.12. **“AstraZeneca Collaboration Patents”** means any and all Patents that claim any of the AstraZeneca Collaboration Know-How, including AstraZeneca’s right and interest in any Joint Patents.
1.13. “AstraZeneca Collaboration Technology” means the AstraZeneca Collaboration Know-How and the AstraZeneca Collaboration Patents. For clarity, all AstraZeneca Collaboration Technology will be “Controlled” by AstraZeneca for purposes of this Agreement.

1.14. “AstraZeneca Indemnitees” has the meaning set forth in Section 8.5(b).

1.15. “AstraZeneca In-License” has the meaning set forth in Section 2.6(e)(i).

1.16. “AstraZeneca [***] Technology” means any Know-How, Materials and Patents [***]).

1.17. “AstraZeneca [***] Technology” has the meaning set forth in Section 2.5(a)(i).

1.18. “AstraZeneca Program Director” has the meaning set forth in Section 3.1.


1.20. “BLA” means a Biologics License Application filed with the FDA or an equivalent application to any Regulatory Authority (including an NDA or its foreign equivalent) requesting Regulatory Approval for a new product, including for Product.

1.21. “Business Combination” means with respect to a Party, any of the following events: (a) any Third Party (or group of Third Parties acting in concert) acquires (including by way of a tender or exchange offer or issuance by such Party), directly or indirectly, beneficial ownership or a right to acquire beneficial ownership of shares of such Party representing fifty percent (50%) or more of the voting shares (where voting refers to being entitled to vote for the election of directors) then outstanding of such Party; (b) such Party consolidates with or merges into another corporation or entity which is a Third Party, or any corporation or entity which is a Third Party consolidates with or merges into such Party, in either event pursuant to a transaction in which more than fifty percent (50%) of the voting shares of the acquiring or resulting entity outstanding immediately after such consolidation or merger is not held by the holders of the outstanding voting shares of such Party immediately preceding such consolidation or merger; or (c) such Party sells, transfers, leases or otherwise disposes of all or substantially all of its assets to a Third Party.


1.23. “Calendar Quarter” means the respective periods of three (3) consecutive calendar months ending on March 31, June 30, September 30 and December 31.

1.24. “cGMP” means current good manufacturing practices and regulatory requirements, as specified in regulations promulgated from time to time by the FDA for the manufacture and testing of pharmaceutical products.

1.25. “CMC” has the meaning set forth in Section 5.4.
1.26. “Collaboration Know-How” means all Know-How and Materials conceived, discovered, developed or otherwise made by or on behalf of a particular Party or any of its Affiliates and Sublicensees (solely or jointly by or on behalf a particular Party or any of its Affiliates and Sublicensees) in the course of performing activities under or in connection with [***], but excluding [***], AstraZeneca [***] Technology.

1.27. “Collaboration mRNA Constructs” [***] means [***].

1.28. “Collaboration Patents” means any and all Patents that claim any of the Collaboration Know-How.


1.30. “Commercialization” means (a) any and all activities directed to the Manufacturing, marketing, detailing, promotion and securing of reimbursement of a product after Regulatory Approval has been obtained (including making, having made, using, importing, selling and offering for sale such product), and will include post-approval clinical studies, post-launch marketing, promoting, detailing, marketing research, distributing, customer service, administering commercially selling, having sold or otherwise disposing or offering to dispose of such product, importing, exporting or transporting such product for commercial sale, and all regulatory compliance with respect to the foregoing, and (b) otherwise marketing, selling or exploiting commercially a product.

1.31. “Commercially Reasonable Efforts” means the carrying out of obligations by a Party [***], using that level of efforts and resources which [***].

1.32. “Confidential Information” has the meaning set forth in Section 7.1(a).


1.34. “Continuation Criteria” means, as the context requires, [***] as described in [***].

1.35. “Contract Year” means each three hundred sixty five (365) or three hundred sixty six (366) day (as applicable) period beginning on the Implementation Date or an anniversary of the Implementation Date, as applicable, occurring prior to the end of the Term.

1.36. “Control” or “Controlled” means, with respect to any Know-How, Material or Patent, the possession (whether by ownership, license or sublicense, other than by [***]) by a Party of the ability to assign or grant to the other Party the licenses, sublicenses or rights to access and use such Know-How, Material or Patent as provided for in the Transaction Agreements, without requiring the payment of any royalties or other consideration therefor or violating the terms of any agreement or other arrangement with any Third Party in existence as of the time such Party would be required hereunder to grant such license, sublicense, or rights of access and use. For clarity, Know-How, Materials and Patents (a) that are [***], and (b) Know-How, Materials and Patents that are licensed to Moderna pursuant to a Moderna In-License are not “Controlled” for purposes of the Transaction Agreements unless and only after such Moderna In-License is converted into a Moderna Collaboration In-License pursuant to Section 2.6(c) and [***] For clarity, [***].
1.37. “Cover” or “Covered” or “Covering”, with reference to (a) a Patent, means [***], and (b) Know-How, means [***].

1.38. “[***] Criteria” means the [***] criteria for selection of a lead candidate suitable for [***], such criteria to be specified [***] in the Services Plan for each Research Polypeptide.

1.39. “Development” means research and preclinical and clinical drug development activities, including: research, test method development and stability testing, toxicology, formulation, optimization, modification, enhancement, improvement, process development, qualification and validation, Manufacture scale-up, development-stage Manufacturing, quality assurance/quality control, holding/keeping (whether for disposal or otherwise), clinical studies, statistical analysis and report writing, the preparation and submission of Regulatory Filings, regulatory affairs with respect to the foregoing and all other activities necessary or reasonably useful or otherwise requested or required by a Regulatory Authority as a condition or in support of obtaining or maintaining a Regulatory Approval, and “Develop”, “Developed” and “Developing” will have corresponding meanings.

1.40. “Development Polypeptide” has the meaning set forth in the A&R Option Agreement.

1.41. “Development Pool Services” has the meaning set forth in Section 2.4(b).

1.42. “Disclosing Party” has the meaning set forth in Section 7.1(a).

1.43. “Discontinued Polypeptide” means any Research Polypeptide or Development Polypeptide that has by any of the terms of the Transaction Agreements or the Original Agreements become a “Discontinued Polypeptide”.

1.44. “Discontinued Product Candidate” means any Collaboration mRNA Construct, Product Candidate or Development Pool Candidate that has by any of the terms of the Transaction Agreements or the Original Agreements become a “Discontinued Product Candidate”.

1.45. “Discontinued Target” means any Research Target that has by any of the terms of the Transaction Agreements or the Original Agreements become a “Discontinued Target”.

1.46. “Disputes” has the meaning set forth in Section 11.1(a).

1.47. “DMF” means any drug master file filed with the FDA, and any equivalent filing in other countries or regulatory jurisdictions.

1.48. “EMA” means the Regulatory Authority known as either the European Medicines Agency or the European Agency for the Evaluation of Medicinal Products and any successor agency thereto.

1.49. [***].
1.50. “Executive Officer” means, for Moderna, [***], and for AstraZeneca, [***]. Either Party may change its Executive Officer upon written notice to the other Party; provided, that such replacement individual has decision-making authority on behalf of such Party in respect of this Agreement.

1.51. “Exploit” means to make, have made, import, use, sell, or offer for sale, including all Development, Manufacturing and Commercialization activities, and “Exploiting” and “Exploitation” will have corresponding meanings.

1.52. “Facility” has the meaning set forth in Exhibit A-1, Paragraph 3(b).

1.53. “FDA” means the United States Food and Drug Administration and any successor agency thereto.

1.54. “FFDCA” means the United States Food, Drug, and Cosmetic Act, as amended from time to time, together with any rules, regulations and requirements promulgated thereunder (including all additions, supplements, extensions, and modifications thereto).

1.55. “FTE” means a full-time scientific or technical person, or in the case of less than a full-time scientific or technical person, a full-time equivalent scientific or technical person year, carried out by an appropriately qualified employee or consultant of Moderna or its Affiliates, based on [***] person-hours [***] per year.

1.56. “FTE Costs” means the actual FTEs employed by Moderna or its Affiliates in the conduct of any Services (excluding [***]) or other activities under any of the Transaction Agreements multiplied by the FTE Rate. The FTE Cost for each FTE will cover [***] with respect to such FTE.

1.57. “FTE Rate” means [***]dollars [***] per FTE, for the calendar year 2013, and adjusted annually by [***] beginning with [***] and thereafter until the end of the Term.

1.58. “Fully Burdened Manufacturing Costs” means costs to perform Manufacturing Services and to supply a Moderna mRNA API and related inputs and services [***]; it being understood and agreed that:

(i) in the case of costs referred to [***] of this sentence [***]; provided, that [***]; and

(ii) in the case of costs referred to [***] of this sentence [***], which Manufacturing costs: (x) will include [***], (y) will be calculated in accordance with [***] and (z) notwithstanding anything to the contrary, will exclude [***].

1.59. “GAAP” means U.S. generally accepted accounting principles or International Financial Reporting Standards, consistently applied, as designated and used by the applicable Party.
1.60. “Good Laboratory Practice” or “GLP” means the then current standards for laboratory activities for pharmaceuticals, as set forth in the FDA’s GLP regulations and/or ICH guidelines and applicable regulations.

1.61. “Government Official” has the meaning set forth in Section 11.4(a)(i).


1.63. “Implementation Date” means April 29th, 2013 being the date on which the applicable waiting period under the Hart-Scott-Antitrust Improvement Act 1976 (as amended) expired or terminated following the HSR Filings (as defined in the Original Services and Collaboration Agreement) made in connection with the execution of the Original Agreements.

1.64. “Included Payments” has the meaning set forth in the A&R Option Agreement.

1.65. “Indemnification Claim Notice” has the meaning set forth in Section 8.5(c).

1.66. “Indemnified Party” has the meaning set forth in Section 8.5(c).

1.67. “Indirect Taxes” means VAT, sales taxes, consumption taxes and other similar taxes required by law to be disclosed on the invoice.

1.68. “Initial Payment” has the meaning set forth in the A&R Option Agreement.

1.69. “Issuing Party” has the meaning set forth in Section 7.3(c).

1.70. “Joint Patents” means all Collaboration Patents that are jointly owned by the Parties in accordance with Section 2.5(a)(iii).

1.71. “Joint Steering Committee; JSC” has the meaning set forth in Section 3.2(a).

1.72. “Joint Technology” means all Collaboration Technology that is jointly owned by the Parties in accordance with Section 2.5(a)(iii).

1.73. “JPC” has the meaning set forth in Section 3.1.

1.74. “Knowledge” means the actual good faith understanding of [***].

1.75. “Know-How” means all inventions, discoveries, commercial, technical, scientific and other know-how and information, trade secrets, knowledge, technology, methods, processes, practices, formulae, instructions, skills, techniques, procedures, experiences, ideas, technical assistance, designs, drawings, assembly procedures, computer programs, apparatuses, assays and biological methodology, specifications, data and results (including biological, chemical, pharmacological, toxicological, pharmaceutical, physical and analytical, laboratory, preclinical, clinical, safety, Manufacturing and quality control data and know-how, including regulatory data, study designs, protocols, laboratory notes and notebooks), in all cases, whether or not confidential, proprietary, patented or patentable, in written, electronic or any other form now known or hereafter developed.
1.76. “Law” or “Laws” means all laws, statutes, rules, regulations, orders, judgments, or ordinances having the effect of law of any federal, national, multinational, state, provincial, county, city or other political subdivision.

1.77. “LCIA” has the meaning set forth in Section 11.1(c).

1.78. “Losses” has the meaning set forth in Section 8.5(a).

1.79. “Manufacturing” means the production, manufacture, processing, filling, finishing, packaging, labeling, shipping and holding of product or any intermediate thereof, including process development, process qualification and validation, scale-up, commercial manufacture and analytic development, product characterization, stability testing, quality assurance and quality control. “Manufacturing” refers to both pre-clinical and clinical Manufacturing for Development, and Manufacturing for Commercialization.

1.80. [***]

1.81. “Manufacturing Know-How” has the meaning set forth in Section 4.5(a).

1.82. “Manufacturing Services” means the Moderna mRNA API Manufacturing services performed by or on behalf of Moderna (a) in accordance with the Services Plan and the terms and conditions hereunder or (b) as part of the Development Pool Services.

1.83. [***]

1.84. [***]

1.85. “Master Clinical Supply Agreement” has the meaning set forth in Section 4.3(a).

1.86. “Master Commercial Supply Agreement” has the meaning set forth in Section 4.3(b).

1.87. “Master Supply Agreements” has the meaning set forth in Section 4.3(b).

1.88. “Material Anti-Corruption Law Violation” means a violation of an Anti-Corruption Law relating to the subject matter of the Transaction Agreements which would if it were publicly known reasonably have a material adverse effect on either Party or on the reputation of a Party because of its relationship with the other Party.

1.89. “Materials” means any tangible chemical or biological material, including any compounds, DNA and RNA (modified and unmodified), mRNA Constructs, Polypeptides, clones, cells, constructs, vectors, receptors and other nucleic acids, proteins, peptides and any expression product, progeny, derivative or other improvement thereto, along with any tangible chemical or biological material embodying any Know-How.
1.90. “Moderna” has the meaning set forth in Recitals.

1.91. “Moderna Collaboration In-License” has the meaning set forth in Section 2.6(b).


1.93. “Moderna Collaboration Patents” means any and all Patents that claim any of the Moderna Collaboration Know-How, including Modena’s right and interest in any Joint Patents.

1.94. “Moderna Collaboration Technology” means the Moderna Collaboration Know-How and Moderna Collaboration Patents. For clarity, all Moderna Collaboration Technology will be “Controlled” for the purpose of this Agreement.

1.95. “Moderna Indemnitees” has the meaning set forth in Section 8.5(a).

1.96. “Moderna In-License” has the meaning set forth in Section 2.6(a).

1.97. “Moderna Know-How” means any and all Know-How Controlled by Modena or any of its Affiliates as of the Signing Date or as to which Modena or any of its Affiliates obtains Control during the Term that [***].

1.98. “Moderna mRNA API” means [***].

1.99. “Moderna Other In-License” has the meaning set forth in Section 2.6(c)(ii).

1.100. “Moderna Patents” means those Patents that are Controlled by Modena or any of its Affiliates as of the Signing Date or as to which Modena or any of its Affiliates obtains Control [***]. Schedule 1.100 sets forth those Moderna Patents in existence as of the Signing Date.

1.101. [***]

1.102. [***]

1.103. “Moderna Program Director” has the meaning set forth in Section 3.1.

1.104. “Moderna Representatives” has the meaning set forth in Section 11.4(a).


1.106. “mRNA Construct” means [***].

1.107. “mRNA Technology” means any Know-How, Materials and Patents directed or otherwise pertaining to [***], excluding any and all AstraZeneca [***] Technology [***] AstraZeneca [***] Technology.

1.108. [***]
1.109. “Original Agreements” has the meaning set forth in the Recitals.

1.110. “Original Option Agreement” has the meaning set forth in the Recitals.

1.111. “Parties” has the meaning set forth in Recitals.

1.112. “Party” has the meaning set forth in Recitals.

1.113. “Patent” means (a) a patent or a patent application, (b) any additions, priority applications, divisions, continuations, and continuations-in-part of any of the foregoing and (c) all patents issuing on any of the foregoing patent applications, together with all invention certificates, substitutions, reissues, reexaminations, registrations, supplementary protection certificates, confirmations, renewals and extensions of any of (a), (b) or (c), and foreign counterparts of any of the foregoing, but not including any rights that give rise to Regulatory Exclusivity Periods (other than supplementary protection certificates, which will be treated as “Patents” hereunder).

1.114. “Patent Costs” means the reasonable, documented, out-of-pocket costs and expenses paid to outside legal counsel, and filing and maintenance expenses, actually and reasonably incurred by a Party in Prosecuting and Maintaining Patents and enforcing and defending them.

1.115. “Person” means any individual, partnership, joint venture, limited liability company, corporation, firm, trust, association, unincorporated organization, governmental authority or agency, or any other entity not specifically listed herein.

1.116. “Polypeptide” means [...].

1.117. “Pre-clinical Activities” has the meaning set forth in Exhibit A-1, Paragraph 2(a).

1.118. “Product” means a human, therapeutic product that includes as an active ingredient (whether alone or in combination with one or more other active ingredients) a Collaboration mRNA Construct [...], a Development Polypeptide.

1.119. “Product Warranty” has the meaning set forth in Exhibit A-1, Paragraph 3(h).

1.120. “Program Directors” has the meaning set forth in Section 3.1.

1.121. [...]

1.122. [...]

1.123. “Receiving Party” has the meaning set forth in Section 7.1(a).

1.124. “Regulatory Approval” means, with respect to a country or extra-national territory, any and all approvals (including BLAs), licenses, registrations or authorizations of any Regulatory Authority necessary in order to commercially distribute, sell or market a product in such country or some or all of such extra-national territory, but not including any pricing or reimbursement approvals.
1.125. “Regulatory Authority” means any national (e.g., the FDA), supra-national (e.g., the EMA), regional, state or local regulatory agency, department, bureau, commission, council or other governmental entity, in any jurisdiction in the world, involved in the granting of Regulatory Approval.

1.126. “Regulatory Filings” means any submission to a Regulatory Authority of any appropriate regulatory application together with any related correspondence and documentation, and will include any submission to a regulatory advisory board, marketing authorization application, and any supplement or amendment thereto.

1.127. “Release” has the meaning set forth in Section 7.3(c).

1.128. “Relevant Authority” means any court or government body, whether national, supra-national, federal, state, local, foreign or provincial, including any political subdivision thereof, including any department, commission, board, bureau, agency, or other regulatory or administrative governmental authority or instrumentality, and further including any quasi-governmental Person or entity exercising the functions of any of these.

1.129. “Reviewing Party” has the meaning set forth in Section 7.3(c).

1.130. [***]

1.131. [***]

1.132. “SEC” has the meaning set forth in Section 7.3(b).

1.133. [Reserved].

1.134. “Services” means (a) the Development services to be performed by or on behalf of Moderna pursuant to the Services Plan as set forth herein, (b) Development Pool Services, and (c) the Manufacturing Services.

1.135. “Services Period” means for each Research Target and each Research Polypeptide [***] such Research Target, the period commencing on nomination of such Research Target or ([***]) and in both cases ending [***] after the Amendment Effective Date or, if earlier the date on which such Research Target becomes a Discontinued Target.

1.136. “Services Plan” has the meaning set forth in Section 2.3(a).

1.137. “Services Program” means the program of services for Development of mRNA Constructs using Moderna Technology in the applicable AstraZeneca Fields that is engaged in by or on behalf of the Parties prior to the Amendment Effective Date, under the Original Services and Collaboration Agreement and with effect on and from the Amendment Effective Date, under this Agreement, including Moderna’s performance of the Services and the Parties’ performance of activities under the Services Plan.

1.138. “Services Program Term” has the meaning set forth in Section 2.4(a).
1.139. “Signing Date” means March 20, 2013.

1.140. “Sublicense” means (a) in the case of AstraZeneca, any Person (other than an Affiliate or a Distributor of AstraZeneca) that is granted a sublicense as permitted by Section 3.6(a) of the A&R Option Agreement (or an option to take such a sublicense), either (i) directly by AstraZeneca or (ii) indirectly by any Person granted rights by AstraZeneca pursuant to subclause (a)(ii); or (b) in the case of Moderna, any Person (other than an Affiliate or Distributor of Moderna) that is granted a sublicense as permitted by Section 3.6(a) of the A&R Option Agreement (or an option to take such a sublicense), either (i) directly by Moderna or (ii) indirectly by any Person granted rights by Moderna pursuant to subclause (b)(i).

1.141. “Supply Failure” means [***].

1.142. “Target” means [***].

1.143. “Tax” and “Taxation” means any form of tax or taxation, levy, duty, charge, social security charge, contribution, or withholding of whatever nature (including any related fine, penalty, addition to tax, surcharge or interest) imposed by, or payable to, a Tax Authority. Notwithstanding anything herein to the contrary, Taxes will not include any Indirect Taxes.

1.144. “Tax Authority” or “Tax Authorities” means any government, state or municipality, or any local, state, federal or other fiscal, revenue, customs, or excise authority, body or official anywhere in the world, authorized to levy tax.

1.145. “Term” has the meaning set forth in Section 9.1.


1.147. “Third Party Claims” has the meaning set forth in Section 8.5(a).

1.148. “Transaction Agreements” means collectively, (a) this Agreement, (b) the A&R Option Agreement and (c) that certain Put Agreement between the Parties dated November 25, 2014.

1.149. “Transferred API(s)” has the meaning set forth in Section 4.5.

1.150. “Triggering Event” has the meaning set forth in Section 4.7.

1.151. “United States” or “U.S.” means the United States of America, including its territories and possessions, the District of Columbia and Puerto Rico.

1.152. “Upfront Payment” has the meaning set forth in Section 6.1.
2. **Services Program.**

2.1. **General.** During the Services Program Term, Moderna will perform the Services and the Parties will otherwise conduct the Services Program on the terms and conditions set forth in this Agreement to identify and validate Research Polypeptides and optimize Collaboration mRNA Constructs such Research Polypeptides. For each Research Polypeptide, the objective of the Services Program is to such Research Polypeptide and meets the Criteria.

2.2. **Research Targets and Research Polypeptides.**

(a) **Nomination.** From the Amendment Effective Date until the anniversary of the Amendment Effective Date (the “Nomination Period”), AstraZeneca may nominate up to Research Polypeptides for each AstraZeneca CV Target and the AstraZeneca Oncology Target by providing written notice to Moderna of same, provided that, subject to the overall cap of Research Polypeptides per Research Target AstraZeneca may. The Program Directors will maintain a current list of Research Targets and Research Polypeptides that will be Developed as a part of the Services Plan. For each Research Target, the list of Research Polypeptides nominated as of the Amendment Effective Date is set forth in Appendix A. For clarity, each such nominated Research Polypeptide counts towards the maximum nomination of Research Polypeptides per Research Target, including following such Research Polypeptide becoming a Development Polypeptide or Discontinued Polypeptide. Subject to such maximum, AstraZeneca may make additional nominations of Research Polypeptides by providing an updated version of Appendix A to Moderna as provided in Section 11.16, [***]. For the purposes of this Section 2.2(a), with respect to each Research Target, each Polypeptide nominated by AstraZeneca that has will be counted towards the overall cap of Research Polypeptides for such Research Target even if such Polypeptides are [***].

(b) **Development of [***].** AstraZeneca may Develop Products that as set forth in Section 4.4 of the A&R Option Agreement. In particular, as part of the Services Program, AstraZeneca may Develop [***] Product Candidates that [***].

(c) **Exclusion of Research Targets and Research Polypeptides from the Services Program.**

(i) AstraZeneca may, at any time, elect to exclude any Research Target from the Services Program by providing an updated version of Appendix A to Moderna as provided in Section 11.16, [***]. Upon Moderna’s receipt of such written notice, such Research Target will be excluded from the Services Program and will automatically become a Discontinued Target. For clarity, termination of Development activities relating to a particular Product Candidate for a [***] Target shall not result in [***].

(ii) For each Research Target in the Services Program, AstraZeneca will keep Moderna informed of progress towards satisfaction of the Continuation Criteria for such Research Target at each JSC meeting, including by providing the JSC at each meeting of the JSC a report (written or oral) summarizing AstraZeneca’s Development activities with respect to such Research Target, including a summary of any material data and results generated by any of such Development activities. In addition, for each Research Target in the Services Program, AstraZeneca will notify Moderna in writing when in AstraZeneca’s reasonable determination a Research Target has met the applicable Continuation Criteria. AstraZeneca will include in any such written notice such information and data as is necessary for Moderna to verify that the
applicable Research Target has met the applicable Continuation Criteria. To continue in the Services Program, each Research Target (other than \([***]\)) must meet the \([***]\) for such Research Target on or before the \([***]\) and the \([***]\) for such Research Target on or before the \([***]\). If with respect to any Research Target, AstraZeneca has not met the applicable Continuation Criteria, or has not provided notice that the applicable Continuation Criteria have been met, in each case on or prior to such \([***]\), the Research Target will be excluded from the Services Program and automatically become a Discontinued Target. In the event that Moderna disagrees with AstraZeneca’s determination as to whether a Research Target has met the \([***]\) or \([***]\) for such Research Target (a “Continuation Criteria Dispute”), Moderna shall provide AstraZeneca with written notice thereof within \([***]\) days after Moderna’s receipt of the applicable notice from AstraZeneca asserting that the applicable Continuation Criteria have been met (the “Continuation Criteria Dispute Notice”) and Section 11.1(b) (but not Section 11.1(c)) shall apply. Development activities with respect to a Research Target will continue notwithstanding a Continuation Criteria Dispute. If during the period in which the Parties are seeking to resolve a Continuation Criteria Dispute, \([***]\); provided, that \([***]\). In the event that Moderna does not provide AstraZeneca with the Continuation Criteria Dispute Notice within the \([***]\) day period specified in this Section 2.2(c)(ii), Moderna shall be deemed to have agreed with AstraZeneca’s determination as set forth in the applicable notice from AstraZeneca asserting that the applicable Continuation Criteria have been met.

(iii) If a Research Target becomes a Discontinued Target, in addition to any other consequences applicable to Discontinued Targets set forth in the Transaction Agreements, Sections 2.2 and 3.4 of the A&R Option Agreement will apply.

2.3. Services Plan.

(a) Performance. During the Services Period for each Research Target (and all Research Polypeptides for such Research Target), Moderna will perform the Services and the Parties will otherwise carry out the Services Program for such Research Target in accordance with a written research plan (the “Services Plan”). The Services Plan will set forth, on a Research Target-by-Research Target basis, all Development activities of the Parties with respect to Collaboration mRNA Constructs generated by Moderna and \([***]\) Research Polypeptides for such Research Target during the applicable Services Period. The purpose of the Services Plan is to detail the responsibilities and activities of (1) Moderna with respect to carrying out the Services, and (2) the Parties with respect to otherwise carrying out the Services Program. The Services Plan will include \([***]\). The Parties agree that as part of any Services Plan, AstraZeneca may request reasonable quantities and Moderna will use Commercially Reasonable Efforts to provide reasonable quantities of \([***]\) to AstraZeneca at a cost to AstraZeneca of \([***]\) for use as part of the Services Program for a Research Target. For clarity, a failure by Moderna to supply such \([***]\) will not result in a Triggering Event. The Services Plan will provide that Moderna (and not AstraZeneca) is responsible for Manufacturing mRNA Constructs. The Services Plan may be updated and amended by the JSC in accordance with Section 3.2(c) from time to time.

(b) Obligations Under the Services Plan. Moderna will use Commercially Reasonable Efforts to perform (itself or through its Affiliates or by permitted subcontracting pursuant to Section 2.10) the Services, and each Party will otherwise use Commercially Reasonable Efforts to perform (itself or through its Affiliates or by permitted subcontracting pursuant to Section 2.10)
its respective obligations under the Services Plan. Each Party will cooperate with and provide reasonable support to the other Party in such other Party’s performance of its responsibilities under the Services Plan. Each Party will keep the other Party reasonably informed of such Party’s Development activities under the Services Program and will reasonably consult with such other Party and reasonably consider such other Party’s comments and advice with respect to all material decisions relating to such activities. The Parties acknowledge and agree, however, that no outcome or success is or can be assured and that failure to achieve desired results will not in and of itself constitute a breach or default of any obligation in this Agreement (notwithstanding the focus of the Services Program described above). The Parties will Develop and Commercialize under the Transaction Agreements only Collaboration mRNA Constructs, and no other mRNA Constructs.

(c) FTEs. The Services Plan will set forth the expected number of FTEs required to perform the Services allocated to Moderna (excluding, for clarity, Manufacturing Services). AstraZeneca will reimburse Moderna [***] for Moderna’s FTE Costs for such FTEs. [***]. Those individuals selected by Moderna to perform the Services and otherwise support the Development and other activities to be undertaken by Moderna under the Services Plan and as part of the Services Program will [***]. In the event that AstraZeneca has concerns regarding the selection of an individual to perform the Services or other activities under this Agreement, the Parties will discuss such concerns in good faith.

(d) [***]. Moderna will (a) use good faith efforts to ensure [***]; and (b) use diligent efforts to ensure [***]. For clarity, any mRNA Constructs that are not Developed in the course of performing activities under the Services Program (under or in connection with this Agreement or the Original Services and Collaboration Agreement) will not constitute Collaboration mRNA Constructs.

(e) Updates. Any modifications or amendments to the Services Plan that are proposed by either Party will be subject to review and prior approval by the JSC pursuant to and in accordance with the terms of Section 3.2(c).

2.4. Services Program Term; Development Pool Services

(a) Duration. Unless (i) terminated pursuant to the terms hereof, or (ii) extended by mutual agreement of the Parties, the term of the Services Program will commence on the Implementation Date and will continue until expiration of the period of [***] from the Amendment Effective Date (the “Services Program Term”), provided that if the Services Period is extended for any Research Target pursuant to Section 2.2(c)(ii), the Services Program Term as applicable to such Research Target shall continue until expiration of such Service Period.

(b) Development Pool Services. During the period after the end of the applicable Services Period until the [***] of the Implementation Date, if AstraZeneca reasonably requests that Moderna perform additional Services during the Option Agreement Term (excluding, for clarity, Manufacturing Services) in support of the evaluation of any Development Pool Candidate (“Development Pool Services”), the Parties will negotiate in good faith the terms and conditions of such performance. In the event the Parties agree on such terms and conditions, Moderna will use Commercially Reasonable Efforts to perform (itself or through its Affiliates or by permitted subcontracting pursuant to Section 2.10) such Development Pools Services in accordance with
such terms and conditions as may be agreed to by the Parties, and AstraZeneca will reimburse Moderna [***] for Moderna’s FTE Costs incurred in performing such Development Pool Services. [***].

(c) Termination of Services. All Services and other Development work hereunder will terminate on the [***] of the Implementation Date.

2.5. Ownership of Technology.

(a) Ownership of Technology

(i) Ownership of [***]. Subject to the license grants to AstraZeneca under any Transaction Agreement, as between the Parties, Moderna will own and retain all right, title and interest in and to all [***]. Accordingly, AstraZeneca will promptly disclose to Moderna in writing, the conception or reduction to practice, or the discovery, development or making of any [***]. AstraZeneca, for itself and on behalf of its Affiliates, hereby assigns (and to the extent such assignment can only be made in the future hereby agrees to assign), to Moderna all its right, title and interest in and to any [***]. AstraZeneca will cooperate, and will cause the foregoing persons and entities to cooperate, with Moderna to effectuate and perfect the foregoing ownership, including by promptly executing and recording assignments and other documents consistent with such ownership. Notwithstanding the foregoing, [***] will not include any [***] (collectively, “AstraZeneca [***] Technology”).

(ii) Ownership of other arising Technology. Subject to Section 2.5(a)(i), all Know-How, Materials and Patents conceived, discovered, developed or otherwise made, by or on behalf of either Party (or its Affiliates or Sublicensees) either alone or jointly with Third Party(ies) or by the Parties or their Affiliates jointly under or in connection with the Transaction Agreements, whether or not conceived, discovered, developed or otherwise made at a facility owned or controlled by such Party and whether or not patented or patentable, and any and all Patent and other intellectual property rights with respect thereto will be owned in accordance with inventorship and in accordance with applicable law in the United States.

(iii) United States Law. The determination of whether Know-How, Materials and Patents are conceived, discovered, developed or otherwise made by a Party for the purpose of allocating proprietary rights (including Patent, copyright or other intellectual property rights) therein, will, for purposes of this Agreement, be made in accordance with applicable law in the United States. In the event that United States law does not apply to the conception, discovery, development or making of any Know-How, Materials or Patents hereunder, each Party will, and does hereby, assign, and will cause its Affiliates and sublicensees to so assign, to the other Party, without additional compensation, such right, title and interest in and to any Know-How, Materials and Patents as well as any intellectual property rights with respect thereto, as is necessary to fully effect ownership as would have been determined under U.S. law.

(iv) [***].

(b) Exploitation of Joint Technology. Subject to Section 2.5(a)(i), 2.5(a)(iii) and to the license grants under the Transaction Agreements, the Parties will each own an equal, undivided interest in any and all Joint Technology. Each Party will exercise its ownership rights in and to

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such Joint Technology, including the right to license and sublicense or otherwise to Exploit, transfer or encumber its ownership interest, without an
accounting or obligation to, or consent required from, the other Party, but subject to the license grants under the Transaction Agreements. At the
reasonable written request of a Party, the other Party will in writing grant such consents and confirm that no such accounting is required to effect the
foregoing regarding Joint Technology. Each Party will promptly disclose to the other Party in writing, and will cause its Affiliates, licensees and
permitted sublicensees to so disclose, the development, making, conception or reduction of practice of any inventions in connection with work
conducted under or in connection with this Agreement or the Original Services & Collaboration Agreement. Each Party will, and does hereby, assign,
and will cause its Affiliates, licensees and sublicensees to so assign, to the other Party, without additional compensation, such right, title and interest in
and to any Joint Technology as well as any intellectual property rights with respect thereto, as is necessary to fully effect the joint ownership provided
for in the first sentence of this Section 2.5(b).

(c) No Implied Rights. No license, sublicense or other right is or will be created or granted hereunder by implication, estoppel or otherwise. Any
licenses, sublicenses or rights will be granted only as expressly provided in the Transaction Agreements. Neither Party nor any of its Affiliates will use
or practice any Know-How, Materials or Patents licensed or provided to such Party or any of its Affiliates outside the scope of or otherwise not in
compliance with the rights and licenses granted to such Party and its Affiliates under the Transaction Agreements.

2.6. Third Party In-Licenses.

(a) Moderna In-Licenses. In the event that Moderna identifies any Patents or Know-How of a Third Party that may [***], Moderna may
independently negotiate and enter into an agreement to obtain a license or other rights to such Patents or Know-How (each such agreement, a
“Moderna In-License”); provided, that Moderna (i) will [***] and (ii) will reserve the right in such Moderna
In-License to [***].

(b) Moderna Collaboration In-Licenses. If during the Services Program Term Moderna enters into any Moderna In-License, Moderna will,
through written notice, bring such Moderna In-License to the attention of the JSC [***]. If a Moderna In-License is brought to the attention of the JSC
pursuant to this Section 2.6(b), the Parties will, through the JSC, discuss in good faith whether such Moderna In-License should be made available for
use [***]. Moderna will disclose the terms of the Moderna In-License to the JSC, subject to [***], and otherwise provide AstraZeneca with such
assistance and information that AstraZeneca reasonably requires to assess whether or not [***]. If AstraZeneca notifies Moderna in writing within [***]
days after the time when Moderna brought the Moderna In-License to the attention of the JSC or AstraZeneca, as applicable, that such Moderna
In-License should be made available for use by [***] (each such Moderna In-License, a “Moderna Collaboration In-License”), then (i) the Patents and
Know-How in-licensed under such Moderna In-License will be deemed Moderna Technology, and (ii) AstraZeneca will be required to make the
payments set forth in Section 2.8(b); provided, that [***]. If AstraZeneca concludes that such Moderna In-License should not be made available [***],
then subject to Section 2.6(c), [***].
(c) Conversion of Moderna In-Licenses. AstraZeneca may elect to convert any Moderna In-License to a Moderna Collaboration In-License by (i) providing written notice to Moderna of the same and (ii) [***]; provided, [***]. Upon Moderna’s receipt of such notice [***], such Moderna In-License will be a Moderna Collaboration In-License hereunder, and the provisions of this Agreement applicable to Moderna Collaboration In-Licenses will apply with respect to such Moderna In-License. Notwithstanding the foregoing, prior to converting any Moderna In-License to a Moderna Collaboration In-License, the Parties will agree on [***].

(d) Moderna Collaboration In-License Requirements. AstraZeneca will abide, and will cause all its Affiliates and applicable Sublicensees to abide, by all requirements of each Moderna Collaboration In-License in all material respects (and in any case in all respects in the case that [***]), to the extent applicable to sublicensees thereunder and to the extent disclosed by Moderna to AstraZeneca pursuant to Section 2.6(b) prior to AstraZeneca’s conclusion to have the Moderna In-License made available, with the understanding that disclosure by Moderna of any Moderna Collaboration In-License to AstraZeneca will be deemed disclosure of such requirements of such Moderna Collaboration In-License so disclosed to AstraZeneca.

(e) AstraZeneca In-Licenses; Moderna Other In-Licenses.

(i) In the event that AstraZeneca identifies any Patents or Know-How of a Third Party that [***] (each such agreement, an “AstraZeneca In-License”). AstraZeneca will notify Moderna of such AstraZeneca In-License. In the event that such notice is given and Moderna concludes that such AstraZeneca In-License should be made available [***], then the Parties will discuss in good faith whether and on what terms AstraZeneca would grant Moderna rights under any such AstraZeneca In-License.

(ii) Subject to Section 2.6(a), in the event that Moderna identifies any Patents or Know-How of a Third Party that [***], Moderna may independently negotiate and enter into an agreement to obtain a license or other rights to such Patents or Know-How [***] (each such agreement, a “Moderna Other In-License”). Moderna may notify AstraZeneca of such Moderna Other In-License. In the event that such notice is given and [***] such Moderna Other In-License should be made available [***], then the Parties will discuss in good faith whether and on what terms Moderna would grant AstraZeneca rights under any such Moderna Other In-License.

(f) [***]

2.7. [***]

2.8. Services Program Expenses.

(a) Expenses. Except as otherwise provided in this Agreement, each of Moderna and AstraZeneca will be responsible for all of its internal and out-of-pocket costs and expenses in connection with the performance of the Services Plan; provided, that AstraZeneca will reimburse Moderna for any direct, reasonable and verifiable out-of-pocket costs that are specified in and in accordance with any budget for the Services Plan and incurred by Moderna in connection with the performance of the Services or other activities as a part of the Services Program. Moderna will issue an invoice each month covering costs that are reimbursable by AstraZeneca pursuant to the foregoing sentence. AstraZeneca agrees to pay each such invoice within [***] days of AstraZeneca’s receipt thereof, subject to the provisions in Section 6.2.
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(b) **Moderna Collaboration In-License Payments.**

(i) If any payments previously disclosed to AstraZeneca pursuant to Section 2.6(b) become due during the Services Program Term under any Moderna Collaboration In-License, [* ***]; provided, that (i) [* ***] within [* ***] days of [* ***] (excluding [* ***]) and (ii) such payment obligation is not specifically attributable to activities under the A&R Option Agreement, which will be addressed thereunder.

(ii) Notwithstanding Section 2.8(b)(i), if any payments previously disclosed to AstraZeneca pursuant to Section 2.6(b) become due during the Services Program Term under any Moderna Collaboration In-License that is [* ***]; provided, that (1) [* ***] within [* ***] (excluding [* ***]).

2.9. **Services Program Records, Reports and Materials.**

(a) **Records.** Each Party will maintain, or cause to be maintained, records of its activities under the Services Program in sufficient detail and in good scientific manner appropriate for scientific, Patent and regulatory purposes, that will properly reflect all work included in the Services Program, for a period of at least [* ***] after the creation of such records, but in no event less than required by applicable Laws. Each Party will have the right to request a copy of any such records.

(b) **Services Program Reports.** Each Party will furnish to the JSC a summary written report within [* ***] days after each [* ***] and [* ***] occurring during the Services Program Term, describing its progress under the Services Plan as part of the Services Program during the previous [* ***] period. The JSC may periodically request summary reports from either Party updating the JSC as to the progress under the Services Plan during any intermediate intervening periods between such [* ***] reports.

(c) **Materials.**

(i) Other than as set forth in Section 4, each Party will, during the Services Program Term, as a matter of course as described in the Services Plan or upon the other Party’s reasonable written request, furnish to each other samples of Materials that are in such Party’s Control and [* ***].

(ii) Each Party will use any Materials provided by the other Party hereunder, including as set forth in Section 4 and Exhibit A-1, only in accordance with the Services Plan and otherwise in accordance with the terms and conditions of this Agreement and any reasonable instructions provided by the Party furnishing the Materials. Except with the prior written consent of the supplying Party (such consent not to be unreasonably withheld, delayed or conditioned), the Party receiving any Materials will not [* ***]. All Materials delivered to the receiving Party, other than pursuant to [* ***], will remain the sole property of the supplying Party and will be used in compliance with all applicable Law. The Materials supplied under this Agreement will be used with prudence and appropriate caution in any experimental work because not all of their characteristics may be known. This Section 2.9(c)(ii) will not apply to [* ***].
2.10. **Permitted Subcontracting and Sublicensing.** Subject to the other terms of the Transaction Agreements, including Section 4 with respect to Manufacturing Services, Section 4.6 of the A&R Option Agreement with respect to the Development Pool Services, any Master Supply Agreement (and any associated Quality Assurance Agreement), and Section 2.12, Moderna may subcontract the Services and each Party may otherwise subcontract any of its activities to be performed under the Services Plan to an Affiliate or a Third Party; **provided, that no such permitted subcontracting shall relieve the subcontracting Party of any of its obligations (except to the extent satisfactorily performed by such subcontractor). In the event that either Party subcontracts activities pursuant to this Section 2.10 to an Affiliate or Third Party, such Affiliate or Third Party will have entered into a written agreement with such Party that includes terms and conditions protecting and limiting use and disclosure of Confidential Information and Materials and Know-How at least to the same extent as under this Agreement, and requiring such Third Party and its personnel to assign to such Party all right, title and interest in and to any Patents, Know-How and Materials created, conceived or developed in connection with the performance of subcontracted activities to the extent required to Exploit Product Candidates. Any such subcontracting activities will be described in the reports for the Services Program required by Section 2.9(b). To the extent that any subcontractor needs a sublicense to perform the Services, Section 3.6 of the A&R Option Agreement will apply.

2.11. **Regulatory Activities.** From the Implementation Date until the [***] of the Implementation Date, and subject to any Third Party confidentiality obligations, each Party will through the JSC keep the other Party appropriately informed of [***]. Upon the request of either Party, and subject to any Third Party confidentiality obligations, the Parties will discuss in good faith appropriate [***]. Each Party will use Commercially Reasonable Efforts to [***]. Notwithstanding the foregoing, (a) except to the extent required by applicable Law, AstraZeneca will have the sole right to [***]; and (b) this Section 2.11 (i) will not require Moderna to disclose any [***] and (ii) will terminate after the Program Services Term upon [***].

2.12. **Applicable Laws and Bioethics Policy.** The Services and Services Program (and any applicable Development Pool Services) to be conducted by each Party (including by its subcontractors) pursuant to this Agreement or the A&R Option Agreement will be carried out in good scientific manner and in compliance with all applicable Laws, as well as the AstraZeneca bioethics policy attached at Schedule 2.12, to attempt to achieve efficiently and expeditiously the objectives of the applicable Services Program (or Development Pool Services, if applicable). Notwithstanding the provisions of Section 2.10, in respect of any Services (or Development Pool Services, if applicable) to be performed by or on behalf of Moderna to be initiated after the Implementation Date, Moderna and AstraZeneca will mutually agree [***].

3. **Governance.**

3.1. **Services Program Management.** Following the Implementation Date, each Party will appoint a person who will oversee day-to-day contact between the Parties for all matters related to the collaboration and management of the Services Program activities in between meetings of the JSC and the joint patent committee as constituted under the A&R Option Agreement (such joint patent committee, the "JPC") and will have such other responsibilities as the Parties may agree in writing after the Implementation Date. One person will be designated by AstraZeneca (the "AstraZeneca Program Director") and one person will be designated by Moderna.
(the “Moderna Program Director,”) together will be the “Program Directors.” Each Party may replace its Program Director at any time by notice in writing to the other Party. Any Program Director may designate a substitute to temporarily perform the functions of that Program Director by written notice to the other Party.

3.2. **Joint Steering Committee.**

(a) **Formation and Membership.** Following the Implementation Date, the Parties will establish a joint steering committee (the “Joint Steering Committee” or “JSC”), comprised of [***] representatives of Moderna and [***] representatives of AstraZeneca. Each JSC member will be a senior development leader or have similar experience and expertise as a senior development leader. Each Party may replace its representatives on the JSC at any time upon written notice to the other Party. With the consent of the other Party (such consent not to be unreasonably withheld, delayed or conditioned), each Party may invite non-voting employees and consultants to attend meetings of the JSC, subject to their agreement to be bound to the same extent as a permitted subcontractor under Section 2.10. Program Directors will attend JSC meetings as participating non-members.

(b) **Meetings.** While in existence, the JSC will meet each [***] (or more frequently as may be determined by the JSC) and may hold meetings in person or by audio or video conference as determined by the JSC, but at a minimum, [***] of such meetings each calendar year starting in 2013 will be in person (which in-person meeting will be held at [***]). Meetings of the JSC will be effective only if at least [***] representative of each Party is present or participating. Each Party will be responsible for all of its own expenses of participating in the meetings. The Parties will endeavor to schedule meetings of the JSC at least [***] in advance. The JSC will determine the JSC operating procedures and will codify these operating procedures in the written minutes of the first meeting (or subsequent meetings as such procedures are updated). The JSC will prepare and circulate a meeting agenda prior to each such meeting. The Parties will alternate in preparing written minutes of such meeting, and the preparing Party will circulate such minutes within [***] days after such meeting. The Parties will agree on the minutes of each meeting promptly, but in no event later than the next meeting of the JSC. Each Party will designate one of its three representatives who is empowered by such Party to make decisions related to the performance of such Party’s obligations under the Transaction Agreements to act as the co-chair of each JSC. The co-chairs will be responsible for overseeing the activities of its JSC members consistent with the responsibilities set forth in Section 3.2(c).

(c) **Responsibilities.** The JSC will oversee the Services Program and the performance of the Services Plan. It is envisioned that the JSC will form project teams to deal with the day-to-day work to execute the Services Plan for particular Research Polypeptides. Without limiting the generality of the foregoing, within such scope, the JSC will have the following responsibilities:

(i) Review Moderna’s performance of the Services and the Parties’ other efforts and progress under the Services Plan;

(ii) Review and approve of the Services Program;
(iii) Propose and approve of any proposed modifications or amendments to a Services Plan and the Services Program (other than minor, day-to-day modifications to the Services Plan and the Services Program made by the project teams (if applicable) and changes that do not affect Moderna), including the selection of Collaboration mRNA Constructs for additional work as part of the Services Program;

(iv) Prioritize and oversee execution of specific activities to be performed under the Services Plan and the Services Program;

(v) Resolve all disputes referred to the JSC by any subcommittee or project teams established by the JSC;

(vi) Review and approve the [***];

(vii) Review and approve quarterly reports from Moderna setting forth [***] incurred by Moderna for which Moderna seeks reimbursement;

(viii) Determine the specific number of FTEs [***] to be dedicated by Moderna in performing the Services and Development activities under the Services Plan and as part of the Services Program in accordance with Section 2.3(c);

(ix) Review data, reports or other information submitted by either Party with respect to development activities performed under a Services Plan and the Services Program by or on behalf of such Party;

(x) Update the Services Plan to include activities with respect to new Research Polypeptides;

(xi) Monitor that all activities are compliant with AstraZeneca’s Bioethics policy and other compliance standards of importance to AstraZeneca or Moderna;

(xii) Form such other committees or project teams as the JSC may deem appropriate (including any project teams to deal with the day-to-day work to execute the Services Plan for a particular Research Polypeptide) and oversee the work of the JPC and any other committees or project teams formed by the JSC (but without alteration of the governance of the JPC as set forth in Section 10.1 of the A&R Option Agreement), including by receiving and reviewing reports and other information submitted by those joint committees and project teams (if applicable); provided, that any such committee or project team may make recommendations to the JSC but may not be delegated JSC decision-making authority;

(xiii) Review and approve the regulatory pathway for the approval by Regulatory Authorities of Collaboration mRNA Constructs as medicinal products and material submissions to Regulatory Authorities with respect to such pathway;

(xiv) Review proposed publications regarding the results of the Services Program proposed to be published in accordance with Section 7.2.
(xv) Address such other matters relating to the activities of the Parties under this Agreement as either Party may bring before the JSC, including any matters that are expressly for the JSC to decide as provided in this Agreement; and

(xvi) Attempt to resolve any disputes relating to the Transaction Agreements on an informal basis.

(d) **Decision-making.** The [***] JSC representatives of each Party will collectively have one (1) vote. The JSC members will use reasonable efforts to reach agreement on all matters. If, despite such efforts, agreement on a particular matter cannot be reached by the JSC within [***] days after the JSC first considers such matter (or such shorter time as may be reasonable in the circumstances), then [***].

(e) **Resolution of Certain Matters.** Notwithstanding the provisions of Section 3.2(d) in the event of a dispute or disagreement arising in, or referred to, the JSC relating to [***] that cannot be resolved by the members of the JSC, upon the written request of a Party, such matter will be referred to the Executive Officers (or their designees, which designee is required to have decision-making authority on behalf of such Party), who will attempt in good faith to resolve such dispute by negotiation and consultation for a [***] period following receipt of such written notice. If, despite such efforts, agreement on a particular matter cannot be reached by the Executive Officers within such [***] period, then [***].

(f) **Limits on JSC Authority.** Each Party will retain the rights, powers and discretion granted to it under this Agreement and no such rights, powers, or discretion will be delegated to or vested in the JSC unless such delegation or vesting of rights is expressly provided for in this Agreement or the Parties expressly so agree in writing. The JSC will not have the power to [***]. Any dispute between the Parties regarding the issues set forth in this Section 3.2(f) will be resolved pursuant to the procedures set forth in Section 11.1.

(g) **Scope of JSC Responsibilities and Term.** Unless otherwise agreed by the Parties or as provided in Section 9.4, the JSC will continue to exist throughout the Term; provided that [***] after the end of the Services Program Term, the responsibilities of the JSC will be limited to those allocated to it in Section 4, Exhibit A-1 and as provided in Section 5.4 of the A&R Option Agreement. After expiration of the Services Program Term, the membership of the JSC will be adjusted to reflect such amended responsibilities, and will meet as reasonably required, and on such notice, as necessary to fulfill those responsibilities, each as determined by the JSC; provided that if a meeting of the JSC is required to address any matter for which the JSC is responsible, either Party may call such meeting on not less than [***] days’ notice).

## 4. Manufacturing

4.1 **General Obligation to Supply.** Subject to the terms and conditions of the Transaction Agreements and in particular this Section 4, Exhibit A-1 and Exhibit A-2, Moderna will Manufacture and supply to AstraZeneca, and AstraZeneca will purchase exclusively from Moderna, such quantities of Moderna mRNA API as AstraZeneca may reasonably require in connection with the Exploitation of Collaboration mRNA Constructs, Product Candidates and Products; provided, that such obligation to purchase exclusively from Moderna will no longer
apply with respect to Moderna mRNA API for a given Product at such time as [***]. Notwithstanding the foregoing, the Parties acknowledge and agree that AstraZeneca will have no right to acquire from Moderna, and Moderna will have no obligation to Manufacture and supply to AstraZeneca, any Moderna mRNA API for use in connection with the Commercialization of any Product unless and until AstraZeneca has exercised its Option as set forth in Section 6.6 of the A&R Option Agreement and paid the applicable Initial Payment under the A&R Option Agreement with respect to such Product. Except (a) following a Triggering Event as described in Section 4.7, (b) on a Product-by-Product basis, at such time as [***], or (c) [***], neither AstraZeneca nor any Affiliate of AstraZeneca (nor any others on behalf of or under license or sublicense from AstraZeneca or any of its Affiliates) will Manufacture (i) any Moderna mRNA API or (ii) Product, except for the Manufacture of Product using Moderna mRNA API supplied by or on behalf of Moderna. For clarity, the rights and obligations under this Section 4, Exhibit A-1 and Exhibit A-2 relate solely to unformulated Moderna mRNA API, unless otherwise agreed by the Parties. AstraZeneca, for itself, its Affiliates and all others acting on behalf of or under license or sublicense from AstraZeneca or any of its Affiliates, will purchase from Moderna all mRNA Constructs to be Exploited under any of the Transaction Agreements or any of the Master Supply Agreements, unless and until (i) there is a Triggering Event, or (ii) [***].

4.2. Non-cGMP Supply for Services Program. In accordance with Exhibit A-1, Moderna will Manufacture and supply AstraZeneca with non-cGMP Moderna mRNA API for use in support of the Services Program, Development Pool Services or Pre-Clinical Activities, as applicable, with respect to each applicable Collaboration mRNA Construct. For clarity, the charges for such Manufacturing Services are as provided in Exhibit A-1 and are inclusive of [***].

4.3. cGMP Supply Agreements.  
(a) AstraZeneca and Moderna have entered into a master clinical supply agreement (dated April 23, 2015) and related quality agreement pursuant to which Moderna will continue to supply to AstraZeneca cGMP Moderna mRNA API for clinical Development of Product Candidates and Products and for any other activities under the Transaction Documents that require cGMP Moderna mRNA API, all in accordance with the Transaction Agreements (as may be amended, the “Master Clinical Supply Agreement”) as required under Section 4.1, in such quantities as AstraZeneca may order in accordance with the terms and conditions of such agreement.

(b) At any time after [***], AstraZeneca may notify Moderna that it desires to commence negotiations of a master commercial supply agreement and related quality agreement pursuant to which Moderna will supply to AstraZeneca cGMP Moderna mRNA API as required under Section 4.1, in such quantities as AstraZeneca may order in accordance with the terms and conditions of such agreement for Commercialization of Products in accordance with the Transaction Agreements. Not later than [***] after such notice, AstraZeneca and Moderna will enter into such agreement (the “Master Commercial Supply Agreement” and, together with the Master Clinical Supply Agreement, the “Master Supply Agreements”).

(c) Each Master Supply Agreement will contain such terms as are reasonable and customary for similar supply agreements, including the terms and conditions described in Exhibit A-2, and will be negotiated and agreed by the Parties in good faith. In the event that the Parties
are not able to agree on such terms to be included in either Master Commercial Supply Agreement within the applicable time periods specified in clauses (a) or (b), as applicable, after negotiation and escalation under Section 11.1(b), the disputed terms will be referred to and finally resolved [***].

4.4. [***]

(a) Following selection of a Product Candidate pursuant to Section 4.1(a) of the A&R Option Agreement, AstraZeneca will provide to Moderna, information regarding the scope and substance of its anticipated clinical Development and Commercialization activities requiring Moderna mRNA API for such Product Candidate (assuming that it becomes an Optioned Product Candidate) ("AstraZeneca Anticipated Requirements"). At the first meeting of the JSC following Moderna’s receipt of the AstraZeneca Anticipated Requirements for a Product Candidate, Moderna will [***].

(b) During the Term (and thereafter during the term of any Master Supply Agreement), Moderna will [***].

(c) In the event that AstraZeneca, at any time in good faith, asserts that [***].

4.5. Technology Transfer. Promptly after the occurrence of any Triggering Event, Moderna will provide written notice thereof to AstraZeneca. After receipt of such notice, or after becoming aware of the occurrence of any Triggering Event, AstraZeneca will notify Moderna by written notice whether the rights and obligations under this Section 4.5 and Section 4.6 apply to [***]; provided, that AstraZeneca may not elect to have the rights and obligations under this Section 4.5 and Section 4.6 apply to clause (b) under the following circumstances: (i) [***] and (iii) [***], in which case [***] will apply, unless and until another Triggering Event occurs (the Moderna mRNA API(s) that are the subject of the transfer [***], the "Transferred APIs"). Within [***] days of a Triggering Event, Moderna will, and will cause its Affiliates and its manufacturers to, [***]. Without limiting the generality of the foregoing, with respect to each Transferred API [***] with respect to which AstraZeneca requests and is entitled to a technology transfer, Moderna and its Affiliates will, and Moderna will [***], at AstraZeneca’s expense:

(a) make available to AstraZeneca [***] a copy of [***] (the “Manufacturing Know-How”);

(b) cause appropriate employees and representatives of Moderna and its Affiliates and [***] to [***];

(c) take such steps as are [***];

(d) upon AstraZeneca’s request, [***];

(e) upon AstraZeneca’s request, [***]; and

(f) provide such other assistance as AstraZeneca may reasonably request to enable AstraZeneca or its designee to Manufacture the Transferred APIs [***] in accordance with the applicable Specifications, including [***].

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Except as set forth above, [***] in connection with such technology transfer, and AstraZeneca will be [***] in connection with such technology transfer. AstraZeneca and its Third Party manufacturer may only use the Manufacturing Know-How provided to AstraZeneca pursuant to this Section 4.5 in support of Manufacturing the Transferred API(s) for so long as it elects (subject to the last sentence of this paragraph) and solely in accordance with the Transaction Agreements, and will not use any such Manufacturing Know-How for any other reason or for any other product or product candidate (or intermediate or component thereof). [***] Following the completion of the technology transfer for the Transferred API(s), AstraZeneca will notify Moderna regarding whether, for how long, and to what extent it would expect to continue to purchase the Transferred API(s) from Moderna if problems leading to the Triggering Event were rectified.

4.6. [***]

4.7. Triggering Events. For the purposes of this Agreement [***], “Triggering Event” means:

(a) [***];
(b) [***];
(c) [***];
(d) [***];
(e) [***]; or
(f) [***].

4.8. Force Majeure. In the case of a force majeure event described in Section 11.8 related to Manufacturing hereunder by or on behalf of Moderna or any force majeure event under any Master Supply Agreement that causes or is likely to cause an inability or materially reduced ability to supply Moderna mRNA API to AstraZeneca hereunder or thereunder, the Parties agree to negotiate in good faith the most optimal manner in which to overcome such inability or materially reduced ability as promptly as practical, taking into account cost and quality. If the Parties agree that such inability or material reduced ability would be more expeditiously remedied, taking into account cost and quality, if AstraZeneca assumed responsibility for such Manufacturing, then the Parties will agree in writing on a plan for such assumption, consent not to be unreasonably withheld.

4.9. Manufacturing Know-How Confidentiality. In addition to the provisions of Section 7, AstraZeneca recognizes that maintaining the confidentiality and trade secret nature of the Manufacturing Know-How requires an even higher level of vigilance than other Confidential Information, and agrees to (a) maintain in confidence Manufacturing Know-How with the same degree of care that AstraZeneca uses to protect its own like information, (b) strictly limit access to and use of Manufacturing Know-How to employees, representatives, consultants and contractors of AstraZeneca, its Affiliates and its designated Third Party contract manufacturers with a need to know such information, and (c) use Manufacturing Know-How only for producing Moderna mRNA API in accordance with a license granted by Moderna and for no other purpose.
AstraZeneca will ensure that any person having access to the Manufacturing Know-How will be made aware of its highly confidential nature and will agree to be bound by confidentiality terms no less stringent than those in this Agreement.

4.10. Preparation of CMC Section and DMF. If not previously prepared and filed, Moderna will, at AstraZeneca’s request, prepare and file with Regulatory Authorities a DMF and provide such other information and assistance as AstraZeneca may reasonably require in connection with the completion of and submission of applications for Regulatory Approvals for Products. AstraZeneca may refer to such DMF in any filing made in connection with obtaining or maintaining a Regulatory Approval for a Product. Moderna will be responsible for assuring that during any period in which Moderna has a supply obligation to AstraZeneca for mRNA API, such DMF will be in the form appropriate for filing with the Regulatory Authorities in the United States, the European Union, Japan and such other countries as requested by AstraZeneca. Moderna will, on written request by AstraZeneca or its Affiliate or Sublicensee, provide to the requesting party and to any specified Regulatory Authority a letter, in the form reasonably required by the requesting party, acknowledging that the requesting party has a right of reference to any such DMF. [***]

5. Regulatory Responsibilities.

5.1. In General. As set forth in greater detail below in this Section 5, AstraZeneca will lead and have sole control of all regulatory efforts for Collaboration mRNA Constructs, Product Candidates, and Products worldwide, including with respect to preparing and filing the relevant Regulatory Filings and all communications with Regulatory Authorities.

5.2. Regulatory Filings. AstraZeneca will be responsible for preparing and submitting all Regulatory Filings related to Collaboration mRNA Constructs, Product Candidates, and Products, including all applications for Regulatory Approval. All applications for Regulatory Approval, the Regulatory Approvals, and other Regulatory Filings (including all INDs) relating to Collaboration mRNA Constructs, Product Candidates, and Products will be the property of AstraZeneca and held in the name of AstraZeneca or its designees.

5.3. Interactions with Regulatory Authorities. AstraZeneca will have the sole right to conduct all communications with the Regulatory Authorities, including all meetings, conferences and discussions (including advisory committee meetings), with regard to Collaboration mRNA Constructs, Product Candidates, and Products in the Territory.

5.4. Moderna Regulatory Responsibilities Related to Manufacture. Consistent with the provisions of Section 4.10, Moderna will, at its sole cost and expense, obtain and maintain all approvals, licenses, registrations, or authorizations (other than the Regulatory Approval for a Product) that are necessary or useful in connection with the Manufacture of Collaboration mRNA Constructs, Product Candidates, and Products by or on behalf of Moderna. In addition, [***], prepare the Chemistry, Manufacturing, and Controls (“CMC”) and other Manufacturing provisions with respect to all Regulatory Filings for, or that are otherwise necessary to obtain and maintain, Regulatory Approvals for the Products, including with respect to any Manufacture and supply of Collaboration mRNA Constructs, Product Candidates, and Products by or on behalf of Moderna pursuant to Section 4, including any amendments with respect thereto [***]. As set forth in greater detail in Section 4.10, the CMC section of a Regulatory Approval for a Product may reference Moderna’s DMF for such Product.
5.5. Cooperation. Without limiting the provisions of Section 5.4, during the Services Program Term, Moderna will cooperate with any reasonable requests for assistance from AstraZeneca with respect to obtaining any Regulatory Approval of Collaboration mRNA Constructs, Product Candidates, and Products and maintaining any Regulatory Approval of Collaboration mRNA Constructs, Product Candidates, and Products that is held by AstraZeneca, including by: [***]. Assistance provided by Moderna to AstraZeneca pursuant to this Section 5.5 [***]. An estimate of such costs and expenses will be provided to AstraZeneca before the initiation of any agreed work.

6. Payment.

6.1. Up-Front Payment. AstraZeneca paid to Moderna within [***] Business Days of the Implementation Date a one-time payment of [***] (the “Upfront Payment”). The (a) Upfront Payment and (b) fees payable by AstraZeneca pursuant to Sections 2.3(c) and 2.8(a) and Section 4 are paid by AstraZeneca in consideration for the Services to be performed by, and the Materials to be provided by, Moderna under this Agreement, and will be non-refundable and non-creditable and not subject to set-off (except for those payments under the foregoing clause (b), which payments will be subject to Section 11.17).

6.2. Reports; Payments. Moderna will furnish to AstraZeneca and the JSC a written report, after the end of each [***], showing the amount of [***], in each case, incurred by Moderna for such [***], which report will be furnished within [***] of the end of [***]. The JSC will review and approve any such report within [***] of receipt thereof. With respect to amounts invoiced by Moderna and payable by AstraZeneca under any Transaction Agreement, Moderna will submit an invoice in a form reasonably acceptable to AstraZeneca.

6.3. Records and Audits. Moderna will keep (and cause its Affiliates to keep) adequate books and records of accounting that fairly reflect the FTE Costs, Patent Costs, and the budgeted out-of-pocket costs explicitly set forth in the Services Plan, all in sufficient detail to confirm the accuracy of any payments required or made under the Transaction Agreements. Such books and records will be maintained by Moderna for at least [***] from the date of creation. Upon reasonable prior written notice to Moderna, such records of Moderna and its Affiliates will be open for inspection during normal business hours by independent accountants selected by AstraZeneca and reasonably acceptable to Moderna and not paid in whole or in part by a contingent fee arrangement, which such accountants will be obliged to execute a reasonable confidentiality agreement prior to commencing any such inspection or audit, for the purpose of verifying the accuracy of any payments required or made hereunder or confirming such rates or prices. All such inspections may be made, at reasonable times mutually agreed by the Parties, no more than once in any [***] period and going back no more than [***] after receipt of the respective invoice and report. The cost of this examination will be borne by AstraZeneca, unless the audit reveals a variance of more than [***] from the reported amounts for a calendar year, in which case Moderna will bear the reasonable out-of-pocket cost of the audit; provided, such variance exceeds [***] dollars [***]. If such audit concludes that additional payments were owed or that excess payments were made during such period, AstraZeneca will pay such additional amounts owed to Moderna and Moderna will pay the amount of any such excess payments to AstraZeneca.
7. **Confidentiality.**

7.1. **Confidential Information.**

(a) **Confidential Information.** Each Party ("Disclosing Party") may have disclosed or will disclose to the other Party ("Receiving Party"), and Receiving Party may acquire during the course and conduct of activities under the Transaction Agreements, certain proprietary or confidential information of Disclosing Party. The term “Confidential Information” means (i) all Materials (excluding any Moderna mRNA API supplied to AstraZeneca pursuant to Section 4) and (ii) all ideas and information of any kind, whether in written, oral, graphical, machine-readable or other form, whether or not marked as confidential or proprietary, which are transferred, disclosed or made available to Receiving Party by Disclosing Party or at the request of Receiving Party, including any of the foregoing of Third Parties. Without limiting the foregoing, [***] will be treated as Confidential Information of both Parties.

(b) **Restrictions.** During the Term and for [***] thereafter, Receiving Party will, and will cause its Affiliates and their respective officers, directors, employees and agents to, keep all Disclosing Party’s Confidential Information in confidence with the same degree of care with which Receiving Party holds its own confidential information (though no less than reasonable care); provided, that the foregoing obligation will apply to any Confidential Information that constitutes a trade secret for so long as such Confidential Information is afforded trade secret protection under applicable Law. Receiving Party will not use, and will cause its Affiliates and their respective officers, directors, employees and agents not to use, Disclosing Party’s Confidential Information except for in connection with the performance of its obligations and exercise of its rights under the Transaction Agreements. Receiving Party has the right to disclose Disclosing Party’s Confidential Information without Disclosing Party’s prior written consent (such consent not to be unreasonably withheld, delayed or conditioned), to the extent and only to the extent reasonably necessary or useful, to Receiving Party’s Affiliates and their employees, subcontractors, sublicensees, consultants or agents who have a need to know such Confidential Information in order to perform its obligations and exercise its rights under the Transaction Agreements and who are required to comply with restrictions on use and disclosure similarly restrictive as those in this Section 7.1(b). Receiving Party will use [***] to cause those entities and persons to comply with such restrictions on use and disclosure. Notwithstanding the foregoing sentence, Receiving Party assumes responsibility for those entities and persons maintaining Disclosing Party’s Confidential Information in confidence and using same only for the purposes described herein.

(c) **Exceptions.** Receiving Party’s obligation of nondisclosure and the limitations upon the right to use the Disclosing Party’s Confidential Information set forth in Section 7.1(b) will not apply to the extent that Receiving Party can demonstrate that the Disclosing Party’s Confidential Information: (i) was known to Receiving Party or any of its Affiliates prior to the time of disclosure; (ii) is or becomes public knowledge through no fault or omission of Receiving Party or any of its Affiliates; (iii) is obtained by Receiving Party or any of its Affiliates from a Third Party under no obligation of confidentiality to Disclosing Party; or (iv) has been independently developed by employees, subcontractors, consultants or agents of Receiving Party or any of its
Affiliates without the aid, application or use of Disclosing Party’s Confidential Information, as evidenced by contemporaneous written records. Notwithstanding the foregoing, (A) any Confidential Information will not be deemed to be within the foregoing exceptions merely because such information is embraced by more general information in the public domain or in the possession of the Receiving Party or any of its Affiliates, and (B) any combination of features will not be deemed to be within the foregoing exceptions merely because individual features are in the public domain or in the possession of the Receiving Party or any of its Affiliates, but only if the combination itself and its principle of operation are in the public domain or in the possession of the Receiving Party or any of its Affiliates.

(d) Permitted Disclosures. Receiving Party may disclose Disclosing Party’s Confidential Information to the extent (and only to the extent) such disclosure is reasonably necessary in the following instances:

(i) in order to comply with applicable Law or the rules of any securities exchange or with a legal or administrative proceeding;

(ii) in connection with (A) prosecuting or defending litigation or (B) Prosecuting or Maintaining Patents for Collaboration Technology; provided, [***];

(iii) in connection with exercising any rights or other licenses under the Transaction Agreements, including with respect to any Joint Technology;

(iv) in the case of AstraZeneca to [***];

(v) in the case of AstraZeneca, [***];

(vi) (A) in the case of Moderna, [***];

(vii) in the case of Moderna, [***]; and

(viii) in the case of Moderna, [***].

In the case of a disclosure pursuant to (A) Sections [***], where reasonably possible, Receiving Party will notify Disclosing Party of Receiving Party’s intent to make any disclosure pursuant thereto sufficiently prior to making such disclosure [***], and (B) with respect to [***], each of those named people and entities are required to [***].

7.2. Publications. The Parties may desire to publish in scientific journals and present at scientific conferences the results of the Services Program, subject to the following process. Notwithstanding anything to the contrary herein, either Party may propose publication of the results of the Services Program following scientific review by the JSC (if in force); provided, that no such publication will be made without written approval by Moderna and AstraZeneca. After receipt of the proposed publication by both AstraZeneca and Moderna, such written approval or disapproval will be provided within [***] days. Both Parties understand that a reasonable commercial strategy may require delay of publication of information or filing of Patent applications, therefore the Parties agree to review and consider delay of publication and filing of patent applications under certain circumstances for a reasonably limited period of time (including
as set forth in Section 10.2 of the A&R Option Agreement). Once publications have been reviewed by each Party and have been approved for publication, the same publications do not have to be provided again to the other Party for review for a later submission for publication. Expedited reviews for abstracts or poster presentations may be arranged if mutually agreeable to the Parties. Each Party will acknowledge the other Party’s technical, non-financial contributions in any such publication. For the avoidance of doubt, the foregoing requirements and restrictions will not apply with respect to either Party’s proposed publication of results of any work performed with respect to any Discontinued Target.

7.3. Terms of this Agreement; Publicity.

(a) Restrictions.

(i) The Parties agree that the terms of the Transaction Agreements will be treated as Confidential Information of both Parties, and thus may be disclosed only as permitted by Section 7.1(d). Each Party will also be permitted to disclose the terms of this Agreement (including the Exhibits and Schedules hereto) and any executed Transaction Agreement, in each case under appropriate confidentiality provisions, on a need to know basis, to [***]; provided, that (A) the disclosing Party agrees to redact information that it reasonably believes is not relevant to the proposed transaction, and (B) [***] may be disclosed to any of the foregoing [***] only after [***].

(ii) [***] Except as required by Law, each Party agrees not to issue any press release or public statement disclosing information relating to the Transaction Agreements, the transactions contemplated hereby or thereby or any of the terms hereof or thereof without the prior written consent of the other Party (such consent not to be unreasonably withheld, delayed or conditioned), or as such consent may be obtained in accordance with Section 7.3(c). [***]

(b) Securities Filings. Each Party acknowledges and agrees that the other Party may submit the Transaction Agreements (including for clarity, the Exhibits and Schedules hereto and thereto) to the United States Securities and Exchange Commission (the “SEC”) or any other securities exchange and if a Party does submit the Transaction Agreements to the SEC or any other securities exchange, such Party agrees to consult with the other Party with respect to the preparation and submission of, a confidential treatment request for the Transaction Agreements. If a Party is required by Law to make a disclosure of the terms of the Transaction Agreements in a filing with or other submission to the SEC or any other securities exchange, and (i) such Party has provided copies of the disclosure to the other Party as far in advance of such filing or other disclosure as is reasonably practicable under the circumstances, (ii) such Party has promptly notified the other Party in writing of such requirement and any respective timing constraints, and (iii) such Party has given the other Party a reasonable time under the circumstances from the date of notice by such Party of the required disclosure to comment upon, request confidential treatment or approve such disclosure, then such Party will have the right to make such public disclosure at the time and in the manner reasonably determined by its counsel to be required by Law. Notwithstanding anything to the contrary herein, it is hereby understood and agreed that if a Party seeking to make a disclosure as set forth in this Section 7.3(b), and the other Party provides comments within the respective time periods or constraints specified herein or within the respective notice, the Party seeking to make such disclosure or its counsel, as the case may be, will
in good faith (A) consider incorporating such comments and (B) use reasonable efforts to incorporate such comments, limit disclosure or obtain confidential treatment to the extent reasonably requested by the other Party.

(c) Press Releases. Neither Party may issue any press release or make any other public announcement or statement concerning the Transaction Agreements, the transactions contemplated hereby or thereby or the terms hereof or thereof, without the prior written approval of the other Party, except as may be required by applicable Law. In the event either Party (the “Issuing Party”) desires to issue a press release or other public statement disclosing information relating to the Transaction Agreements, the transactions contemplated hereby or thereby or the terms hereof or thereof, the Issuing Party will provide the other Party (the “Reviewing Party”) with a copy of the proposed press release or public statement (the “Release”) and seek the Reviewing Party’s prior written consent; provided, that to the extent the press release or a public statement only includes the facts and under the circumstances described in Section 7.3(a)(i) and (a)(ii), the Reviewing Party may not withhold, delay or condition its consent. The Issuing Party will specify with each such Release, taking into account the urgency of the matter being disclosed, a reasonable period of time within which the Receiving Party may provide any comments on such Release. If the Receiving Party provides any comments, the Parties will consult on such Release and work in good faith to prepare a mutually acceptable Release. Either Party may subsequently publicly disclose any information previously contained in any Release so consented to.

7.4. Relationship to the Confidentiality Agreement. This Agreement supersedes the Confidentiality Agreement; provided, that all “Confidential Information” disclosed or received by the Parties thereunder will be deemed “Confidential Information” hereunder and will be subject to the terms and conditions of this Agreement.

8. Representations and Warranties; Limitations of Liability; Indemnification.

8.1. Representations and Warranties of Each Party. Each Party represents and warrants to the other as of the Signing Date and the Amendment Effective Date that:

(a) Such Party is duly organized, validly existing and in good standing under the laws of the jurisdiction in which it is organized.

(b) Such Party (i) has the legal right and power to enter into this Agreement, to extend the rights granted or to be granted to the other in this Agreement, and to fully perform its obligations hereunder, and (ii) has taken all requisite action on its part to authorize the execution and delivery of this Agreement and the performance of its obligations hereunder. This Agreement has been duly executed and delivered on behalf of such Party, and constitutes a legal, valid and binding obligation, enforceable against such Party in accordance with its terms, except as may be limited by bankruptcy, insolvency, reorganization or other laws affecting creditors’ rights generally and by general equitable principles.

(c) Neither such Party nor its Affiliates has been debarred or is subject to debarment. Neither it nor its Affiliates will use in any capacity, in connection with the services to be performed under the Transaction Agreements, any person who has been debarred pursuant to Section 306 of
the FFDCA, or who is the subject of a conviction described in such section. In addition, neither it nor its Affiliates has used in any capacity, in connection with any Development activities with respect to the mRNA Technology or any Polypeptide carried out prior to the Signing Date, any person who has been debarred or was the subject of a conviction described in Section 306. Such Party agrees to inform the other Party in writing immediately if it or any person who is performing services under the Transaction Agreements is debarred or is the subject of a conviction described in Section 306, or if any action, suit, claim, investigation or legal or administrative proceeding is pending or, to the best of such Party’s or its Affiliates’ Knowledge, is threatened, relating to the debarment or conviction of such Party or any person performing services under the Transaction Agreements, or if such Party becomes aware that it or any person performing Development activities with respect to an mRNA Construct, Polypeptide, Product Candidate or Product carried out prior to the Signing Date was debarred or was the subject of a conviction described in Section 306.

(d) All necessary consents, approvals and authorizations of all governmental authorities and other Persons required to be obtained by such Party to enter into, or perform its obligations under, this Agreement have been obtained.

(e) The execution and delivery of this Agreement and the performance of such Party’s obligations hereunder (i) will not conflict with or violate any requirement of applicable Law or orders of governmental bodies except as individually or in the aggregate would not be reasonably expected to have a material adverse effect on or a material adverse change in the ability of such Party to perform its obligations under or with respect to this Agreement; and (ii) do not conflict with, or constitute a default under, any contractual obligation of such Party, except as individually or in the aggregate would not have a material adverse effect on or a material adverse change in the ability of such Party to perform its obligations under or with respect to this Agreement.

8.2. **Disclaimers.** Without limiting the respective rights and obligations of the Parties expressly set forth herein, each Party specifically disclaims any guarantee that the Services Program or an Optioned Product Candidate will be successful, in whole or in part. EXCEPT AS OTHERWISE EXPRESSLY PROVIDED IN THIS AGREEMENT OR THE OTHER TRANSACTION AGREEMENTS, THE PARTIES MAKE NO REPRESENTATIONS AND EXTEND NO WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO ANY MODERNA TECHNOLOGY, PRODUCT CANDIDATES, MATERIALS, INCLUDING WARRANTIES OF VALIDITY OR ENFORCEABILITY OF ANY PATENTS, TITLE, QUALITY, MERCHANTABILITY, FITNESS FOR A PARTICULAR USE OR PURPOSE, PERFORMANCE, AND NONINFRINGEMENT OF ANY THIRD PARTY PATENTS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

8.3. **No Consequential Damages.** NOTWITHSTANDING ANYTHING IN THIS AGREEMENT OR THE OTHER TRANSACTION AGREEMENTS, EXCEPT FOR DAMAGES DUE TO THE FRAUD OR WILLFUL MISCONDUCT OR GROSS NEGLIGENCE OF THE LIABLE PARTY, NEITHER PARTY WILL BE LIABLE TO THE OTHER OR ANY THIRD PARTY WITH RESPECT TO ANY SUBJECT MATTER OF THIS AGREEMENT OR THE OTHER TRANSACTION AGREEMENTS FOR ANY INDIRECT, PUNITIVE, SPECIAL OR CONSEQUENTIAL DAMAGES, EVEN IF SUCH PARTY HAS BEEN INFORMED OR SHOULD HAVE KNOWN OF THE POSSIBILITY OF SUCH DAMAGES; PROVIDED, THAT THIS SECTION 8.3 WILL NOT APPLY TO THE PARTIES’ INDEMNIFICATION RIGHTS AND OBLIGATIONS UNDER SECTION 8.5.
8.4. **Performance by Others.** Subject to Sections 2.10 (in the case of subcontractors) and 7.1(b), the Parties recognize that each Party may perform some or all of its obligations under this Agreement through Affiliates and permitted subcontractors; *provided*, that each Party will remain responsible and liable for the performance by its Affiliates and permitted subcontractors and will cause its Affiliates and permitted subcontractors to comply with the provisions of this Agreement in connection therewith.

8.5. **Indemnification.**

(a) **Indemnification by AstraZeneca.** AstraZeneca will indemnify Moderna, its Affiliates and their respective directors, officers, employees, Third Party licensors under the Existing In-License Agreements and agents, and their respective successors, heirs and assigns (collectively, "**Moderna Indemnitees**"), and defend and save each of them harmless, from and against any and all losses, damages, liabilities, costs and expenses (including reasonable attorneys’ fees and expenses) (collectively, "**Losses**") in connection with any and all suits, investigations, claims or demands of Third Parties (collectively, "**Third Party Claims**") arising from or occurring as a result of: [***]; *provided*, that AstraZeneca will not be obligated to indemnify Moderna Indemnitees for any Losses to the extent that such Losses arise as a result of gross negligence or willful misconduct on the part of a Moderna Indemnitee.

(b) **Indemnification by Moderna.** Moderna will indemnify AstraZeneca, its Affiliates and their respective directors, officers, employees and agents, and their respective successors, heirs and assigns (collectively, "**AstraZeneca Indemnitees**"), and defend and save each of them harmless, from and against any and all Losses in connection with any and all Third Party Claims arising from or occurring as a result of: [***]; *provided*, that Moderna will not be obligated to indemnify AstraZeneca Indemnitees for any Losses to the extent that such Losses arise as a result of (1) gross negligence or willful misconduct on the part of an AstraZeneca Indemnitee or (2) [***].

(c) **Notice of Claim.** All indemnification claims provided for in Section 8.5(a) and 8.5(b) will be made solely by such Party to this Agreement (the "**Indemnified Party**"). The Indemnified Party will promptly notify the indemnifying Party (an "**Indemnification Claim Notice**") of any Losses or the discovery of any fact upon which the Indemnified Party intends to base a request for indemnification under Section 8.5(a) or 8.5(b), but in no event will the indemnifying Party be liable for any Losses that result from any delay in providing such notice. Each Indemnification Claim Notice must contain a description of the claim and the nature and estimated amount of such Loss (to the extent that the nature and amount of such Loss is known at such time). The Indemnified Party will furnish promptly to the indemnifying Party copies of all papers and official documents received in respect of any Losses and Third Party Claims.
(d) Defense, Settlement, Cooperation and Expenses.

(i) Control of Defense. At its option, the indemnifying Party may assume the defense of any Third Party Claim by giving written notice to the Indemnified Party within [***] days after the indemnifying Party’s receipt of an Indemnification Claim Notice. The assumption of the defense of a Third Party Claim by the indemnifying Party will not be construed as an acknowledgment that the indemnifying Party is liable to indemnify the Indemnified Party in respect of the Third Party Claim, nor will it constitute a waiver by the indemnifying Party of any defenses it may assert against the Indemnified Party’s claim for indemnification. Upon assuming the defense of a Third Party Claim, the indemnifying Party may appoint as lead counsel in the defense of the Third Party Claim any legal counsel selected by the indemnifying Party (the indemnifying Party will consult with the Indemnified Party with respect to a possible conflict of interest of such counsel retained by the indemnifying Party). In the event the indemnifying Party assumes the defense of a Third Party Claim, the Indemnified Party will immediately deliver to the indemnifying Party all original notices and documents (including court papers) received by the Indemnified Party in connection with the Third Party Claim. Should the indemnifying Party assume the defense of a Third Party Claim, except as provided in Section 8.5(d)(ii), the indemnifying Party will not be liable to the Indemnified Party for any legal costs or expenses subsequently incurred by such Indemnified Party in connection with the analysis, defense or settlement of the Third Party Claim. [***]

(ii) Right to Participate in Defense. Without limiting Section 8.5(d)(i), any Indemnified Party will be entitled to participate in, but not control, the defense of such Third Party Claim and to employ counsel of its choice for such purpose; provided, that such employment will be at the Indemnified Party’s own cost and expense unless [***].

(iii) Settlement. With respect to any Third Party Claims that relate solely to the payment of money damages in connection with a Third Party Claim and that will not result in the Indemnified Party’s becoming subject to injunctive or other relief or otherwise adversely affecting the business of the Indemnified Party in any manner, and as to which the indemnifying Party will have acknowledged in writing the obligation to indemnify the Indemnified Party hereunder, the indemnifying Party will have the sole right to agree to the entry of any judgment, enter into any settlement or otherwise dispose of such Loss, on such terms as the indemnifying Party, in its sole discretion, will deem appropriate. With respect to all other Losses in connection with Third Party Claims, where the indemnifying Party has assumed the defense of the Third Party Claim in accordance with Section 8.5(d)(i), the indemnifying Party will have authority to agree to the entry of any judgment, enter into any settlement or otherwise dispose of such Loss provided it obtains the prior written consent of the Indemnified Party (such consent not to be unreasonably withheld, delayed or conditioned). The indemnifying Party will not be liable for any settlement or other disposition of a Loss by an Indemnified Party that is reached without the prior written consent of the indemnifying Party. Regardless of whether the indemnifying Party chooses to defend or prosecute any Third Party Claim, no Indemnified Party will admit any liability with respect to or settle, compromise or discharge, any Third Party Claim without the prior written consent of the indemnifying Party, such consent not to be unreasonably withheld, delayed or conditioned.

(iv) Cooperation. If the indemnifying Party chooses to defend or prosecute any Third Party Claim, the Indemnified Party will, and will cause each other Indemnified Party to, cooperate in the defense or prosecution thereof and will furnish such records, information and testimony, provide such witnesses and attend such conferences, discovery proceedings, hearings, trials and appeals as may be reasonably requested in connection therewith. Such cooperation will include access during normal business hours afforded to indemnifying Party to, and reasonable
retention by the Indemnified Party of, records and information that are reasonably relevant to such Third Party Claim, and making Indemnified Parties and other employees and agents available on a mutually convenient basis to provide additional information and explanation of any material provided hereunder, and the indemnifying Party will reimburse the Indemnified Party for all its reasonable out-of-pocket costs and expenses in connection therewith.

(v) **Costs and Expenses.** Except as provided above in this Section 8.5(d), the reasonable and verifiable costs and expenses, including attorneys’ fees and expenses, incurred by the Indemnified Party in connection with any claim will be reimbursed on a Calendar Quarter basis by the indemnifying Party, without prejudice to the indemnifying Party’s right to contest the Indemnified Party’s right to indemnification and subject to refund in the event the indemnifying Party is ultimately held not to be obligated to indemnify the Indemnified Party.

8.6. **Insurance.** Each Party will maintain at its sole cost and expense, an adequate liability insurance or self-insurance program (including product liability insurance) to protect against potential liabilities and risk arising out of activities to be performed under the Transaction Agreements, and any agreement related hereto and upon such terms (including coverages, deductible limits and self-insured retentions) as are customary in the U.S. pharmaceutical industry, or, if such activities are conducted outside the U.S., as are customary in such country, for the activities to be conducted by such Party under the Transaction Agreements. The coverage limits set forth herein will not create any limitation on a Party’s liability to the other under the Transaction Agreements.

9. **Term and Termination.**

9.1. **Term.** This Agreement will take effect as of the Amendment Effective Date and on such date it will replace and supersede the Original Services and Collaboration Agreement in its entirety; provided that [***]. Unless sooner terminated in accordance with the terms hereof or by mutual written consent, the term of this Agreement will be deemed to have commenced on the Signing Date and continue for the Option Agreement Term (the “Term”). For the avoidance of doubt, the replacement and superseding of the Original Agreements will not relieve the Parties of any liability which accrued prior to the Amendment Effective Date.

9.2. **Termination by Moderna for Breach.** Moderna will have the right to terminate this Agreement in full upon delivery of written notice to AstraZeneca in the event of any material breach by AstraZeneca of any terms and conditions of this Agreement [***]; provided, that to the extent that any such breach is limited to Collaboration mRNA Constructs for a particular Research Polypeptide or Development Polypeptide, Moderna will have the right to terminate this Agreement only with respect to the Collaboration mRNA Constructs for such Research Polypeptide or Development Polypeptide (as applicable), and (a) such Collaboration mRNA Constructs will become Discontinued Product Candidates, (b) the applicable Research Polypeptide or Development Polypeptide will become a Discontinued Polypeptide and (c) the Research Target addressed by such Discontinued Polypeptide will become a Discontinued Research Target unless for such Research Target there is an Optioned Product Candidate [***] Development Polypeptide for such Research Target. For clarity, for the purposes of such discontinuance, [***]. Notwithstanding the foregoing, any such termination under this Section 9.2 will not be effective if such breach has been cured within [***] days after written notice thereof is given by Moderna to
AstraZeneca specifying the nature of the alleged breach (or, if such default cannot be cured within such [***]-day period, such longer period as reasonably required to cure such breach; provided, that AstraZeneca commences actions to cure such default within such [***]-day period and thereafter diligently continues such actions); provided, that to the extent such material breach involves the failure to make an undisputed payment when due, such breach must be cured within [***] days after written notice thereof is given by Moderna to AstraZeneca. [***]

9.3. Termination by AstraZeneca.

(a) Breach. AstraZeneca will have the right to terminate this Agreement in full upon delivery of written notice to Moderna in the event of any material breach by Moderna of any terms and conditions of this Agreement [***]; provided, that to the extent that any such breach is limited to a particular Target, AstraZeneca will have the right to terminate this Agreement only with respect to such Target, and such Target will become a Discontinued Target. Notwithstanding the foregoing, any such termination under this Section 9.3(a) will not be effective if such breach has been cured within [***] days after written notice thereof is given by AstraZeneca to Moderna specifying the nature of the alleged breach (or, if such default cannot be cured within such [***]-day period, such longer period as reasonably required to cure such breach; provided, that Moderna commences actions to cure such default within such [***]-day period and thereafter diligently continues such actions); provided, that to the extent such material breach involves the failure to make an undisputed payment when due, such breach must be cured within [***] days after written notice thereof is given by AstraZeneca to Moderna. [***]

(b) Discretionary Termination. AstraZeneca will have the right to terminate this Agreement in full ninety (90) days after delivery of written notice to Moderna if the Executive Officer of AstraZeneca concludes due to scientific, technical, regulatory or commercial reasons, including [***].

9.4. Alternative to Termination. If AstraZeneca has the right to terminate this Agreement under Section 9.3(a) (including expiration of all applicable cure periods thereunder), in lieu of exercising such termination right, AstraZeneca may elect once by written notice to Moderna before the end of such applicable cure period to have this Agreement continue in full force and effect, in which case the following will apply:

(a) starting immediately after the end of such applicable cure period, any payments for Contingent Event Option Exercise Payment and Option Exercise Earn-Out payments payable under the A&R Option Agreement following such date that AstraZeneca has the right to terminate this Agreement under Section 9.3(a) will be reduced by [***]; provided, that such reduction will not apply if and to the extent [***];

(b) The procedures set forth in [***] will continue to apply.

(c) [***]

(d) AstraZeneca’s obligation to [***] will terminate; provided, that AstraZeneca will keep Moderna reasonably informed of AstraZeneca’s Development activities under the Services Program and Development of Product Candidates in the Development Pool.
9.5. Effects of Termination or Expiration. Upon termination or expiration of this Agreement for any reason:

(a) the Services Program will terminate and any Research Polypeptides will become Discontinued Polypeptides (and Collaboration mRNA Constructs with respect thereto will become Discontinued Product Candidates); provided, for clarity, that, AstraZeneca will retain its rights and obligations under the A&R Option Agreement to any Optioned Product Candidates (and associated Subject Constructs and Products) at the time of such termination unless AstraZeneca is in breach of the A&R Option Agreement with respect to such Optioned Product Candidates (and associated Subject Constructs and Products) and the provisions of this Agreement relevant to the Parties’ on-going activities with respect to such and Optioned Product Candidates (and associated Subject Constructs and Products) including Article 4 and Exhibit A-1 shall continue to apply;

(b) Moderna will return (or destroy or erase, as directed by AstraZeneca) all data, files, records and other materials containing or comprising AstraZeneca’s Confidential Information. Notwithstanding the foregoing, (i) in respect of physical embodiments of information, Moderna will be permitted to retain one copy of such data, files, records, and other materials for non-commercial archival purposes, and (ii) in respect of any information stored electronically or in other non-physical media, it will be sufficient for Moderna to procure that access to such information is restricted to non-commercial archiving purposes only;

(c) except to the extent AstraZeneca has rights to continue to Exploit Product Candidates, Option Product Candidates or Products pursuant to the Transaction Agreements, all documents relating solely to or necessary to Exploit Discontinued Product Candidates, as such items exist as of the effective date of such termination, will be assigned to Moderna, and AstraZeneca will provide to Moderna one (1) copy of the foregoing;

(d) except as otherwise necessary to continue exercising any ongoing licenses under the Transaction Agreements, the Parties will return (or destroy or erase, as directed by the other Party) all data, files, records and other materials containing or comprising the other Party’s Confidential Information. Notwithstanding the foregoing, (i) in respect of physical embodiments of information, the Parties will be permitted to retain one copy of such data, files, records, and other materials for non-commercial archival purposes, and (ii) in respect of any information stored electronically or in other non-physical media, it will be sufficient for such Party to procure that access to such information is restricted to non-commercial archiving purposes only.

In the event that Moderna terminates this Agreement with respect to a particular Research Polypeptide or Development Polypeptide pursuant to Section 9.2, the provisions of this Section 9.5 will apply only with respect to such Research Polypeptide or Development Polypeptide.

9.6. Survival. In addition to the consequences of expiration or termination set forth in Section 9.5, the following provisions will survive termination or expiration of this Agreement: [***]. Termination or expiration of this Agreement will not relieve the Parties of any liability or obligation which accrued hereunder prior to the effective date of such termination or expiration nor preclude either Party from pursuing all rights and remedies it may have hereunder or at law or
in equity with respect to any breach of this Agreement nor prejudice either Party’s right to obtain performance of any obligation. All other rights and obligations will terminate upon expiration of this Agreement.

9.7. Integrated Agreements. The Parties acknowledge that the Transaction Agreements, together, constitute an integrated set of agreements entered into as part of the same transaction that collectively govern the subject matter covered by the Transaction Agreements. Early termination of any one of the Transaction Agreements without the others would fundamentally alter the intended allocation of rights and obligations intended by the Parties in entering into the Transaction Agreements. Thus, if a Party (or its bankruptcy trustee) has the right to reject any of the Transaction Agreements under the U.S. Bankruptcy Code or any analogous provision under any other law in any country outside the United States, such Party (or the applicable bankruptcy trustee) will either reject all of the Transaction Agreements or assume all of the Transaction Agreements, but may not reject one Transaction Agreement without rejecting the others.

10. Tax Treatment of Agreement

10.1. [***]

10.2. [***]

10.3. Indirect Taxes. Notwithstanding anything to the contrary contained in this Section 10.3 or elsewhere in this Agreement, the following will apply with respect to Indirect Taxes. All payments hereunder are exclusive of Indirect Taxes. If any Indirect Taxes are chargeable in respect of any such payments, AstraZeneca will pay such Indirect Taxes at the applicable rate in respect of any such payments following the receipt, where applicable, of an Indirect Taxes invoice issued by Moderna in respect of those payments, such Indirect Taxes to be payable on the due date of the payment of the payments to which such Indirect Taxes relate or at the time such Indirect Taxes are required to be collected by Moderna, in the case of payment of Indirect Taxes to Moderna. The Parties will issue invoices for all goods and services supplied under this Agreement consistent with Indirect Tax requirements, and to the extent any invoice is not initially issued in an appropriate form, AstraZeneca will promptly inform Moderna and will cooperate with Moderna to provide such information or assistance as may be necessary to enable the issuance of such invoice consistent with Indirect Tax requirements.

10.4. Import Duties. The Parties will co-operate in accordance with applicable Laws to ensure where permissible no import duties are paid on imported materials supplied by Moderna on the terms set forth in this Agreement. The Party responsible for shipping will value any such materials in accordance with applicable laws.


11.1. Dispute Resolution for the Transaction Agreements.

(a) Disputes. Disputes of any nature arising under, relating to, or in connection with the Transaction Agreements (“Disputes”) will be resolved pursuant to this Section 11.1.
(b) **Dispute Escalation.** In the event of a Dispute between the Parties, the Parties will first attempt to resolve such dispute by negotiation and consultation between themselves or the ISC. In the event that such dispute is not resolved on an informal basis within [***] days from receipt of the written notice of a Dispute, any Party may, by written notice to the other, have such dispute referred to the Executive Officers (or their designees, which designee is required to have decision-making authority on behalf of such Party), who will attempt to resolve such Dispute by negotiation and consultation for a [***] day period following receipt of such written notice.

(c) **Full Arbitration.** In the event the Parties have not resolved such Dispute, other than a Continuation Criteria Dispute, within [***] days of receipt of the written notice referring such Dispute to the Executive Officers, either Party may at any time after such [***]-day period submit such Dispute to be finally settled by arbitration in accordance with the rules of the London Court of International Arbitration (the “LCIA”) in effect at the time of submission, as modified by this Section 11.1. The arbitration will be governed by the Laws of the state of New York. The arbitration will be heard and determined by three (3) arbitrators who are judges or attorneys with relevant experience in the pharmaceutical and biotechnology industry, each of whom will be impartial and independent. Each Party will appoint one arbitrator and the third arbitrator will be selected by the two Party-appointed arbitrators, or, failing agreement within [***] days following appointment of the second arbitrator by the LCIA. Such arbitration will take place in Boston, Massachusetts. The arbitration award so given will be a final and binding determination of the dispute, will be fully enforceable in any court of competent jurisdiction, and will not include any damages expressly prohibited by Section 8.3. Fees, costs and expenses of arbitration are to be divided by the Parties in the following manner: AstraZeneca will pay for the arbitrator it chooses, Moderna will pay for the arbitrator it chooses, and the Parties will share payment for the third arbitrator. Except in a proceeding to enforce the results of the arbitration or as otherwise required by law, neither Party nor any arbitrator may disclose the existence, content or results of any arbitration hereunder without the prior written consent of both Parties (each such consent not to be unreasonably withheld, delayed or conditioned).

(d) **Injunctive Relief.** Notwithstanding the dispute resolution procedures set forth in this Section 11.1, in the event of an actual or threatened breach of the Transaction Agreements, the aggrieved Party may seek provisional equitable relief (including restraining orders, specific performance or other injunctive relief), without first submitting to any dispute resolution procedures hereunder.

(e) **Tolling.** The Parties agree that all applicable statutes of limitation and time-based defenses (such as estoppel and laches) will be tolled while the dispute resolution procedures set forth in this Section 11.1 are pending, and the Parties will cooperate in taking all actions reasonably necessary to achieve such a result. [***]

11.2. **Cumulative Remedies and Irreparable Harm.** All rights and remedies of the Parties hereunder will be cumulative and in addition to all other rights and remedies provided hereunder or available by agreement, at law or otherwise. Each Party acknowledges and agrees that breach of any of the terms or conditions of this Agreement would cause irreparable harm and damage to the other and that such damage may not be ascertainable in money damages and that as a result thereof the non-breaching Party would be entitled to seek on an interim basis from a court and on a permanent basis from an arbitral tribunal equitable or injunctive relief restraining any breach or
future violation of the terms contained herein by the breaching Party without the necessity of proving actual damages or posting bond. Such right to equitable relief is in addition to whatever remedies either Party may be entitled to as a matter of law or equity, including money damages.

11.3. **Business Combination.** Notwithstanding anything to the contrary herein or therein, for purposes of the Transaction Agreements, [***].

11.4. **Anti-Bribery and Corruption Compliance.**

(a) Moderna agrees, on behalf of itself, its officers, directors and employees and on behalf of its Affiliates, agents, representatives, consultants and subcontractors hired for activities undertaken for or in connection with the performance of the Transaction Agreements (together with Moderna, the "Moderna Representatives") that for the performance of its obligations hereunder, Moderna Representatives will not directly or indirectly pay, offer or promise to pay, or authorize the payment of any money, or give, offer or promise to give, or authorize the giving of anything else of value, to:

(i) any government or political party official, official of an international public organization, candidate for public office or representative of other businesses or a person acting on behalf of any of the foregoing (each, a “Government Official”) in order to influence official action;

(ii) any Person (whether or not a Government Official) (A) to influence such Person to act in breach of a duty of good faith, impartiality or trust (“acting improperly”), (B) to reward such Person for acting improperly, or (C) where such Person would be acting improperly by receiving the money or other thing of value;

(iii) any other Person while knowing or having reason to know that all or any portion of the money or other thing of value will be paid, offered, promised or given to, or will otherwise benefit, a Government Official in order to influence official action for or against either Party in connection with the matters that are the subject of the Transaction Agreements; or

(iv) any Person to reward that Person for acting improperly or to induce that Person to act improperly.

(b) Moderna Representatives will not, directly or indirectly, solicit, receive or agree to accept any payment of money or anything else of value in violation of the law, including the U.S. Foreign Corrupt Practices Act, as amended, the UK Bribery Act 2010, as amended, and any other applicable anti-corruption laws and laws for the prevention of fraud, racketeering, money laundering or terrorism (“Anti-Corruption Laws”).

(c) Moderna acknowledges that its undertakings given in Sections 11.4(a) and 11.4(b) are material to AstraZeneca in entering into a relationship with AstraZeneca.

(d) Moderna, on behalf of itself and its Moderna Representatives, represents and warrants to AstraZeneca that during the Term and [***] thereafter, it will and will procure that its Moderna Representatives keep and maintain accurate books and reasonably detailed records in connection with the performance of its obligation under the Transaction Agreements including all records required to establish compliance with Sections 11.4(a) and 11.4(b) above.
(e) Moderna will promptly provide AstraZeneca with written notice of the following events: (i) upon becoming aware of any breach or violation by it or its Moderna Representatives of any representation, warranty or undertaking set forth in Sections 11.4(a) and 11.4(b); and (ii) upon receiving a formal notification that it is the target of a formal investigation by a Relevant Authority for a Material Anti-Corruption Law Violation or upon receipt of information from any of its Moderna Representatives connected with this Agreement that any of them is the target of a formal investigation by a Relevant Authority for a Material Anti-Corruption Law Violation.

(f) During the Term and [***] thereafter, Moderna will for the purpose of auditing and monitoring the performance of its compliance with the Transaction Agreements and particularly this Section 11.4 permit AstraZeneca, its Affiliates, any auditors of any of them and any Regulatory Authority to have access to any premises of Moderna or its Moderna Representatives used in connection with the Transaction Agreements, together with a right to access personnel and records that relate to the Transaction Agreements.

(g) Moderna will be responsible for any breach of any representation, warranty or undertaking in this Section 11.4 or of the Anti-Corruption Laws by any of its Moderna Representatives.

(h) Each Party may disclose the terms of the Transaction Agreements or any action taken under this Section 11.4 to prevent a potential violation or continuing violation of applicable Anti-Corruption Laws, including the identity of the other Party and the payment terms, to any governmental authority if such Party determines, upon advice of counsel, that such disclosure is necessary.

11.5. Relationship of Parties. Nothing in this Agreement is intended or will be deemed to constitute a partnership, agency, employer-employee or joint venture relationship between the Parties. No Party will incur any debts or make any commitments for the other, except to the extent, if at all, specifically provided herein. There are no express or implied third party beneficiaries hereunder.

11.6. Compliance with Law. Each Party will perform or cause to be performed any and all of its obligations or the exercise of any and all of its rights hereunder in good scientific manner and in compliance with all applicable Law.

11.7. Data Privacy. Without prejudice to Section 11.6, notwithstanding any other term of the Transaction Documents neither Party will, or will be required to, transfer to the other Party any information relating to an identified or identifiable (directly or indirectly) natural person (“Personal Data”) if either Party, acting reasonably, determines that such transfer or any subsequent processing of such Personal Data would not comply with any applicable laws relating to the transfer and processing of such Personal Data. If the transfer of such Personal Data is otherwise required by this Agreement, the Parties shall negotiate in good faith and seek to enter into such agreement as reasonably required to ensure that such transfer and subsequent processing does comply with such applicable laws.
11.8. **Force Majeure.** Neither Party will be liable to the other for failure of or delay in performing obligations set forth in this Agreement (other than any obligation to pay monies when due), and neither will be deemed in breach of such obligations, if such failure or delay is due to natural disasters or any causes reasonably beyond the control of such Party; *provided*, that the Party affected will promptly notify the other of the force majeure condition and will exert reasonable efforts to eliminate, cure or overcome any such causes and to resume performance of its obligations as soon as possible.

11.9. **Governing Law.** This Agreement will be governed by and construed in accordance with the Laws of the state of New York, without respect to its conflict of laws rules or principles that might otherwise refer construction or interpretation of this Agreement to the substantive Law of another jurisdiction; *provided*, that any dispute relating to the scope, validity, enforceability or infringement of any Patents will be governed by, and construed and enforced in accordance with, the substantive Laws of the jurisdiction in which such Patents apply. The Parties agree to exclude the application to this Agreement of the United Nations Convention on Contracts for the International Sale of Goods.

11.10. **Counterparts; Facsimiles.** This Agreement may be executed in one or more counterparts, each of which will be deemed an original, and all of which together will be deemed to be one and the same instrument. Facsimile or PDF execution and delivery of this Agreement by either Party will constitute a legal, valid and binding execution and delivery of this Agreement by such Party.

11.11. **Headings.** All headings in this Agreement are for convenience only and will not affect the meaning of any provision hereof.

11.12. **Waiver of Rule of Construction.** Each Party has had the opportunity to consult with counsel in connection with the review, drafting and negotiation of this Agreement. Accordingly, the rule of construction that any ambiguity in this Agreement will be construed against the drafting party will not apply.

11.13. **Interpretation.** Whenever any provision of this Agreement uses the term “including” (or “includes”), such term will be deemed to mean “including without limitation” (or “includes without limitations”). “Herein,” “hereby,” “hereunder,” “hereof” and other equivalent words refer to this Agreement as an entirety and not solely to the particular portion of this Agreement in which any such word is used. Except where the context otherwise requires, whenever used, the singular will include the plural, the plural the singular, the use of any gender will be applicable to all genders and the word “or” is used in the inclusive sense (and/or). Unless otherwise provided, all references to Sections, Schedules and Exhibits in this Agreement are to Sections, Schedules and Exhibits of this Agreement. References to any Sections include Sections and subsections that are part of the related Section (e.g., a section numbered “Section 2.1” would be part of “Section 2”, and references to “Section 2.1” would also refer to material contained in the subsection described as “Section 2.1(a)”).

11.14. **Binding Effect.** This Agreement will inure to the benefit of and be binding upon the Parties, their Affiliates, and their respective lawful successors and assigns.
11.15. **Assignment.** This Agreement may not be assigned by either Party, nor may either Party delegate its obligations or otherwise transfer any rights created by this Agreement, except as expressly permitted hereunder or otherwise without the prior written consent of the other Party, which consent will not be unreasonably withheld, delayed or conditioned; provided, that either Party may assign this Agreement to an Affiliate or to such Party’s successor in connection with the merger, consolidation, sale of all or substantially all of its assets or that portion of its business pertaining to the subject matter of this Agreement, or any Business Combination of such Party. Notwithstanding the foregoing, neither Party may assign this Agreement unless such assignment also includes an assignment of all of the Transaction Agreements other than an assignment with respect to a particular Optioned Product Candidate as permitted by the A&R Option Agreement, to the same Affiliate or Third Party successor, as applicable. The rights and obligations of the Parties under this Agreement will be binding upon and inure to the benefit of the successors and permitted assigns of the Parties, and the name of a Party appearing herein will be deemed to include the name of such Party’s successors and permitted assigns to the extent necessary to carry out the intent of this Section 11.15.

11.16. **Notices.** All notices, requests, demands and other communications required or permitted to be given pursuant to this Agreement or the A&R Option Agreement will be in writing and will be deemed to have been duly given upon the date of receipt if delivered by hand, recognized international overnight courier, electronic transmission to email address below (if any), or registered or certified mail, return receipt requested, postage prepaid to the following addresses:

If to Moderna:

Modernix Therapeutics, Inc.
200 Technology Square
Cambridge, MA MA 02139

Attention: Stéphane Bancel, CEO
Email:

With copies to:

ModernaxTX, Inc.
200 Technology Square
Cambridge, MA MA 02139

Attention: Shaun Ryan, Deputy General Counsel
Email: Shaun.Ryan@modernatx.com; legal@modernatx.com

Goodwin|Procter LLP
53 State Street
Boston, MA 02109

Attention: Kingsley Taft, Esq.
Email: Ktaft@goodwinlaw.com

If to AstraZeneca:

AstraZeneca AB
Pepparedsleden 1
S-431 83 Mölndal
Attention: Senior Director, Innovative Medicines, iMed CVGI
Either Party may change its designated address by notice to the other Party in the manner provided in this Section 11.16.

Notwithstanding the foregoing, notification of the nomination of Polypeptides as “Research Polypeptides”, the exclusion of Research Targets from the Services Program and notification of AstraZeneca’s determination that a Research Target has met the applicable Continuation Criteria may be made by each Party by e-mail from its Program Director to the other Party’s Program Director using the then current e-mail addresses of the Program Directors.

11.17. **Right to Set-Off** Except as otherwise set forth in this Agreement or any Transaction Agreement, each Party has the right at all times to retain and set off against all amounts due and owing to the other Party as determined in a final judgment any damages recovered by such Party for any Losses incurred by such Party.

11.18. **Amendment and Waiver** This Agreement may be amended, supplemented, or otherwise modified only by means of a written instrument signed by both Parties; provided, that any unilateral undertaking or waiver made by one Party in favor of the other will be enforceable if undertaken in a writing signed by the Party to be charged with the undertaking or waiver. Any waiver of any rights or failure to act in a specific instance will relate only to such instance and will not be construed as an agreement to waive any rights or fail to act in any other instance, whether or not similar.

11.19. **HSR Act Filings** The Parties acknowledge that HSR Act Filings (as defined in the Original Services & Collaboration Agreement) were made in accordance with the Original Services and Collaboration Agreement.

11.20. **Severability** In the event that any provision of this Agreement will, for any reason, be held to be invalid or unenforceable in any respect, and if the rights or obligations of either Party under this Agreement will not be materially and adversely affected thereby, (a) such provisions will be given no effect by the Parties and will not form part of this Agreement, (b) all other provisions of this Agreement will remain in full force and effect, and (c) the Parties will negotiate in good faith to modify this Agreement to preserve (to the extent possible) their original intent.

11.21. **Entire Agreement** This Agreement and the other Transaction Agreements (and any agreements entered into pursuant to the Original Agreements) are the sole agreements with respect to the subject matter and, except as provided in Section 9.1, supersede all other agreements and understandings between the Parties with respect to same (including the Confidentiality Agreement).
IN WITNESS WHEREOF, the Parties have caused this Amended and Restated Services and Collaboration Agreement to be executed by their respective duly authorized officers as of the Amendment Effective Date.

MODERNA TX, INC.

By: /s/ Stéphane Bancel
   (Signature)

Name: Stéphane Bancel
Title: CEO
Date: June 15, 2018
ASTRAZENECA AB

By: /s/ Jesper Bergkvist
   (Signature)

Name: Jesper Bergkvist
Title: Legal Director
Date: June 15, 2018
Exhibit A-I

non-cGMP Moderna mRNA API Supply Terms

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Exhibit A-2

cGMP Moderna mRNA API Supply Terms

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Schedule 1.34

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### A&R Services and Collaboration Agreement

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Schedule 2.12

AstraZeneca Bioethics Policy

The AstraZeneca Bioethics Policy is applicable to everyone involved in R&D activities including any third party who acts on our behalf.

AstraZeneca Bioethics Policy defines the principles, behaviours and ethical standards governing our research and development worldwide. While many topics are covered by existing national laws and regulations, this policy sets out the commitment beyond ordinary legal compliance of AstraZeneca and third parties acting on AstraZeneca’s behalf. Further information on Animal Care and Use at AstraZeneca is available on our web site (https://www.astrazeneca.com/content/dam/az/PDF/2016/Bioethics_policy.pdf)

• [***]
Appendix A

List of nominated Research Polypeptides as of the Amendment Effective Date

[***]
A&R SERVICES AND COLLABORATION AGREEMENT

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A&R SERVICES AND COLLABORATION AGREEMENT

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Exhibit 10.8

Patent Sublicense Agreement

This Patent Sublicense Agreement ("Agreement") is between CELLSCRIPT, LLC, a Wisconsin limited liability company having a place of business at 726 Post Road, Madison, WI 53713, USA ("Cellscript") and ModernaTx, Inc., a Delaware corporation having a place of business at 320 Bent Street, Cambridge, MA 02141, USA ("Company"). This Agreement is effective as of June 26, 2017 (the "Effective Date"). Each of Company and Cellscript are referred to herein as a "Party" and collectively as the "Parties".

BACKGROUND

WHEREAS, mRNA RiboTherapeutics, Inc. ("mRNA RiboTherapeutics") has an exclusive license from the Trustees of the University of Pennsylvania, a Pennsylvania nonprofit corporation ("Penn") for certain intellectual property comprising patents, patent applications and technology relating to use of modified ribonucleic acid (RNA) technology which was developed by Drs. Drew Weissman and Katalin Kariko of Penn’s Perelman School of Medicine as described in [***], and certain other intellectual property comprising patents, patent applications and technology relating to the modified RNA technology, inter alia, for reprogramming of mammalian cells to induced pluripotent stem cells, as described in [***], pursuant to the Second Amended and Restated Patent License Agreement which became effective as of December 20, 2016 (the "Penn License Agreement"), under which Cellscript has a sublicense from mRNA RiboTherapeutics in certain fields of use pursuant to the Amended and Restated Patent Sublicense Agreement which became effective as of December 20, 2016 (the "Cellscript Sublicense Agreement"), under which Cellscript has the right to further sublicense all or any part of the rights granted to Cellscript to other parties; and

WHEREAS, Company desires a sublicense to the Patents Rights (as defined below) from Cellscript for in vivo uses in humans and non-human animals and for certain other uses pertaining thereto and Cellscript is willing to grant to Company a sublicense to said intellectual property for such uses under the terms and conditions herein;

NOW, THEREFORE, in consideration of the mutual obligations contained in this Agreement, and intending to be legally bound, the Parties agree as follows:

1 SUBLICENSE

1.1 Sublicense Grant. Cellscript hereby grants to Company and Company hereby accepts from Cellscript a worldwide, non-exclusive sublicense under the Patent Rights during the Term to make, have made, import, use, offer for sale, sell and/or have sold Licensed Products according to the terms and conditions herein: (1) in Field of Use B for all uses in the In Vivo Field of Use, including: (a) all therapeutic and prophylactic uses in humans; (b) all non-therapeutic and non-prophylactic uses in humans; and (c) all uses, including therapeutic and prophylactic uses (e.g., Veterinary Products), in non-human animals; and (2) in Field of Use A for internal research and screening uses, including [***], including for the Fields of Use in (1)(a) through (1)(c); ((1) and (2) collectively, the "Sublicensed Fields of Use"), as all said terms are defined in Sections 1.2 and 6.1 herein (the "Sublicense"). The Sublicense includes the right for Company to grant sublicenses to its affiliates and Third Parties for all or any part of the rights and fields of use granted to Company, under terms that are consistent with this Agreement. No other rights or licenses are granted by Cellscript to Company under this Agreement; [***].
## Related Definitions

Whenever the words or terms “comprising,” “containing,” “having,” “include,” includes,” “including,” “such as,” “for example,” “an example,” “examples,” “e.g.,” “for further clarification” or the like are used in this Agreement, they shall be understood to be followed by the words “without limitation” or “but without limitation.” The terms “a,” “an,” and “the” and the use of such terms or nouns in definitions in either the singular or the plural are to be construed to cover both the singular and the plural unless otherwise noted.

“Licensed Products” means products that are made, made for, used, imported, offered for sale or sold by Company or its Affiliates or Third Party sublicensees. For clarity, Licensed Products includes any method, procedure or process, the use of which by Company or its Affiliates or Third Party sublicensees.

“Exhibit A-1 Patent Rights” means all of Penn’s patent rights represented by or issuing from: (a) the United States and PCT patents and patent applications listed in Exhibit A-1; (b) any continuation, divisional, reexamination, and re-issue applications of (a); and (c) any extensions and foreign counterparts of (a) or (b).

“Exhibit A-2 Patent Rights” means all of Penn’s patent rights represented by or issuing from: (a) the United States and PCT patents and patent applications listed in Exhibit A-2; (b) any continuation, divisional, reexamination, and re-issue applications of (a); and (c) any extensions and foreign counterparts of (a) or (b).


“Affiliate” means a legal entity that is controlling, controlled by or under common control with Company and that has executed either this Agreement, a sublicense for at least a portion of the rights granted to Company under this Agreement, or a written joinder agreement agreeing to be bound by all of the terms and conditions of this Agreement. The uncapitalized term “affiliate” means, with respect to a first legal entity, any other legal entity that is controlling, controlled by or under common control with said first legal entity. For purposes of the definitions of “Affiliate” and “affiliate” herein, the word “control” means (x) the direct or indirect ownership of fifty percent (50%) or more of the outstanding voting securities of a legal entity, (y) the right to receive fifty percent (50%) or more of the profits or earnings of a legal entity, or (z) the right to determine the policy decisions of a legal entity.

“Field of Use A” means and is limited to internal laboratory research or screening. For clarity, Field of Use A includes. For further clarity, a party that has a sublicense in Field of Use A pertaining to a sublicensed therapeutic or prophylactic or diagnostic or prognostic use in Field of Use B shall have the right to.

“Field of Use B” means the field other than Field of Use A and includes but is not limited to therapeutic, prophylactic, diagnostic, prognostic and cosmetic uses in humans and agricultural, animal improvement and veterinary uses in animals. For clarity, Field of Use B includes any and all fields of use, including the In Vivo Field of Use and Ex Vivo Field of Use, other than for Field of Use A.

“Fields of Use” means Field of Use A and Field of Use B.

“Ex Vivo Field of Use” is a subfield of Field of Use A or Field of Use B wherein a product or method that is covered by Patent Rights is used in cells, tissues or organs that are ex vivo or outside of a living human or animal body or organism.
“In Vivo Field of Use” is a subfield of Field of Use A or Field of Use B wherein a product or method that is covered by Patent Rights is used in vivo, [***].

“Diagnostic and Prognostic Field of Use” is a subfield of use within Field of Use B wherein a product or service covered by Patent Rights is used for diagnosis, prognosis or testing of a human or non-human animal or a sample therefrom in order to detect, identify, determine a cause, evaluate, analyze, understand, predict, rule in, or rule out a medical condition or disease or to predict an effect or response to treatment, and/or to monitor the effect of a treatment of such medical condition or disease. [***]

“Veterinary Product” means a product that is covered by Patent Rights which is used for the care, treatment, breeding or use of livestock or companion animals.

“Third Party” means any person, corporation, partnership, association, consortium or business, legal or governmental entity other than Penn, Cellscript, Company or any of their respective affiliates.

1.3 Reservation of Rights by Penn. Penn reserves the right to use, and to permit other non-commercial entities to use, the Patent Rights for educational and non-commercial research purposes.

1.4 U.S. Government Rights. The Parties acknowledge that the United States government retains rights in intellectual property funded under any grant or similar contract with a Federal agency. The License is expressly subject to all applicable United States government rights, including, but not limited to, any applicable requirement that products, which result from such intellectual property and are sold in the United States, must be substantially manufactured in the United States.

1.5 Sublicense Conditions. Company’s right to extend any or all of the rights granted to Company by Cellscript via a sublicense to affiliates or Third Parties is subject to each of the following conditions:

1.5.1 Company will have the right to grant further sublicenses to its affiliates and to Third Parties (“sub-sublicensees”) that permit multiple levels of sublicensing, including in Third Party sub-sublicenses that permit further levels of sublicensing (e.g., to “sub-sub-sublicensees”). In each further sub-sublicense agreement to an affiliate or Third Party, Company will require the sub-sublicensee to comply with terms and conditions that are consistent with this Agreement, and in each agreement for further sublicensing (e.g., by a sub-sublicensee of Company to a sub-sub-sublicensee), the party granting the further sublicense will require the party receiving the further sublicense to comply with terms and conditions that are consistent with its sub-sublicense agreement from Company. Except when used to clarify the meaning of the different terms in this Section 1.5.1, the term sublicense in this Agreement includes any permitted sub-sublicense, sub-sub-sublicense, etc. and the term sublicensee includes any permitted sub-sublicensee, sub-sub-sublicensee, etc.

1.5.2 Within [***] days after Company enters into a sublicense agreement, Company will deliver to Cellscript a complete and accurate copy of the entire sublicense agreement written in the English language, provided that Company will have the right to redact the terms and conditions of such sublicense agreement that are not necessary for Cellscript to confirm compliance with all terms and conditions required under this Sublicense, including Section 1.5 hereof. Cellscript’s receipt of the sublicense agreement will not constitute a waiver of any right or obligation of Cellscript or of Company under this Agreement.
1.5.3 In the event that Company causes or experiences a Trigger Event (as defined in Section 6.4), to the extent permissible by law, [***].

1.5.4 Company’s execution of a sublicense agreement will not relieve Company of any of its obligations under this Agreement. Company is primarily liable to Cellscript for any act or omission of a sublicensee that would be a breach of this Agreement if performed or omitted by Company, and Company will be deemed to be in breach of this Agreement as a result of such act or omission. Upon learning of any such breach of this Agreement due to an act or omission of a sublicensee of Company, Company will [***]. Provided that Company [***], a breach by said sublicensee shall not be considered a breach by Company that will be considered a cause for termination of this Agreement under Section 6.3.

1.5.5 A sublicense granted by the Company or a further sublicensee thereof will not be assignable or transferable by said sublicensee or further sublicensee thereof without the prior written consent of Cellscript, except to an affiliate of the sublicensee of Company or an affiliate of said further sublicensee thereof, or to a Third Party company that: (i) can demonstrate based on reliable financial information that it has all technical knowledge, capabilities and/or financial resources needed to perform in all respects in the place and stead of said sublicensee or further sublicensee thereof; (ii) agrees to assume all duties and responsibilities under the sublicense; [***]; and (v) agrees in writing to be bound by all of the terms and conditions of the sublicense and a copy of such written undertaking is promptly provided to Company, which will provide a copy to Cellscript, which, in turn, will provide a copy to mRNA RiboTherapeutics.

1.6 No License by Implication. Nothing in this Agreement confers by estoppel implication or otherwise, any license or rights under any Penn patent other than rights granted under patents included in the Patent Rights and Exhibit D Patents, regardless whether such patents are dominant or subordinate to the Patent Rights and Exhibit D Patents.

1.7 License to the Exhibit D Patents. Whereas Cellscript has an exclusive license from Penn for certain U.S. patents and patent applications listed in Exhibit D hereto, including any continuation, divisional, reexamination, and re-issue applications and any patents or extensions of any of the foregoing (collectively referred to as “Exhibit D Patents” herein), which Exhibit D Patents are not included in Patent Rights herein; and whereas, Company desires a sublicense to Exhibit D Patents in the Sublicensed Fields of Use during the Term and Cellscript is willing to grant such a sublicense in the Sublicensed Fields of Use according to the terms and conditions herein, now, therefore, Cellscript hereby grants to Company and Company hereby accepts from Cellscript a limited worldwide, non-exclusive sublicense under Exhibit D Patents during the Term to make, have made, import, use, offer for sale, sell and/or have sold Licensed Products which are also covered by Exhibit D Patents, solely in the Sublicensed Fields of Use, and according to the terms and conditions herein. The sublicense includes the right for Company to grant sublicenses to its affiliates and Third Parties for all or any part of the rights granted to Company in the Sublicensed Fields of Use, under terms that are consistent with this Agreement. No other rights or licenses pertaining to Exhibit D Patents are granted by Cellscript to Company under this Agreement. [***]

1.8 Relation of this Agreement to mRNA RiboTherapeutics Sublicense Agreement. Concurrent with the execution of this Agreement, Company is entering into a separate sublicense agreement with mRNA RiboTherapeutics (the “mRNA RiboTherapeutics Sublicense Agreement”), pursuant to which mRNA RiboTherapeutics is granting Company a sublicense under Patent Rights with respect to certain fields of use that are different from and are not included within the scope of the Sublicense granted to Company in this Agreement.
2 DILIGENCE

2.1 Development Plan and Sublicense Disclosure Report. By [***], Company will deliver to Cellscript: (1) a copy of an annual development plan, including [***] and a summary of material development efforts for Licensed Products since the last development plan ("Development Plan"); [***] (2) a Sublicense Disclosure Report ("SDR"), [***].

2.2 Company’s Efforts. Company will use commercially reasonable efforts to develop, commercialize, market and sell Licensed Products in the Sublicensed Fields of Use in a manner consistent with the Development Plan. In addition to Company’s own efforts to develop, commercialize, market and sell Licensed Products, the efforts of other parties, including Affiliates, Third Party sublicensees, contractors, Third Parties funded by Company under a research or service agreement, and distributors, will also be deemed as efforts of Company.

2.3 Diligence Events. Company, whether itself, or through its Affiliates, Third Party sublicensees, contractors, or Third Parties funded by Company under a research or service agreement, will use commercially reasonable efforts to achieve each of the milestone diligence events by the applicable completion date listed in the table below for the first Licensed Product for human therapeutic or prophylactic use in Field of Use B. Company will provide Cellscript with written notice within [***] days of first completion of each milestone diligence event for a Licensed Product for human therapeutic or prophylactic use in Field of Use B by Company or an Affiliate or Third Party sublicensee.

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2.4 Diligence Resources. Until [***], Company will expend financial resources for the development and commercialization of the Licensed Products in amounts not less than the diligence minimums specified in the table below ("Development Expenditures") in each [***] period following the Effective Date. Development Expenditures shall include all research and development expenditures directly relating to Licensed Products, including [***]. If Company’s total expenditures for development and commercialization of Licensed Products in any [***] do not meet or exceed the applicable diligence minimum, then [***].

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3 FEES AND ROYALTIES

3.1 **Sublicense Grant Fees.** In partial consideration for the Sublicense, Company will pay to Cellscript: [***] a non-refundable, non-creditable sublicense fee of twenty-two million U.S. dollars ($22,000,000) on [***] of 2019, [***].

3.2 **Sublicense Maintenance Fees.** In partial consideration of the Sublicense, Company will pay to Cellscript [***] on each [***] occurring during the Term until the date of [***]. For clarity, the next annual sublicense maintenance fee under this Agreement is payable to Cellscript on [***].

3.3 **Milestone Payments.** In partial consideration of the Sublicense, promptly following the Effective Date, Company will provide Cellscript with [***] and Company will pay to Cellscript within [***] after the Effective Date all [***]. Thereafter, in further partial consideration of the Sublicense, Company will pay to Cellscript the milestone payment listed in Table A or Table C in this Section 3.3, as applicable, [***], regardless of whether the milestone is achieved by Company, an Affiliate or a Third Party sublicensee. Company will provide Cellscript with written notice within [***] days after each milestone is achieved by Company or a sublicensee and Company will pay to Cellscript all applicable milestone payments owed therefor within [***] days of the end of the calendar quarter in which the milestone event is achieved. [***]

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6
3.4 Earned Royalties. In partial consideration of the Sublicense, Company will pay to Cellscript royalties on Net Sales of Licensed Products in the Sublicensed Fields of Use as stated below.

3.4.1 Earned Royalties on Licensed Products in Field of Use A. In partial consideration of the Sublicense, Company will pay to Cellscript a [***] percent ([***]%) royalty on Net Sales of Licensed Products by Company or its Affiliates or Third Party sublicensees for use in [***] during the Quarter. For the avoidance of doubt, if Company or any Affiliate or Third Party sublicensee [***], then Company will pay to Cellscript [***] on all such Net Sales of Licensed Products for use in Field of Use A by Company or by said sublicensees. For clarity, Company and its Affiliates or Third Party sublicensees shall not [***].

3.4.2 Earned Royalties on Licensed Products for the In Vivo Field of Use in Field of Use B. In partial consideration of the Sublicense, Company will pay to Cellscript a [***] percent ([***]%) royalty on Net Sales of Licensed Products in Field of Use B for all uses in the In Vivo Field of Use, including: [***] during the Quarter. For the avoidance of doubt, if Company or its Affiliates or Third Party sublicensees grant sublicensees to sell Licensed Products for any such uses in Field of Use B, Company will pay to Cellscript a [***] percent [***] royalty on Net Sales of all such Licensed Products sold by said sublicensees.
3.4.3 **Royalty Reduction.** If Company or an Affiliate or Third Party sublicensee of Company is obligated to pay [***] (defined below) for a Licensed Product [***], then Company may deduct [***] percent ([***]%) of such [***] from any royalties on Net Sales in [***] due to Cellscript under Section 3.4.2 of this Agreement, provided that:

(a) On an ongoing basis and prior to reduction of any royalty on Net Sales for a given calendar quarter, Company first provides [***]; and

(b) In no event shall royalties on Net Sales due to Cellscript in any reporting period be so reduced to less than [***] percent ([***]%) for Licensed Products for use in the In Vivo Field of Use in Field of Use B.

“[***]” means any [***] that Company or an Affiliate or a Third Party sublicensee owes to one or more other parties pursuant to one or more licenses for [***] that are determined to be [***] with respect to the manufacture, use or sale of any Licensed Product.

3.5 **Related Definitions.**

3.5.1 The term “**Sale**” means any bona fide transaction for which consideration is received or expected by Company or its Affiliates or Third Party sublicensees for the sale, use, lease, transfer or other disposition of a Licensed Product to a Third Party. A Sale is deemed completed at the time that Company or an Affiliate or Third Party [***].

3.5.2 The term “**Quarter**” means each three-month period beginning on the first day of January, April, July or October.

3.5.3 The term “**Net Sales**” means the consideration [***].
3.5.4 The term "Qualifying Costs" means: [***].

3.6 Minimum Royalties. In partial consideration of the Sublicense, and only to the extent that [***], Company will pay to Cellscript the amount, if any, by which the applicable minimum royalties listed for the respective Categories in the tables below exceed Company’s or its Affiliates’ or Third Party sublicensees’ actual earned royalties under Section 3.4 for each Quarter after the first Sale of a Licensed Product in the Sublicensed Fields of Use in each said Category by Company or its Affiliates or Third Party sublicensees. For sake of clarity, the highest minimum royalty owed by Company to Cellscript under this Agreement would be [***].

Category 1 - Licensed Products in Field of Use A

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Category 2 - Licensed Products in Field of Use B
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Category 3 - Licensed Products in Field of Use B
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4 REPORTS AND PAYMENTS

4.1 Royalty Reports. Within [***] days after the end of each Quarter following the first Sale, Company will deliver to Cellscript a report, [***], detailing the calculation of all royalties, fees and other payments due to Cellscript for such Quarter. The report will include, at a minimum, the following information for the Quarter, each listed by product, by country: [***].

4.2 Payments. Company will pay all royalties, fees and other payments due to Cellscript under Sections 3.3, 3.4 and 3.6 within [***] days after the end of the Quarter in which the royalties, fees or other payments accrued. Cellscript agrees that it will pay all such amounts to mRNA RiboTherapeutics according to and within the time periods required by the Cellscript Sublicense Agreement, and mRNA RiboTherapeutics will pay to Penn all royalties, fees and other payments due to Penn according to and within the time periods required by the Penn License Agreement. For clarity, (a) only one royalty will be due with respect to the Sale of the same unit of Licensed Product and (b) royalties are payable hereunder only on Sales of Licensed Product for use in the Sublicensed Fields of Use, it being understood that Company and its sublicensees have no right to sell Licensed Products in any Fields of Use except Sublicensed Fields of Use.

4.3 Records. Company will maintain, and will cause its Affiliates and Third Party sublicensees to maintain, complete and accurate books, records and related background information to verify Sales, Net Sales, and all of the royalties, fees, and other payments due or paid under this Agreement, as well as the various computations reported under Section 4.1. The records for each Quarter will be maintained for at least [***] years after submission of the applicable report required for Section 4.1.

4.4 Audit Rights. Upon [***], Company and its Affiliates and Third Party sublicensees will provide Penn and its accountants (or Cellscript and its accountants in the event that Cellscript is Penn’s designated auditor) with access to [***] to conduct a review or audit of Sales, Net Sales, and all of the royalties, fees, and other payments payable under this Agreement. Access will be made available: (a) during normal business hours; (b) in a manner reasonably designed to facilitate such accountant’s review or audit without unreasonable disruption to Company’s business; and (c) no more than [***] during the Term (as defined below) and for a period of [***] thereafter. Company will promptly pay to Cellscript the amount of any underpayment determined by the review or audit, plus accrued interest. If the review or audit determines that Company has underpaid any payment by [***] percent ([***]% or more, then Company will also promptly pay the costs and expenses of the auditing party’s accountants in connection with the review or audit. In addition, once annual Sales of Licensed Products exceed [***].

4.5 Currency. All dollar amounts referred to in this Agreement are expressed in United States dollars. All payments will be made in United States dollars. If Company receives payment from a sublicensee in a currency other than United States dollars for which a royalty or fee is owed under this Agreement, then (a) the payment will be converted into United States dollars at the conversion rate for the foreign currency as published in the eastern edition of the Wall Street Journal as of the last business day of the Quarter in which the payment was received by Company, and (b) the conversion computation will be documented by Company in the applicable report delivered to Cellscript under Section 4.1.
4.6 **Place of Payment.** All payments by Company to CELLSCRIPT, LLC and will be made to the following addresses:

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<th>By ACH/Wire:</th>
<th>By Check (direct mail):</th>
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4.7 **Interest.** All amounts that are not paid by Company when due will accrue interest from the date due until paid at a rate equal to [***] percent ([***]% per month (or the maximum allowed by law, if less).

5 **CONFIDENTIALITY AND USE OF NAMES**

5.1 **Confidentiality.** Each Party agrees that it will not, under this Agreement, provide to the other Party or its affiliates any Confidential Information of such Party unless (i) such Party has first identified the general nature of such Confidential Information to such other Party in writing and such other Party has affirmatively agreed in writing to receive such Confidential Information, or (ii) such other Party has specifically requested such Confidential Information in writing. For clarity, any such consent or request issued by email or other written electronic means shall satisfy the foregoing “writing” requirements. Any Confidential Information disclosed by a Party to the other Party other than in accordance with this Section 5.1 will be deemed not to be Confidential Information of such Party. Notwithstanding the foregoing, Cellscript is obligated to accept and treat as confidential any Confidential Information disclosed by Company in the reports or notices required by Sections 2.1, 2.3, 3.3, 3.4.3(a), 4.1, 4.4, 4.6 and 6.6, which information Company agrees Cellscript may disclose to mRNA RiboTherapeutics or Penn without the prior written consent of Company.

5.2 **Confidential Information.** Each Party ("Disclosing Party") may disclose to the other Party ("Receiving Party"), and Receiving Party may acquire during the course and conduct of activities under the Agreement, certain proprietary or confidential information of Disclosing Party in connection with this Agreement. The term "Confidential Information" shall mean all ideas and information of any kind, whether in written, oral, graphical, machine-readable or other form, whether or not marked as confidential or proprietary, which are transferred, disclosed or made available by Disclosing Party in accordance with Section 5.1.
5.3 **Restrictions.** During the Term and for [***] years thereafter, Receiving Party shall keep all Disclosing Party’s Confidential Information in confidence with the same degree of care with which Receiving Party holds its own confidential information. Receiving Party shall not use Disclosing Party’s Confidential Information except in connection with the performance of its obligations and exercise of its rights under this Agreement. Receiving Party has the right to disclose Disclosing Party’s Confidential Information without Disclosing Party’s prior written consent, to the extent and only to the extent reasonably necessary, to Receiving Party’s affiliates and their employees, subcontractors, consultants or agents who have a need to know such Confidential Information in order to perform Receiving Party’s obligations or exercise Receiving Party’s rights under this Agreement, provided said affiliates and their employees, subcontractors, consultants or agents are required to comply with a written confidentiality agreement having restrictions on use and disclosure of Disclosing Party’s Confidential Information which are no less stringent than those in this Section 5.3 (other than with respect to the term of the confidentiality obligations, which shall be at least [***] years from the date of disclosure). Receiving Party assumes responsibility for compliance with such restrictions by its affiliates and their employees, subcontractors, consultants or agents.

5.4 **Exceptions.** Receiving Party’s obligation of nondisclosure and the limitations upon the right to use the Disclosing Party’s Confidential Information shall not apply to the extent that Receiving Party can demonstrate, as evidenced by contemporaneous written records, that the Disclosing Party’s information: (i) was known to Receiving Party or any of its affiliates prior to the time of disclosure; (ii) is or becomes public knowledge through no fault or omission of Receiving Party or any of its affiliates; (iii) is obtained by Receiving Party or any of its affiliates from a Third Party under no obligation of confidentiality to Disclosing Party; (iv) has been independently developed by employees, subcontractors, consultants or agents of Receiving Party or any of its affiliates without the aid, application or use of Disclosing Party’s Confidential Information or (v) is not Confidential Information under Section 5.1.

5.5 **Permitted Disclosures.** Receiving Party may disclose Disclosing Party’s Confidential Information to the extent (and only to the extent) such disclosure is reasonably necessary in the following instances:

5.5.1 in order to comply with applicable law (including any securities law or regulation or the rules of a securities exchange) or with a legal or administrative proceeding;

5.5.2 in connection with prosecuting or defending litigation, regulatory approvals and other regulatory filings and communications, and filing, prosecuting and enforcing patents in connection with Receiving Party’s rights and obligations pursuant to this Agreement; and

5.5.3 in connection with exercising its rights hereunder, to its affiliates; in the case of Company as the Receiving Party, to potential and future collaborators and sublicensees; in the case of Company or Cellscript as the Receiving Party, to permitted acquirers or assignees; and investment bankers, investors and lenders, except that Cellscript will obtain the prior written consent of Company before disclosing any information disclosed to Cellscript pursuant to Sections 2.1, 2.3, 3.3, 3.4.3(a), 4.1, 4.4, 4.6 and 6.6;

provided that (1) with respect to Sections 5.5.1 or 5.5.2, where reasonably possible, Receiving Party shall notify Disclosing Party of Receiving Party’s intent to make any disclosure pursuant thereto sufficiently prior to making such disclosure so as to allow Disclosing Party adequate time to take whatever action it may deem appropriate to protect the confidentiality of the information to be disclosed, and (2) with respect to Section 5.5.3, each of those named people
5.6 Terms of this Agreement. The Parties agree that the terms of this Agreement shall be treated as Confidential Information of both Parties, and thus may be disclosed only as permitted by Section 5.5. Each Party agrees not to issue any press release or public statement disclosing information relating to this Agreement or the terms hereof without the prior written consent of the other Party not to be unreasonably withheld.

5.7 Use of Penn’s, Cellscript’s or Company’s Name. Company and its Affiliates, Third Party sublicensees, employees, and agents are not granted any rights hereunder to use the name, logo, seal, trademark, or service mark (including any adaptation of them) of Penn or any Penn school, or their respective organizations, employees, students or representatives, without the prior written consent of Penn. Except to the extent permitted pursuant to this Article 5, neither Party shall have any right, express or implied, to use in any manner the name or other designation of the other Party or any other trade name or trademark of the other Party for any Purpose, except as may be required by applicable law or regulation.

6 TERM AND TERMINATION

6.1 Term. This Agreement will commence on the Effective Date and terminate upon the expiration or abandonment of the last patent to expire or become abandoned of the Patent Rights (the “Term”).

6.2 Early Termination by Company. Company may terminate this Agreement at any time effective upon completion of each of the following conditions: (a) providing at least sixty (60) days prior written notice to Cellscript of such intention to terminate; (b) ceasing to make, have made, use, import, offer for sale and sell all Licensed Products under the Sublicense; 

6.3 Early Termination by Cellscript. Cellscript may, to the extent permissible by law, terminate this Agreement if: (a) Company is more than [***] days late in paying to Cellscript any amounts owed under this Agreement and does not pay Cellscript in full, including accrued interest, within [***] days after receiving written notice of the breach from Cellscript (a “Payment Default”); or (b) other than a Payment Default, Company materially breaches this Agreement and Company does not cure the breach within [***] days after receiving written notice of the breach from Cellscript; or (c) Company causes or experiences a Trigger Event, [***]. It is understood that, with respect to both of (a) and (b), Company is also responsible for its Affiliates and Third Parties sublicensees.

6.4 Trigger Event. The term “Trigger Event” means any of the following: (a) Company (i) becomes insolvent, bankrupt or generally fails to pay its debts as such debts become due, (ii) is adjudicated insolvent or bankrupt, (iii) admits in writing its inability to pay its debts, (iv) suffers the appointment of a custodian, receiver or trustee for its assets and, if appointed without its consent, not discharged within [***] days, (v) makes an appointment of its assets for the benefit of creditors, or (vi) suffers proceedings being instituted against it under any law related to bankruptcy, insolvency, dissolution, liquidation or the reorganization, readjustment or release of multiple debtors and, if contested by it, not dismissed or stayed within [***] days; (b) the institution or commencement by Company of any proceeding under any law related to bankruptcy, insolvency, liquidation or the reorganization, readjustment or release of multiple
debtors; (c) the entering of any order for relief relating to any of the proceedings described in Section 6.4(a) or (b) above; (d) the calling by Company of a meeting of multiple creditors with a view to arranging a composition of adjustment of its debts; (e) the act or failure to act by Company that results in its consent to, approval of, or acquiescence in any of the proceedings described in Section 6.4(a) - (d) above; or (f) [***].

6.5 Effect of Termination.

6.5.1 Effect of Termination Except under Section 6.2. Upon the termination of this Agreement prior to expiration of the Term for any reason except pursuant to Section 6.2: (a) the Sublicense to the Patent Rights and Exhibit D Patents will terminate; (b) [***]; (c) Company will pay to Cellscript all amounts, including accrued interest, owed to Cellscript under this Agreement through the date of termination, including royalties on Licensed Products invoiced or shipped through the date of termination and any sell off period permitted by Section 6.6, whether or not payment is received prior to termination or expiration of the sell off period permitted by Section 6.6; (d) Company will, at Cellscript’s request, return to Cellscript all confidential information of Cellscript (if any) related to exploitation of Patent Rights and Exhibit D Patents and [***]; (e) in the case of termination under Section 6.3, all duties of Cellscript and all rights (but not duties) of Company under this Agreement immediately terminate without further action required by either Cellscript or Company; and (f) all outstanding Third Party sublicenses, to the extent each is not in default, will be assigned by Company to Cellscript, [***], and each Third Party sublicense agreement will remain in full force and effect [***], but the duties and obligations of Cellscript under the [***] sublicense agreements will not be greater than the duties of Cellscript under this Agreement and the rights of Cellscript under the [***] sublicenses will not be less than those of Cellscript under this Agreement, including [***]. Notwithstanding the foregoing, in the event the Cellscript Sublicense Agreement is terminated and said termination of the Cellscript Sublicense Agreement is not due to any act or omission of Company or its Affiliates or Third Party sublicensees and, to the extent the Company is not in default under the Sublicense, Cellscript will assign this Agreement to mRNA RiboTherapeutics, such assignment will be accepted by mRNA RiboTherapeutics and this Agreement and each of Company’s further sublicense agreements, to the extent each said further sublicense is not in default, will remain in full force and effect (including with respect to the sublicensed Exhibit A-1 Patent Rights and Exhibit A-2 Patent Rights and Exhibit D Patents), with mRNA RiboTherapeutics as the sublicensor to Company instead of Cellscript, but the duties and obligations of mRNA RiboTherapeutics under the assigned Sublicense and the Company’s further sublicenses will not be greater than the duties of Cellscript under this Agreement, and the rights of mRNA RiboTherapeutics under the assigned Sublicense and Company’s further sublicenses will not be less than the rights of Cellscript under this Agreement, [***].

6.5.2 Effect of Termination under Section 6.2. Upon the termination of this Agreement under Section 6.2: (a) the Sublicense to Company and all further sublicenses to Affiliates and Third Parties terminate (except to the extent that said Third Party sublicenses [***] (b) [***]; (c) Company will pay to Cellscript all amounts, including accrued interest, owed to Cellscript under this Agreement through the date of termination, including royalties on Licensed Products invoiced or shipped through the date of termination and any sell off period permitted by Section 6.6, whether or not payment is received prior to termination or expiration of the sell off period permitted by Section 6.6, and (d) Company will, at Cellscript’s request, return to Cellscript all confidential information of Cellscript; and (e) all outstanding sublicenses of Company to Third Parties and all outstanding sublicenses of Company’s Affiliates to Third Parties, to the extent each is not in default, will be assigned [***] to Cellscript [***], and each such assigned
 sublicense agreement will remain in full force and effect [***], but the duties and obligations of Cellscript under the [***] sublicense agreements will not be greater than the duties and obligations of Company under this Agreement, and the rights of Cellscript under the [***] sublicense agreements will not be less than the rights of Company under this Agreement, including [***], and Cellscript may, [***].

6.6 Inventory & Sell Off. Subject to the remainder of this Section 6.6, upon the termination of this Agreement for any reason, Company will:

(1) cause physical inventories to be taken [***] of: (a) all completed Licensed Products on hand under the control of Company and its Affiliates and Third Party sublicensees and (b) such Licensed Products as are in the process of manufacture and any component parts on the date of termination of this Agreement; (2) deliver promptly to Cellscript a copy of said written inventory, [***]; (3) promptly remove, efface or destroy or require or cause to be removed, effaced or destroyed all references to Penn and Cellscript from any advertising, labels, web sites or other materials used in the promotion of the business of Company or its Affiliates or Third Party sublicensees; and (4) [***]. Subject to this Section 6.6, Company and its Affiliates and Third Party sublicensees may sell off its inventory of Licensed Products existing on the date of termination for a period of [***] months and pay Cellscript royalties on Sales of such inventory within [***] days following the expiration of such [***] month period. Notwithstanding the foregoing:

(i) Company’s obligations under this Section 6.6 will not apply to the Sublicense or to Company’s sublicense agreements if the Sublicense is assigned to mRNA RiboTherapeutics pursuant to Section 6.5.1; and

(ii) the obligations of each of Company’s sublicensees pursuant to this Section 6.6 will not apply to Company’s or its Affiliates’ or Third Party sublicensees’ sublicense agreements that are assigned to Cellscript pursuant to Sections 6.5.1(f) or 6.5.2(e); and

(iii) Company’s and its Affiliates’ and Third Party sublicensees’ obligations under this Section 6.6 will not apply with respect to any Licensed Product that is for use in a Field of Use for which Company (and its Affiliates or Third Party sublicensees) has a different sublicense agreement [***].

6.7 Survival. Company’s obligation to pay all amounts, including accrued interest, owed to Cellscript under this Agreement will survive the termination of this Agreement for any reason. [***] will survive the termination of this Agreement in accordance with their respective terms. The Parties acknowledge and agree that the Sublicense is, for the purposes of section 365(n) of the U.S. Bankruptcy Code, a license to “intellectual property” as defined under Section 101 of the U.S. Bankruptcy Code. The Parties intend that all payments under Article 3 of this Agreement constitute “royalties” within the meaning of section 365(n) of the U.S. Bankruptcy Code.

7 PATENT PROSECUTION AND MAINTENANCE

7.1 Patent Control for Patent Rights. [***] control the preparation, prosecution and maintenance of the Patent Rights and the selection of patent counsel, subject to the remainder of this Section 7.1. For purposes of this Section 7.1, the word “maintenance” includes any interference negotiations, claims, or proceedings, in any forum, [***]), a Third Party, or the United States Patent and Trademark Office or any foreign equivalent pertaining to Patent Rights, and any requests [***] that the United States Patent and Trademark Office or any foreign equivalent reexamine or reissue any patent in the Patent Rights. Notwithstanding the foregoing, [***] will provide [***] and its counsel with reasonable opportunities to consult with [***] regarding prosecution and maintenance of Patent Rights.

7.2 Patent Control for Exhibit D Patents. [***] control the preparation, prosecution and maintenance of the Exhibit D Patents and the selection of patent counsel, subject to the
remainder of this Section 7.2. For purposes of this Section 7.2, the word “maintenance” includes any interference negotiations, claims, or proceedings, in any forum, [***], a Third Party, or the United States Patent and Trademark Office pertaining to Exhibit D Patents, and any requests [***] that the United States Patent and Trademark Office reexamine or reissue any patent in the Exhibit D Patents. Notwithstanding the foregoing, [***] will provide [***] and its counsel with reasonable opportunities to consult with [***] regarding prosecution and maintenance of Exhibit D Patents.

8 INFRINGEMENT

8.1 Control. [***]

8.2 Cooperation. In any litigation under this Article 8, each Party, at the reasonable request and sole expense of the other Party, will provide reasonable cooperation to such other Party. This Article 8 will not be construed to require either Party to undertake any activities, including legal discovery, at the request of any Third Party, except as may be required by lawful process of a court of competent jurisdiction.

9 REPRESENTATIONS, WARRANTIES, COVENANTS AND DISCLAIMER OF WARRANTIES

9.1 Covenants of Cellscript. Cellscript covenants to Company that, during the Term:

9.1.1 Cellscript will take all reasonable actions necessary to maintain Cellscript’s rights under the Cellscript Sublicense Agreement and to the extent within its power, will ensure that the rights granted to Company herein are maintained.

9.1.2 In the event of termination of the Cellscript Sublicense Agreement, this Agreement will be assigned to mRNA RiboTherapeutics without any further action by the Parties, and the sublicenses granted hereunder, to the extent they are not in breach or default, will remain in full force and effect with respect to the sublicensed Exhibit A-1 Patent Rights, Exhibit A-2 Patent Rights and Exhibit D Patents.

9.1.3 Cellscript will use diligent efforts not to breach the Cellscript Sublicense Agreement, and to the extent within its legal power, will ensure that its sublicensed affiliates do not breach or cause a breach of any sublicense under the Cellscript Sublicense Agreement that would result in mRNA RiboTherapeutics having the right to terminate the Cellscript Sublicense Agreement or Penn having the right to terminate the Penn License Agreement, and, in the event of any such breach, Cellscript will use diligent efforts to expeditiously cure (or cause to be cured) any such breach.

9.1.4 Upon Cellscript learning of any breach of a sublicense agreement by any sublicensee of Cellscript or any of its further sublicensees that would result in mRNA RiboTherapeutics having the right to terminate the Cellscript Sublicense Agreement or Penn having the right to terminate the Penn License Agreement, Cellscript will expeditiously take appropriate actions to stop such act or omission, up to and including termination of the applicable sublicense, as stated in Section 1.5.4 of the Cellscript Sublicense Agreement.

9.1.5 Cellscript will make all payments due under the Cellscript Sublicense Agreement and will make all required disclosures to mRNA RiboTherapeutics in connection therewith, in each case in a timely manner in accordance with the terms thereof.
9.1.6 Promptly following Cellscript’s or any of its affiliates’ receipt of any material written notice or correspondence pertaining to the Sublicense that would reasonably be expected to adversely affect Company’s rights under this Agreement, Cellscript will, to the extent permissible, furnish a copy of such notice or correspondence to Company, provided that Cellscript may redact portions of any such notice or correspondence that do not relate to or impact Company’s rights hereunder.

9.1.7 Cellscript will promptly notify Company if Cellscript receives a notice from mRNA RiboTherapeutics or Penn of intent to terminate the Penn License Agreement.

9.1.8 Cellscript agrees that Cellscript and its affiliates will not sue, bring an action against, or otherwise assert any claim against Company or its Affiliates or Third Party sublicensees or their successors in ownership (to which this Agreement or a sublicense under this Agreement is assigned according to terms and conditions for assignment pursuant to Section 15.5 or Section 15.5.5 herein) for infringement of or misappropriation of any Patent Rights (as defined in Section 1.2) or Exhibit D Patents (as defined in Section 1.7) that are used by Company or its Affiliates or Third Party sublicensees or their successors in ownership in the In Vivo Field of Use (as defined in Section 1.2) within Sublicensed Fields of Use. For clarity, the foregoing covenant [*]. For further clarity, [*]. This covenant shall terminate with the termination of this Agreement unless the termination is: [*] (“Contested Termination”). In the event of a Contested Termination, this covenant shall continue to run during the [*] days, and if a lawsuit is initiated, until said state or federal court enters a final decision from which no appeal has been or can be taken.

9.1.9 Cellscript will not amend the Cellscript Sublicense Agreement in any manner that would negatively affect the rights and/or obligations of the Company under this Agreement. Following execution of any amendment to the Cellscript Sublicense Agreement that pertains to or impacts Company or its rights hereunder, Cellscript agrees that it will provide a copy of same to Company, except that Cellscript may redact portions of any such amendment that do not relate to or impact Company or its rights hereunder in any way.

9.1.10 To the extent within its rights and legal power, Cellscript will not exercise any right to terminate the Cellscript Sublicense Agreement in whole or in part.

9.1.11 [*]

9.2 Covenants of mRNA RiboTherapeutics. mRNA RiboTherapeutics covenants to Company as follows:

9.2.1 mRNA RiboTherapeutics will not terminate the Cellscript Sublicense Agreement without good and reasonable cause.

9.2.2 In the event of termination of the Cellscript Sublicense Agreement, provided that Company did not cause said termination of the Cellscript Sublicense Agreement and is not in breach or default under this Agreement, this Agreement will be assigned to mRNA RiboTherapeutics without any further action by Cellscript, mRNA RiboTherapeutics will accept such assignment of this Agreement and this Agreement, including all of Company’s outstanding Third Party sublicenses thereunder, will remain in full force and effect with respect to the sublicensed Exhibit A-1 Patent Rights, Exhibit A-2 Patent Rights, with mRNA RiboTherapeutics as the sublicensor instead of Cellscript, but the duties and obligations of mRNA RiboTherapeutics under the assigned Agreement will not be greater than the duties of Cellscript under this Agreement and the rights (including all financial consideration and other rights) of mRNA RiboTherapeutics under the assigned Agreement will not be less than those of Cellscript.
under this Agreement, and mRNA RiboTherapeutics may, at its sole discretion, amend this Agreement to contain terms and conditions found in the Cellscript Sublicense Agreement.

9.2.3 Upon mRNA RiboTherapeutics learning of any breach of a sublicense agreement by any sublicensee or any further sublicensees thereof in any manner that would result in mRNA RiboTherapeutics having the right to terminate the Cellscript Sublicense Agreement or Penn having the right to terminate the Penn License Agreement, mRNA RiboTherapeutics will expeditiously take appropriate actions to stop such act or omission, up to and including termination of the applicable sublicense.

9.2.4 mRNA RiboTherapeutics will make all payments due under the Penn License Agreement and will make all required disclosures to Penn in connection therewith, in each case in a timely manner in accordance with the terms thereof.

9.2.5 Upon mRNA RiboTherapeutics learning of any breach of a sublicense agreement by any sublicensee or any further sublicensees thereof in any manner that would result in mRNA RiboTherapeutics having the right to terminate the Cellscript Sublicense Agreement or Penn having the right to terminate the Penn License Agreement, mRNA RiboTherapeutics will expeditiously take appropriate actions to stop such act or omission, up to and including termination of the applicable sublicense.

9.2.6 mRNA RiboTherapeutics will promptly notify Cellscript and Company if it receives a notice from Penn of intent to terminate the Penn License Agreement.

9.2.7 mRNA RiboTherapeutics agrees that mRNA RiboTherapeutics and its affiliates will not sue, bring an action against, or otherwise assert any claim against Company or its Affiliates or Third Party sublicensees or their successors in ownership (to which this Agreement or a sublicense under this Agreement is assigned according to terms and conditions for assignment pursuant to Section 15.5 or Section 1.5.5 herein) for infringement of or misappropriation of any Patent Rights (as defined in Section 1.2) that are used by Company or its Affiliates or Third Party sublicensees or their successors in ownership in the In Vivo Field of Use [***]. This covenant shall terminate with the termination of this Agreement unless the termination is a Contested Termination. In the event of a Contested Termination, this covenant shall continue to run during the [***] days, and if a lawsuit is initiated, until said state or federal court enters a final decision from which no appeal has been or can be taken.

9.2.8 mRNA RiboTherapeutics will not amend the Cellscript Sublicense Agreement in any manner that would negatively affect the rights and/or obligations of the Company under this Agreement.

9.2.9 [***]

9.3 Covenants of Company. Company covenants to Cellscript and to mRNA RiboTherapeutics that, during the Term:

9.3.1 Upon Company learning of any breach of a sublicense agreement by any of its Affiliates or Third Party sublicensees in any manner that would result in mRNA RiboTherapeutics having the right to terminate the Cellscript Sublicense Agreement or Penn having the right to terminate the Penn License Agreement, Company will [***].

9.3.2 Company will not breach this Agreement, and to the extent within its legal power, will ensure that its Affiliates do not breach or cause breach of any sublicense under this Agreement, in any manner that would [***].
9.3.3 Company will pay all payments due under this Agreement pursuant to Article 3 and in accordance with the terms in Articles 3 and Section 4.2 and will provide all information, reports and notices required in accordance with Sections 2.1, 2.3, 3.3, 3.4.3(a), 4.1, 4.4 and 6.6 and in the form of the sample report attached as Exhibit C, in each case in accordance with the time periods set forth therein.

9.3.4 Promptly following Company’s or any of its Affiliates’ receipt of any material written notice or correspondence pertaining to the Sublicense that would reasonably be expected to adversely affect Cellscript’s rights or obligations under this Agreement, Company will, to the extent permissible, furnish a copy of such notice or correspondence to Cellscript, provided that Company may redact portions of any such notice or correspondence that do not relate to or impact Cellscript’s rights hereunder.

9.3.5 Company will promptly notify Cellscript if Company receives [***].

9.3.6 [***]

9.4 Representations and Warranties of Cellscript. As of the Effective Date, Cellscript, on behalf of itself and its affiliates, hereby represents and warrants to Company that:

9.4.1 (a) either Cellscript or mRNA RiboTherapeutics has provided Company with a copy of a true and correct copy of the Cellscript Sublicense Agreement (including all exhibits and amendments thereto), which has been redacted only with respect to the numerical values of the compensation payable thereunder and certain terms and conditions that do not pertain to and that are immaterial to Company’s rights in the Sublicensed Fields of Use, (b) prior to the Effective Date, mRNA RiboTherapeutics has provided Company with an opportunity to view a copy of the Cellscript Sublicense Agreement (including all exhibits and amendments thereto) which is true, correct and complete except for being redacted only with respect to the amounts paid or payable by Cellscript to mRNA RiboTherapeutics for said sublicense and the milestones and other fees and royalties payable by Cellscript for the Ex Vivo Field of Use; (c) either Cellscript or mRNA RiboTherapeutics has provided Company with a true and correct copy of the Penn License Agreement (including all exhibits and amendments thereto) which has been redacted only with respect to the numerical values of the compensation payable thereunder and certain terms and conditions that do not pertain to and that are immaterial to Company’s rights in the Sublicensed Fields of Use or the fields of use sublicensed to Company under the mRNA RiboTherapeutics Sublicense Agreement, (d) prior to the Effective Date, mRNA RiboTherapeutics has provided Company with an opportunity to view a true and correct copy of the Penn License Agreement (including all exhibits and amendments thereto) which has been redacted only with respect to [***], (d) except for [***], there is no other outstanding license, sublicense agreement, written or verbal, for Patent Rights in Field of Use B between Cellscript or mRNA RiboTherapeutics (or any affiliate thereof) on the one hand and Penn on the other hand, or between Cellscript (or any affiliate thereof) and mRNA RiboTherapeutics (or any affiliate thereof).

9.4.2 (a) Neither Cellscript nor any affiliate thereof has [***]; (b) except for (i) this Agreement to Company, (ii) the Cellscript Sublicense Agreement; (iii) the mRNA RiboTherapeutics Sublicense Agreement to Company, [***]; and (c) Cellscript has not granted any liens or encumbrances in or to its rights in Patent Rights or the Cellscript Sublicense Agreement.
9.4.3 Cellscript has not breached or defaulted under any provision of the Cellscript Sublicense Agreement in any material respect or received any written notice from mRNA RiboTherapeutics of any claims for indemnification pursuant thereto.

9.4.4 To the knowledge of Cellscript, (a) there are no facts that would preclude Penn from having clear title to the Patent Rights, (b) there are no pending or threatened litigations, interferences, reexaminations, oppositions or like procedures involving any such Patent Rights and (c) all of the issued patents within the Patent Rights are valid and enforceable, are in full force and effect and have not lapsed, expired or otherwise terminated.

9.4.5 Cellscript believes the terms and conditions of this Agreement are [***] consistent with the terms and conditions of the Cellscript Sublicense and the Penn License Agreement;

9.4.6 Cellscript has not received any written notice of any claim by any person or entity challenging the sublicense rights of Cellscript or the validity or enforceability of the Patent Rights.

9.4.7 [***]

9.4.8 Cellscript believes that the representations and warranties of Cellscript in this Agreement, do not, taken as a whole, (i) contain any untrue statement of a material fact; or (ii) omit to state any material fact necessary to make the statements or facts contained therein, in light of the circumstances under which they were made, not misleading. Cellscript has not knowingly withheld any information with respect to the Cellscript Sublicense Agreement, the Penn License Agreement or the Patent Rights that would reasonably be expected to be material to Company’s decision to enter into this Agreement.

9.5 Representations and Warranties of mRNA RiboTherapeutics. As of the Effective Date, mRNA RiboTherapeutics, on behalf of itself and its affiliates, hereby represents and warrants to Company that:

9.5.1 (a) either Cellscript or mRNA RiboTherapeutics has provided Company with a copy of a true and correct copy of the Cellscript Sublicense Agreement (including all exhibits and amendments thereto), which has been redacted with respect to the numerical values of the compensation payable thereunder and certain terms and conditions that do not pertain to and that are immaterial to Company’s rights in the Sublicensed Fields of Use, (b) prior to the Effective Date, either mRNA RiboTherapeutics or Cellscript has provided Company with an opportunity to view a copy of the Cellscript Sublicense Agreement (including all exhibits and amendments thereto) which is true, correct and complete except for being redacted only with respect to the amounts paid or payable by Cellscript to mRNA RiboTherapeutics for said sublicense and the milestones and other fees and royalties payable by Cellscript for the Ex Vivo Field of Use; (c) either Cellscript or mRNA RiboTherapeutics has provided Company with a true, correct and complete copy of the Penn License Agreement (including all exhibits and amendments thereto), which has been redacted with respect to the numerical values of the compensation payable thereunder and certain terms and conditions that do not pertain to and that are immaterial to Company’s rights in the Sublicensed Fields of Use or the fields of use sublicensed to Company under the mRNA RiboTherapeutics Sublicense Agreement, (d) prior to the Effective Date, mRNA RiboTherapeutics has provided Company with an opportunity to view a true and correct copy of the Penn License Agreement (including all exhibits and amendments thereto) which has been redacted only with respect to [***], there are no other license, sublicense or other agreements, written or verbal, relating to the Patent Rights between Cellscript or mRNA

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9.5.2 (a) Neither mRNA RiboTherapeutics nor any affiliate thereof has [***]; (b) except for (i) the Cellscript Sublicense Agreement; (ii) this Agreement to Company, (iii) the mRNA RiboTherapeutics Sublicense Agreement to Company, (iv) [***], and (v) [***]; and (c) neither mRNA RiboTherapeutics nor any affiliate thereof has granted any liens or encumbrances in or to its rights in Patent Rights or the Cellscript Sublicense Agreement.

9.5.3 Cellscript has not breached or defaulted under any provision of the Cellscript Sublicense Agreement in any material respect or received any written notice from mRNA RiboTherapeutics of any claims for indemnification pursuant thereto and mRNA RiboTherapeutics has not breached or defaulted under any provision of the Penn License Agreement in any material respect or received any written notice from Penn of any claims for indemnification pursuant thereto.

9.5.4 To the knowledge of mRNA RiboTherapeutics, (a) there are no facts that would preclude Penn from having clear title to the Patent Rights, (b) there are no pending or threatened litigations, interferences, reexaminations, oppositions or like procedures involving any such Patent Rights and (c) all of the issued patents within the Patent Rights are valid and enforceable, are in full force and effect and have not lapsed, expired or otherwise terminated.

9.5.5 mRNA RiboTherapeutics believes the terms and conditions of this Agreement are [***] consistent with the terms and conditions of the Cellscript Sublicense Agreement and the Penn License Agreement.

9.5.6 mRNA RiboTherapeutics has not received, any written notice of any claim by any person or entity challenging the sublicense rights of Cellscript or the validity or enforceability of the Patent Rights.

9.5.7 [***]

9.5.8 mRNA RiboTherapeutics believes that the representations and warranties of mRNA RiboTherapeutics in this Agreement, do not, taken as a whole, (i) contain any untrue statement of a material fact; or (ii) omit to state any material fact necessary to make the statements or facts contained therein, in light of the circumstances under which they were made, not misleading. mRNA RiboTherapeutics has not knowingly withheld any information with respect to the Cellscript Sublicense Agreement, the Penn License Agreement or the Patent Rights that would reasonably be expected to be material to Company’s decision to enter into this Agreement.

9.6 Representations and Warranties of Company. Company, on behalf of itself and its affiliates, hereby represents and warrants to Cellscript and to mRNA RiboTherapeutics that, as of the Effective Date:

9.6.1 Company is duly organized and validly existing under the laws of the jurisdiction of its incorporation and has full corporate power and authority to enter into this Agreement.

9.6.2 Company is in good standing with all relevant governmental authorities.

9.6.3 Company has taken all corporate actions necessary to authorize the execution and delivery of this Agreement and the performance of its obligations under this Agreement.
9.6.4 The performance of its obligations under this Agreement do not conflict with or constitute a default under its charter documents, any contractual obligation of Company or any court order.

9.6.5 [***]

9.6.6 [***]

9.6.7 Company has read the copy of the Penn License Agreement (including all exhibits and amendments thereto) that was provided to Company by mRNA RiboTherapeutics or Cellscript.

9.6.8 Company has read the redacted copy of the Cellscript Sublicense (including all exhibits and amendments thereto) that was provided to Company by Cellscript or mRNA RiboTherapeutics.

9.6.9 Company believes that the representations and warranties of Company in this Agreement, do not, taken as a whole, (i) contain any untrue statement of a material fact; or (ii) omit to state any material fact necessary to make the statements or facts contained therein, in light of the circumstances under which they were made, not misleading. Company has not knowingly withheld any information with respect to the any of Company’s above statements that would reasonably be expected to be material to Cellscript’s decision to enter into this Agreement.

9.7 Disclaimer of Warranties. EXCEPT AS SPECIFICALLY SET FORTH IN THIS ARTICLE 9, NO PARTY MAKES ANY REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS OR SUFFICIENCY OF PATENT RIGHTS OR EXHIBIT D PATENTS FOR A PARTICULAR PURPOSE, APPLICATION OR USE, NON-INFRINGEMENT, OR ANY OTHER STATUTORY WARRANTY.

10 ADDITIONAL TERMS REGARDING SUBLICENSING

10.1 Purpose of this Article. This Article 10 sets forth terms and conditions for further sublicensing by Primary Sublicensors in the Human In Vivo Therapeutics Field, wherein, for the purposes of this Article 10:

(a) “sublicensing” herein means any grant of a sublicense, covenant not to sue, or option for current or future rights under Patent Rights, and the noun “sublicense” herein means a document that grants such sublicense, covenant not to sue, or option for current or future rights under Patent Rights;

(b) “Primary Sublicensors” herein means (i) mRNA RiboTherapeutics, (ii) Cellscript, and (iii) any affiliate of (i) or (ii) that is granted a sublicense in the Human In Vivo Therapeutics Field; and

(c) “[***]” herein means any or all therapeutic and prophylactic use(s) in [***].

For clarity and the absence of doubt, Article 10 shall not be interpreted in any way so as to limit, restrict or impose any terms or conditions on Primary Sublicensors’ rights to grant sublicenses under Patent Rights to any party at any time for any Field of Use other than the Human In Vivo Therapeutics Field.

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10.2 **Human In Vivo Therapeutics Field Sublicenses.** Subject to the rights of the Primary Sublicensors and their respective owners under Section 10.4, Cellscript, mRNA RiboTherapeutics and Company agree that, from the Effective Date until [***], mRNA RiboTherapeutics and Cellscript will not grant and will ensure that other Primary Sublicensors will not grant Human In Vivo Therapeutics Field Sublicenses[***].

“Human In Vivo Therapeutics Field Sublicense” means a sublicense to make, have made, use, import, offer for sale, sell and/or have sold any number of products [***] for the Human In Vivo Therapeutics Field, [***].

10.3 **Product Sublicenses.** Subject to the rights of the Primary Sublicensors and their respective owners under Section 10.4, Cellscript, mRNA RiboTherapeutics and Company agree that, from the Effective Date until [***], Cellscript and mRNA RiboTherapeutics will (and will ensure that the other Primary Sublicensors will):

(a) grant Product Sublicenses only to [***],

wherein “Product Sublicenses” herein mean sublicenses under Patent Rights to research, develop, manufacture and/or commercialize specific products [***], for a therapeutic or prophylactic use in humans in the In Vivo Field of Use, and

wherein “[***]” herein means [***]:

(i) [***]

(ii) [***]

(iii) [***]

(b) only grant [***] Sublicenses for [***]

(c) except as set forth in Sections 10.2 and 10.3, not otherwise grant sublicenses under the Patent Rights to research, develop, manufacture and/or commercialize [***][***].

10.4 **Sale of a Primary Sublicensor.** Company understands and agrees that the owners of each of mRNA RiboTherapeutics and Cellscript shall have the right to sell all or any part of the outstanding stock or ownership interest or the business or the assets thereof, as applicable, of mRNA RiboTherapeutics and/or Cellscript [***] at any time and without any conditions pursuant to this Agreement other than the requirements under Section 15.5,

except that, as a condition to any such sale occurring prior to [***]:

(a) the owners of each of mRNA RiboTherapeutics and Cellscript [***] sell mRNA RiboTherapeutics or Cellscript to [***]; and

(b) without in any way negating or ceding or giving up any of their current rights to sell all or any part of the stock, ownership interest, business or assets of mRNA RiboTherapeutics and/or Cellscript or to discuss any such sale with any potential purchaser at any time, including from the Effective Date of this Agreement [***], the owners of mRNA RiboTherapeutics and Cellscript agree not to [***] prior to [***].

wherein “[***]” herein means [***]; and

for the avoidance of doubt, Company agrees that this Section 10.4(a) shall not be interpreted so as to prohibit the owners of mRNA RiboTherapeutics and/or Cellscript from [***].

(c) the purchaser of mRNA RiboTherapeutics or Cellscript, respectively, will pay [***]:

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(d) on the effective date of any such sale of [***], the purchased company (whether mRNA RiboTherapeutics or Cellscript) and the purchaser and their assignees and successors in ownership thereof shall [***]:

(i) grant [***] Sublicenses to affiliates and Third Parties [***], and

(ii) grant [***] Sublicenses to affiliates and any Third Parties to research, develop, manufacture and/or commercialize any number of products [***] without being subject to any of the restrictions, limitations or requirements that the sublicensee is [***] as is required of the Primary Sublicensors in Section 10.3; and

(d) on the effective date of any such sale of more than fifty percent (50%) of the outstanding stock or ownership interest or all of the business or assets of mRNA RiboTherapeutics or Cellscript [***], all of the rights of the Primary Sublicensors to grant Product Sublicenses pursuant to Section 10.3 shall remain only with the Primary Sublicensors for which their stock, ownership interest, business and assets were not sold.

[***]

10.5 From [***], Primary Sublicensors and any owners, assignees or successors in ownership thereof shall have the right to grant [***] of [***] Sublicense(s) to any parties without any conditions (other than those imposed by the Penn License Agreement or the Cellscript Sublicense) and to grant any number of Product Sublicenses or any other sublicenses of any kind under Patent Rights to any parties without any limitations or restrictions or requirements whatsoever under this Article 10.

11 LIMITATION OF LIABILITY; DISCLAIMER.

11.1 Limitation of Liability. CELLSCRIPT, mRNA RIBOTHERAPEUTICS AND PENN WILL NOT BE LIABLE TO COMPANY, ITS AFFILIATES, SUBLICENSEES, SUCCESSORS OR ASSIGNS, OR ANY THIRD PARTY WITH RESPECT TO ANY CLAIM: ARISING FROM COMPANY’S USE OF THE PATENT RIGHTS, EXHIBIT D PATENTS, LICENSED PRODUCTS OR ANY OTHER TECHNOLOGY LICENSED UNDER THIS AGREEMENT; OR ARISING FROM THE COMPANY’S, COMPANY’S AFFILIATES’ OR COMPANY’S SUBLICENSEES’ DEVELOPMENT, TESTING, MANUFACTURE, USE OR SALE OF LICENSED PRODUCTS. NOTWITHSTANDING ANYTHING IN THIS AGREEMENT OR OTHERWISE, NONE OF CELLSCRIPT, mRNA RIBOTHERAPEUTICS, PENN, OR COMPANY WILL BE LIABLE TO THE OTHER OR ANY THIRD PARTY WITH RESPECT TO ANY SUBJECT MATTER OF THIS AGREEMENT FOR ANY INDIRECT, PUNITIVE, SPECIAL OR CONSEQUENTIAL DAMAGES, EVEN IF SUCH PARTY HAS BEEN INFORMED OR SHOULD HAVE KNOWN OF THE POSSIBILITY OF SUCH DAMAGES; PROVIDED THAT THIS SECTION 11.1 WILL NOT APPLY: (a) TO A PARTY’S INDEMNIFICATION RIGHTS AND OBLIGATIONS UNDER ARTICLE 12 OR ARTICLE 13; (b) IN CIRCUMSTANCES OF GROSS NEGLIGENCE OR INTENTIONAL MISCONDUCT BY A PARTY OR ITS AFFILIATES; OR (c) WITH RESPECT TO A PARTY’S LIABILITY FOR BREACH OF ARTICLE 5 or 10.

11.2 Disclaimer. THE PATENT RIGHTS, EXHIBIT D PATENTS, LICENSED PRODUCTS AND ANY OTHER TECHNOLOGY LICENSED UNDER THIS AGREEMENT ARE PROVIDED ON AN “AS IS” BASIS. EXCEPT AS EXPRESSLY SET FORTH IN THIS AGREEMENT, NONE OF CELLSCRIPT, mRNA RIBOTHERAPEUTICS, PENN, OR COMPANY MAKE ANY REPRESENTATIONS OR WARRANTIES, EXPRESS OR

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12 PENN INDEMNIFICATION

12.1 Indemnification. Company will defend, indemnify, and hold harmless each Penn Indemnified Party from and against any and all Penn Liabilities with respect to an Indemnification Event. The term “Penn Indemnified Party” means each of Penn and its trustees, officers, faculty, students, employees, contractors, and agents. For clarity, Cellscript is not a Penn Indemnified Party. The term “Penn Liabilities” means all damages, awards, deficiencies, settlement amounts, defaults, assessments, fines, dues, penalties, costs, fees, liabilities, obligations, taxes, liens, losses, lost profits and expenses (including, but not limited to, court costs, interest and reasonable fees of attorneys, accountants and other experts) that are incurred by a Penn Indemnified Party or awarded or otherwise required to be paid to Third Parties by a Penn Indemnified Party. The term “Indemnification Event” means any Claim against one or more Penn Indemnified Parties arising out of or resulting from: [***]. The term “Claim” in this Article 12 means any charges, complaints, actions, suits, proceedings, hearings, investigations, claims or demands.

12.2 Reimbursement of Costs. Company will pay directly all Penn Liabilities incurred for defense or negotiation of any Claim or will reimburse Penn for all documented Penn Liabilities incident to the defense or negotiation of any Claim within [***] days after Company’s receipt of invoices for such fees, expenses and charges.

12.3 Control of Litigation. Company controls any litigation or potential litigation involving the defense of any Claim, including the selection of counsel, with input from Penn. Penn reserves the right to protect its interest in defending against any Claim by selecting its own counsel, with any attorneys’ fees and litigation expenses paid for by Company, pursuant to Sections 12.1 and 12.2.

12.4 Other Provisions. Company will not settle or compromise any Claim giving rise to Penn Liabilities in any manner that imposes any restrictions or obligations on Penn or grants any rights to the Patent Rights, Exhibit D Patents or the Licensed Products without Penn’s prior written consent. If Company fails or declines to assume the defense of any Claim within [***] days after notice of the Claim, or fails to reimburse a Penn Indemnified Party for any Penn Liabilities pursuant to Sections 12.1 and 12.2 within the [***] day time period set forth in Section 12.2, then Penn may assume the defense of such Claim for the account and at the risk of Company, and any Penn Liabilities related to such Claim will be conclusively deemed a liability of Company. The indemnification rights of the Penn Indemnified Parties under this Article 12 are in addition to all other rights that a Penn Indemnified Party may have at law, in equity or otherwise.
13 OTHER INDEMNIFICATION

13.1 Indemnification by Company. Company will indemnify, defend and hold harmless Cellscript and its affiliates, and its or their respective directors, officers, employees and agents ("Cellscript Indemnified Parties"), from and against any and all liabilities, damages, losses, costs and expenses including the reasonable fees of attorneys (collectively “Losses”) arising out of or resulting from any and all Third Party suits, claims, actions, proceedings, payment obligations or demands (“Claims” in this Article 13) to the extent based upon:

13.1.1 [***]
13.1.2 [***]
13.1.3 [***]

except, in each case above, to the extent such Claim arose out of or resulted from or is attributable to any acts or omissions of Cellscript or its directors, officers, employees and agents, or other circumstances for which Cellscript has an indemnity obligation pursuant to Section 13.2 below.

13.2 Indemnification by Cellscript. Cellscript will indemnify, defend and hold harmless Company and its affiliates, and its or their respective directors, officers, employees and agents ("Company Indemnified Parties"), from and against any and all Losses arising out of or resulting from any and all Claims to the extent based upon:

13.2.1 [***]
13.2.2 [***]

except, in each case above, to the extent such Claim arose out of or resulted from or is attributable to any acts or omissions of Company or its affiliates or Third Party sublicensees or contractors and its or their respective directors, officers, employees and agents or other circumstances for which Company has an indemnity obligation pursuant to Section 13.1 above.

13.3 Procedure. If an Indemnified Party entitled to indemnification under Sections 13.1 or 13.2 seeks such indemnification (wherein “Indemnified Party” in this Article 13 means a “Company Indemnified Party” and/or an “Cellscript Indemnified Party”), such Indemnified Party will:

(i) inform the indemnifying Party in writing of a Claim as soon as reasonably practicable after such Indemnified Party receives notice of such Claim;

(ii) permit the indemnifying Party to assume direction and control of the defense of the Claim (including the sole right to settle such Claim at the sole discretion of the indemnifying Party, provided that (a) such settlement or compromise does not admit any fault or negligence on the part of the Indemnified Party, or impose any obligation on, or otherwise materially adversely affect, the Indemnified Party or other Party and (b) the indemnifying Party first obtains the written consent of the Indemnified Party with respect to such settlement, which consent will not be unreasonably withheld);

(iii) cooperate as reasonably requested (at the expense of the indemnifying Party) in the defense of the Claim; and

(iv) undertake reasonable steps to mitigate any Losses with respect to the Claim.

Notwithstanding anything in this Agreement to the contrary, the indemnifying Party will have no liability under Sections 13.1 or 13.2, as the case may be, for Claims settled or compromised by the Indemnified Party without the indemnifying Party’s prior written consent.

14 INSURANCE

14.1 Coverages. Company will procure and maintain insurance or self-insurance that covers the following minimum liability amounts with respect to personal injury, bodily injury and property damage arising out of Company’s performance under this Agreement: (a) during the Term, comprehensive general liability, including broad form and contractual liability, in a
minimum amount of $[***] combined single limit per occurrence and in the aggregate; (b) prior to the commencement of clinical trials involving Licensed Products, clinical trials a minimum amount of $[***] combined single limit per occurrence and in the aggregate; and (c) prior to the Sale of the first Licensed Product, product liability a minimum amount of $[***] combined single limit per occurrence and in the aggregate. Penn and Cellscript may review periodically the adequacy of the minimum amounts of insurance or self-insurance for each liability coverage area required by this Section 14.1, and Penn and Cellscript reserve the right to request Company to adjust the limits accordingly to the extent existing limits are not commercially reasonable. The required minimum amounts of insurance or self-insurance do not constitute a limitation on Company’s liability or indemnification obligations to Penn or Cellscript under this Agreement.

15 ADDITIONAL PROVISIONS

15.1 Independent Contractors. The Parties are independent contractors. Nothing contained in this Agreement is intended to create an agency, partnership or joint venture between the Parties. At no time will either Party make commitments or incur any charges or expenses for or on behalf of the other Party.

15.2 No Discrimination. Company will not discriminate against any employee or applicant for employment because of race, color, sex, sexual or affectional preference, age, religion, national or ethnic origin, handicap, or veteran status.

15.3 Compliance with Laws. Company must comply with all prevailing laws, rules and regulations that apply to its activities or obligations under this Agreement. For example, Company will comply with applicable United States export laws and regulations. The transfer of certain technical data and commodities may require a license from the applicable agency of the United States government and/or written assurances by Company that Company will not export data or commodities to certain foreign countries without prior approval of the agency. Penn and Cellscript do not represent that no license is required, or that, if required, the license will issue.

15.4 Modification, Waiver & Remedies. This Agreement may only be modified by a written amendment that is executed by an authorized representative of each Party. Any waiver must be express and in writing. No waiver by either Party of a breach by the other Party will constitute a waiver of any different or succeeding breach. Unless otherwise specified, all remedies are cumulative.

15.5 Assignment. This Agreement may not be assigned (by operation of law or otherwise) by either Party without the prior written consent of the other Party (which consent will not be unreasonably withheld); except that, either Party may assign this Agreement without such consent to an affiliate or to a Third Party successor that purchases greater than fifty percent (>50%) of the outstanding stock or ownership interest or all or substantially all of such Party’s business or assets to which this Agreement relates, whether by sale of shares or ownership interest, merger, consolidation, sale of assets or otherwise, provided that, prior to said transfer, the intended assignee agrees in writing to be legally bound by this Agreement in the place and stead of the assignor and provides the non-assigning Party with a copy of said assignee’s written undertaking. Neither Party will grant a security interest in the Sublicense or this Agreement during the Term. Any prohibited assignment or security interest in contravention of the foregoing will be null and void. The rights and obligations of the Parties under this Agreement will be binding upon and inure to the benefit of the successors and permitted assignees of the Parties, and the name of a Party appearing herein will be deemed to include the name of such Party’s successors and permitted assigns to the extent necessary to carry out the intent of this Section 15.5.
15.6 **Notices.** Any notice or other required communication (each, a “Notice”) must be in writing, addressed to the Party’s respective Notice Address listed on the signature page, and delivered: (a) personally, with signed receipt; (b) by certified mail, postage prepaid, return receipt requested; (c) by recognized overnight courier service, charges prepaid; or (d) by facsimile. A Notice will be deemed received: if delivered personally, on the date of delivery; if mailed, five (5) days after deposit in the United States mail; if sent via courier, one (1) business day after deposit with the courier service; or if sent via facsimile, upon receipt of confirmation of transmission provided that a confirming copy of such Notice is sent by certified mail, postage prepaid, return receipt requested.

15.7 **Severability & Reformation.** If any provision of this Agreement is held to be invalid or unenforceable by a court of competent jurisdiction, then the remaining provisions of this Agreement will remain in full force and effect. Such invalid or unenforceable provision will be automatically revised to be a valid or enforceable provision that comes as close as permitted by law to the Parties’ original intent.

15.8 **Headings & Counterparts.** The headings of the articles and sections included in this Agreement are inserted for convenience only and are not intended to affect the meaning or interpretation of this Agreement. This Agreement may be executed in one or more counterparts, each of which when executed and delivered by facsimile, electronic transmission, or by mail delivery, will be an original and all of which shall constitute one and the same instrument.

15.9 **Governing Law.** This Agreement will be governed in accordance with the laws of the Commonwealth of Pennsylvania, without giving effect to the conflict of law provisions of any jurisdiction.

15.10 **Dispute Resolution.** If a dispute arises between the Parties concerning any right or duty under this Agreement, then the Parties will confer, as soon as practicable, in an attempt to resolve the dispute. If the Parties are unable to resolve the dispute amicably, then the Parties will submit to the exclusive jurisdiction of, and venue in, the state and Federal courts located in the Eastern District of Pennsylvania with respect to all disputes arising under this Agreement. Notwithstanding anything herein to the contrary, in the event of an actual or threatened breach of this Agreement, the aggrieved Party may seek provisional equitable relief (including restraining orders, specific performance or other injunctive relief) in any court of competent jurisdiction to protect the interests of such Party.

15.11 **Further Assurance.** Each Party shall duly execute and deliver, or cause to be duly executed and delivered, such further instruments and do and cause to be done such further acts and things, including the filing of such assignments, agreements, documents and instruments, as may be necessary or as the other Party may reasonably request in connection with this Agreement or to carry out more effectively the provisions and purposes hereof, or to better assure and confirm unto such other Party its rights and remedies under this Agreement.

15.12 **Interpretation.** Except where the context otherwise requires, wherever used, the singular shall include the plural, the plural the singular, the use of any gender shall be applicable to all genders and the word “or” is used in the inclusive sense (and/or). The captions of this Agreement are for convenience of reference only and in no way define, describe, extend or limit the scope or intent of this Agreement or the intent of any provision contained in this Agreement. The term “including” as used herein shall mean including, without limiting the generality of any
15.13 **Condition Precedent to Execution of this Agreement.** The Parties understand and agree that each Party’s willingness to enter into this Agreement is contingent upon the execution of both this Agreement and the mRNA RiboTherapeutics Sublicense Agreement (*****), and, as such, the Parties’ willingness to enter into this Agreement is conditioned upon the execution of the mRNA RiboTherapeutics Sublicense Agreement concurrently with this Agreement.

15.14 **Entire Agreement.** This Agreement and the mRNA RiboTherapeutics Sublicense Agreement set forth the complete, final and only agreements with respect to the subject matter hereof and supersede all other agreements and understandings between the Parties with respect to the subject matter hereof. The Parties acknowledge and agree that this Agreement and the mRNA RiboTherapeutics Sublicense Agreement are separate and distinct agreements and there will be no “cross default” with respect to this Agreement and the mRNA RiboTherapeutics Sublicense Agreement.

[Remainder of Page Intentionally Left Blank]
Each Party has caused this Agreement to be executed by its duly authorized representative.

CELLSCRIPT, LLC

By: /s/ Gary A. Dahl, Ph.D.
Name: Gary A. Dahl, Ph.D.
Title: President
Address: CELLSCRIPT, LLC
726 Post Road
Madison, WI 53713

MODERNATX, INC.

By: /s/ Stephen Hoge, M.D.
Name: Stephen Hoge, M.D.
Title: President
Address: MODERNATX, INC.
320 Bent Street
Cambridge, MA 02141

mRNA RIBOTHERAPEUTICS, INC.,

which is executing this Agreement solely

with respect to the following provisions:

- Section 6.5.1, solely with respect to acceptance of sublicense agreements assigned by Cellscript;
- Section 9.2, including 9.2.1 through 9.2.9;
- Section 9.5, including 9.5.1 through 9.5.8; and
- Article 10.

By: /s/ Gary A. Dahl, Ph.D.
Name: Gary A. Dahl, Ph.D.
Title: President

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<tr>
<th>Exhibit</th>
<th>Description</th>
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<tr>
<td>Exhibit A</td>
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<td>Exhibit B</td>
<td>Sublicense Disclosure Report</td>
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<td>Exhibit C</td>
<td>Form of Royalty Report</td>
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<td>Exhibit D</td>
<td>Cellscript’s Exhibit D Patents</td>
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33
Exhibit B
Sublicense Disclosure Report

[***]

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Exhibit D

**Exhibit D Patents Sublicensed to Company under Section 1.7.**

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36
LEASE AGREEMENT

THIS LEASE AGREEMENT is made as of this 26th day of May, 2016, between ARE-TECH SQUARE, LLC, a Delaware limited liability company ("Landlord"), and MODERNA THERAPEUTICS, INC., a Delaware corporation ("Tenant").

BASIC LEASE PROVISIONS

Address: 200 Technology Square, Cambridge, Massachusetts

Premises: That portion of the Building containing approximately 124,760 rentable square feet, as determined by Landlord, as more specifically described on Exhibit A-1 and as shown on Exhibit A-2. The Premises shall be delivered in phases as provided in Section 2 below.

Building: The specific building in which the Premises are located, which building is within the Project and located at 200 Technology Square, also known as Unit 200 of the Condominium described in Exhibit B.

Project: The real property on which the Building is located, also known as Technology Square Condominium (the "Condominium"), together with all improvements thereon and appurtenances thereto from time to time located thereon in the City of Cambridge, Middlesex County, Commonwealth of Massachusetts, as described on Exhibit B. The Landlord reserves the right to modify the Condominium at any time and from time to time, provided that such modifications will not materially adversely affect Tenant’s use of the Premises for the Permitted Use or materially increase Tenant’s monetary obligations under this Lease, but the parties acknowledge the Condominium presently consists of Units 100, 200, 300, 400, 500, 600 and 700 (also known as Buildings 100, 200, 300, 400, 500, 600 and 700), as well as specified common areas on the Condominium (including the Technology Square Garage).

Base Rent: $72.00 per rentable square foot of the Premises per year, subject to annual increases on the Adjustment Date as set forth herein

Rentable Area of Premises: 124,760 sq. ft.

Rentable Area of Building: 177,101 sq. ft. Tenant’s Share of Operating Expenses: 70.44% (1.04% attributable to the Phase 1 Premises; 29.72% attributable to the Phase 2 Premises; 10.31% attributable to the Phase 3 Premises; 10.08% attributable to the Phase 4 Premises; 9.14% attributable to the Phase 5 Premises; 10.15% attributable to the Phase 6 Premises)

Rentable Area of Project: 1,181,635 sq. ft. Building’s Share of Project: 14.99%

Security Deposit: $2,245,680.00, subject to adjustment pursuant to Section 6 below.

Phase 1 Premises Target Commencement Date: September 1, 2016
Rent Adjustment Percentage: 2.5%

Base Term: Beginning on the Phase 1 Premises Commencement Date and ending on December 31, 2027.

Permitted Use: Research and development laboratory, related office and other related uses consistent with the current character of the Project and otherwise in compliance with the provisions of Section 7 hereof.

Address for Rent Payment:
385 East Colorado Boulevard, Suite 299
Pasadena, CA 91101
Attention: Accounts Receivable

Landlord’s Notice Address:
385 East Colorado Boulevard, Suite 299
Pasadena, CA 91101
Attention: Corporate Secretary

Tenant’s Notice Address:
200 Technology Square
Cambridge, MA 02139
Attention: Mr. Steve Harbin

With a copy to:
320 Bent Street
Cambridge, MA 02141
Attention: General Counsel

The following Exhibits and Addenda are attached hereto and incorporated herein by this reference:

[X] EXHIBIT A-1—DESCRIPTION OF PREMISES
[X] EXHIBIT A-2—DEPICTION OF PREMISES
[X] EXHIBIT B—DESCRIPTION OF PROJECT
[X] EXHIBIT C—WORK LETTER
[X] EXHIBIT D—COMMENCEMENT DATE
[X] EXHIBIT E—RULES AND REGULATIONS
[X] EXHIBIT F—TENANT’S PERSONAL PROPERTY

1. Lease of Premises. Upon and subject to all of the terms and conditions hereof, Landlord hereby leases the Premises to Tenant and Tenant hereby leases the Premises from Landlord. The portions of the Project which are for the non-exclusive use of tenants of the Project are collectively referred to herein as the “Common Areas.” The Common Areas shall include all common loading docks, freight elevators and bathrooms at the Building. Landlord reserves the right to modify Common Areas, provided that such modifications do not materially adversely affect Tenant’s use of the Premises for the Permitted Use. From and after the Phase 1 Premises Commencement Date with respect to the Phase 1 Premises (and from and after each subsequent Commencement Date (as defined in Section 2 below) with respect to each respective Phase of the Premises) through the expiration of the Term, Tenant shall have access to the Building, the Phase 1 Premises (and from and after each subsequent Commencement Date with respect to each respective Phase of the Premises) and the Technology Square Garage 24 hours a day, 7 days a week, except in the case of emergencies, as the result of Legal Requirements, the performance by Landlord of any installation, maintenance or repairs, or any other temporary interruptions, and otherwise subject to the terms of this Lease.

2. Delivery; Acceptance of Premises; Commencement Dates.

(a) Phase 1 Premises. Landlord shall use reasonable efforts to make available to Tenant in vacant, broom clean condition (“Delivery” or “Deliver”) that portion of the Premises consisting of the Phase 1 Premises on or before the Phase 1 Premises Target Commencement Date. If Landlord fails to timely Deliver the Phase 1 Premises, Landlord shall not be liable to Tenant for any loss or damage resulting therefrom, and this Lease shall not be void or voidable. If Landlord does not Deliver the Phase 1 Premises to Tenant by the Phase 1 Premises Target Commencement Date (as such date may be extended by Force Majeure delays), then, Base Rent payable with respect to the Phase 1 Premises shall be abated 1 day for each day after the Phase 1 Premises Target Commencement Date that Landlord fails to Deliver the Phase 1 Premises to Tenant. The “Phase 1 Premises Commencement Date” shall be the date Landlord Delivers the Phase 1 Premises to Tenant; provided, however, that in no event shall the Phase 1 Premises Commencement Date occur prior to the Phase 1 Target Commencement Date.
Provided that Tenant shall have notified Landlord in writing within 120 consecutive days after the Phase 1 Premises Commencement Date of any manner in which the Building Systems (as defined in Section 13) serving the Phase 1 Premises are not in good operating condition, Landlord shall, at its sole cost and expense (which shall not constitute an Operating Expense), be responsible for any repairs that are required to be made to such Building Systems, unless Tenant or any Tenant Party was responsible for the cause of such repair, in which case Tenant shall pay the cost.

Prior to the Phase 1 Premises Commencement Date, following Landlord’s receipt of written request from Tenant, Landlord shall, subject to Landlord’s standard non-reliance letter, deliver to Tenant copies of the surrender reports delivered to Landlord by the immediately prior occupant of the Phase 1 Premises.

Except as otherwise set forth in this Lease or the Work Letter: (i) Tenant shall accept the Phase 1 Premises in their “as-is” condition as of the Phase 1 Premises Commencement Date, subject to all applicable Legal Requirements (as defined in Section 7 hereof); (ii) Landlord shall have no obligation for any defects in the Phase 1 Premises; and (iii) Tenant’s taking possession of the Phase 1 Premises shall be conclusive evidence that Tenant accepts the Phase 1 Premises and that the Phase 1 Premises were in good condition at the time possession was taken. Any occupancy of the Phase 1 Premises by Tenant before the Phase 1 Premises Commencement Date shall be subject to all of the terms and conditions of this Lease, including the obligation to pay Base Rent and Operating Expenses.

(b) Phase 2 Premises.

(i) Landlord shall use reasonable efforts to Deliver in vacant, broom clean condition that portion of the Phase 2 Premises not subject to the GSK Sublease (as defined below) (the “Phase 2 Non-Sublease Premises”) on or before the Phase 2 Non-Sublease Premises Target Commencement Date. If Landlord fails to timely Deliver the Phase 2 Non-Sublease Premises, Landlord shall not be liable to Tenant for any loss or damage resulting therefrom, and this Lease shall not be void or voidable. If Landlord does not Deliver the Phase 2 Non-Sublease Premises to Tenant by the Phase 2 Non-Sublease Premises Target Commencement Date (as such date may be extended by Force Majeure delays), then, Base Rent payable with respect to the Phase 2 Non-Sublease Premises shall be abated 1 day for each day after the Phase 2 Non-Sublease Premises Target Commencement Date that Landlord fails to Deliver the Phase 2 Non-Sublease Premises to Tenant. The “Phase 2 Non-Sublease Premises Commencement Date” shall be the date Landlord Delivers the Phase 2 Non-Sublease Premises to Tenant; provided, however, that in no event shall the Phase 2 Non-Sublease Premises Commencement Date occur prior to the Phase 2 Non-Sublease Premises Target Commencement Date. The “Phase 2 Non-Sublease Premises Target Commencement Date” is January 1, 2018.

Provided that Tenant shall have notified Landlord in writing within 120 consecutive days after the Phase 2 Non-Sublease Premises Commencement Date of any manner in which the Building Systems serving the Phase 2 Non-Sublease Premises are not in good operating condition, Landlord shall, at its sole cost and expense (which shall not constitute an Operating Expense), be responsible for any repairs that are required to be made to such Building Systems, unless Tenant or any Tenant Party was responsible for the cause of such repair, in which case Tenant shall pay the cost.

Prior to the Phase 2 Non-Sublease Premises Commencement Date, following Landlord’s receipt of written request from Tenant, Landlord shall, subject to Landlord’s standard non-reliance letter, deliver to Tenant copies of the surrender reports delivered to Landlord by the immediately prior occupant of the Phase 2 Non-Sublease Premises.
Except as otherwise set forth in this Lease or the Work Letter: (i) Tenant shall accept the Phase 2 Non-Sublease Premises in their “as-is” condition as of the Phase 2 Non-Sublease Premises Commencement Date, subject to all applicable Legal Requirements; (ii) Landlord shall have no obligation for any defects in the Phase 2 Non-Sublease Premises; and (iii) Tenant’s taking possession of the Phase 2 Non-Sublease Premises shall be conclusive evidence that Tenant accepts the Phase 2 Non-Sublease Premises and that the Phase 2 Non-Sublease Premises were in good condition at the time possession was taken. Any occupancy of the Phase 2 Non-Sublease Premises by Tenant before the Phase 2 Non-Sublease Premises Commencement Date shall be subject to all of the terms and conditions of this Lease, including the obligation to pay Base Rent and Operating Expenses.

(ii) The “Phase 2 Sublease Premises Commencement Date” shall be January 1, 2018. Landlord and Tenant acknowledge that Tenant occupied a portion of the Phase 2 Premises (the “Phase 2 Sublease Premises”) prior to the Phase 2 Sublease Premises Commencement Date pursuant to that certain Sublease Agreement between GlaxoSmithKline LLC, a Delaware limited liability company ("GSK"), and Tenant, dated as of July 29, 2013 (as the same has been or may in the future be amended, the “GSK Sublease”), which GSK Sublease is subject to that certain lease agreement now between Landlord and GSK dated June 22, 2007 (as the same has been or may in the future be amended, the “GSK Lease”).

Landlord and Tenant agree that if the GSK Lease terminates prior to January 1, 2018, then, notwithstanding anything to the contrary contained in this Lease, the Phase 2 Sublease Premises Commencement Date shall be amended to be the day immediately after the date of such early termination of the GSK Lease (“Early Phase 2 Sublease Commencement Date”); provided, however, that (i) Tenant shall, commencing on the Early Phase 2 Sublease Commencement Date through January 1, 2018, be required to pay (a) Base Rent for the Phase 2 Sublease Premises in an amount equal to the amount of Base rent that Tenant would have been required to pay for the Phase 2 Sublease Premises under the GSK Sublease during such period, and (b) Tenant’s Share of Operating Expenses for the Phase 2 Sublease Premises pursuant to the terms of this Lease, and (ii) if the GSK Lease has terminated due to a casualty or condemnation, such casualty or condemnation shall be deemed to have occurred during the Base Term of this Lease and the rights and obligations of Landlord and Tenant with respect to the Phase 2 Sublease Premises pursuant to this Lease shall be governed by Section 18 or Section 19 of this Lease, as applicable.

Except as otherwise set forth in this Lease or the Work Letter: (i) Landlord shall have no obligation for any defects in the Phase 2 Sublease Premises; and (ii) Tenant’s occupancy of the Phase 2 Sublease Premises pursuant to the GSK Sublease shall be conclusive evidence that the Phase 2 Sublease Premises were in good condition at the time possession was taken.

(c) Phase 3 Premises. Landlord shall use reasonable efforts to Deliver to Tenant in vacant, broom clean condition that portion of the Premises consisting of the Phase 3 Premises on or before the Phase 3 Premises Target Commencement Date. If Landlord fails to timely Deliver the Phase 3 Premises, Landlord shall not be liable to Tenant for any loss or damage resulting therefrom, and this Lease shall not be void or voidable. If Landlord does not Deliver the Phase 3 Premises to Tenant by the Phase 3 Premises Target Commencement Date (as such date may be extended by Force Majeure delays), then, Base Rent payable with respect to the Phase 3 Premises shall be abated 1 day for each day after the Phase 3 Premises Target Commencement Date that Landlord fails to Deliver the Phase 3 Premises to Tenant. The “Phase 3 Premises Commencement Date” shall be the date Landlord Delivers the Phase 3 Premises to Tenant; provided, however, that in no event shall the Phase 3 Premises Commencement Date occur prior to the Phase 3 Premises Target Commencement Date. The “Phase 3 Premises Target Commencement Date” is June 1, 2018.

Provided that Tenant shall have notified Landlord in writing within 120 consecutive days after the Phase 3 Premises Commencement Date of any manner in which the Building Systems serving the Phase 3 Premises are not in good operating condition, Landlord shall, at its sole cost and expense (which shall not constitute an Operating Expense), be responsible for any repairs that are required to be made to such Building Systems, unless Tenant or any Tenant Party was responsible for the cause of such repair, in which case Tenant shall pay the cost.
Prior to the Phase 3 Premises Commencement Date, following Landlord’s receipt of written request from Tenant, Landlord shall, subject to Landlord’s standard non-reliance letter, deliver to Tenant copies of the surrender reports delivered to Landlord by the immediately prior occupant of the Phase 3 Premises.

Except as otherwise set forth in this Lease or the Work Letter: (i) Tenant shall accept the Phase 3 Premises in their “as-is” condition as of the Phase 3 Premises Commencement Date, subject to all applicable Legal Requirements; (ii) Landlord shall have no obligation for any defects in the Phase 3 Premises; and (iii) Tenant’s taking possession of the Phase 3 Premises shall be conclusive evidence that Tenant accepts the Phase 3 Premises and that the Phase 3 Premises were in good condition at the time possession was taken. Any occupancy of the Phase 3 Premises by Tenant before the Phase 3 Premises Commencement Date shall be subject to all of the terms and conditions of this Lease, including the obligation to pay Base Rent and Operating Expenses.

(d) Phase 4 Premises. The “Phase 4 Commencement Date” shall be May 1, 2019. Landlord and Tenant acknowledge that Tenant occupied the Phase 4 Premises prior to the Phase 4 Premises Commencement Date pursuant to that certain sublease agreement between Capsugel, Inc., a Delaware corporation (“Capsugel”), and Tenant dated March 28, 2014 (as the same has been or may in the future be amended, the “Capsugel Sublease”), which Capsugel Sublease is subject to that certain lease agreement between Landlord and Capsugel dated December 9, 2008, as the same has been or may in the future be amended.

Landlord and Tenant agree that if the Capsugel Lease terminates prior to May 1, 2019, then, notwithstanding anything to the contrary contained in this Lease, the Phase 4 Premises Commencement Date shall be amended to be the day immediately after the date of such early termination of the Capsugel Lease (“Early Phase 4 Commencement Date”); provided, however, that (i) Tenant shall, commencing on the Early Phase 4 Commencement Date through April 30, 2019, be required to pay (a) Base Rent for the Phase 4 Premises in an amount equal to the amount of base rent that Tenant would have been required to pay for the Phase 4 Premises under the Capsugel Sublease during such period, and (b) Tenant’s Share of Operating Expenses for the Phase 4 Premises pursuant to the terms of this Lease, and (ii) if the Capsugel Lease has terminated due to a casualty or condemnation, such casualty or condemnation shall be deemed to have occurred during the Base Term of this Lease and the rights and obligations of Landlord and Tenant with respect to the Phase 4 Premises pursuant to this Lease shall be governed by Section 18 or Section 19 of this Lease, as applicable.

Except as otherwise set forth in this Lease or the Work Letter: (i) Landlord shall have no obligation for any defects in the Phase 4 Premises; and (ii) Tenant’s occupancy of the Phase 4 Premises pursuant to the Capsugel Sublease shall be conclusive evidence that the Phase 4 Premises were in good condition at the time possession was taken.

(e) Phase 5 Premises. Landlord shall use reasonable efforts to Deliver to Tenant in vacant, broom clean condition that portion of the Premises consisting of the Phase 5 Premises on or before the Phase 5 Premises Target Commencement Date. If Landlord fails to timely Deliver the Phase 5 Premises, Landlord shall not be liable to Tenant for any loss or damage resulting therefrom, and this Lease shall not be void or voidable. If Landlord does not Deliver the Phase 5 Premises to Tenant by the Phase 5 Premises Target Commencement Date (as such date may be extended by Force Majeure delays), then, Base Rent payable with respect to the Phase 5 Premises shall be abated 1 day for each day after the Phase 5 Premises Target Commencement Date that Landlord fails to Deliver the Phase 5 Premises to Tenant. The “Phase 5 Premises Commencement Date” shall be the date Landlord Delivers the Phase 5 Premises to Tenant; provided, however, that in no event shall the Phase 5 Premises Commencement Date occur prior to the Phase 5 Premises Target Commencement Date. The “Phase 5 Premises Target Commencement Date” is July 1, 2019.
Provided that Tenant shall have notified Landlord in writing within 120 consecutive days after the Phase 5 Premises Commencement Date of any manner in which the Building Systems serving the Phase 5 Premises are not in good operating condition, Landlord shall, at its sole cost and expense (which shall not constitute an Operating Expense), be responsible for any repairs that are required to be made to such Building Systems, unless Tenant or any Tenant Party was responsible for the cause of such repair, in which case Tenant shall pay the cost.

Prior to the Phase 5 Premises Commencement Date, Landlord shall, following Landlord’s receipt of written request from Tenant, subject to Landlord’s standard non-reliance letter, deliver to Tenant copies of the surrender reports delivered to Landlord by the immediately prior occupant of the Phase 5 Premises.

Except as otherwise set forth in this Lease or the Work Letter: (i) Tenant shall accept the Phase 5 Premises in their “as-is” condition as of the Phase 5 Premises Commencement Date, subject to all applicable Legal Requirements; (ii) Landlord shall have no obligation for any defects in the Phase 5 Premises; and (iii) Tenant’s taking possession of the Phase 5 Premises shall be conclusive evidence that Tenant accepts the Phase 5 Premises and that the Phase 5 Premises were in good condition at the time possession was taken. Any occupancy of the Phase 5 Premises by Tenant before the Phase 5 Premises Commencement Date shall be subject to all of the terms and conditions of this Lease, including the obligation to pay Base Rent and Operating Expenses.

(f) Phase 6 Premises. Landlord shall use reasonable efforts to Deliver to Tenant in vacant, broom clean condition that portion of the Premises consisting of the Phase 6 Premises on or before the Phase 6 Premises Target Commencement Date. If Landlord fails to timely Deliver the Phase 6 Premises, Landlord shall not be liable to Tenant for any loss or damage resulting therefrom, and this Lease shall not be void or voidable. If Landlord does not Deliver the Phase 6 Premises to Tenant by the Phase 6 Premises Target Commencement Date (as such date may be extended by Force Majeure delays), then, Base Rent payable with respect to the Phase 6 Premises shall be abated 1 day for each day after the Phase 6 Premises Target Commencement Date that Landlord fails to Deliver the Phase 6 Premises to Tenant. The “Phase 6 Premises Commencement Date” shall be the date Landlord Delivers the Phase 6 Premises to Tenant; provided, however, that in no event shall that Phase 6 Premises Commencement Date occur prior to the Phase 6 Premises Target Commencement Date. The “Phase 6 Premises Target Commencement Date” is December 1, 2020.

Provided that Tenant shall have notified Landlord in writing within 120 consecutive days after the Phase 6 Premises Commencement Date of any manner in which the Building Systems serving the Phase 6 Premises are not in good operating condition, Landlord shall, at its sole cost and expense (which shall not constitute an Operating Expense), be responsible for any repairs that are required to be made to such Building Systems, unless Tenant or any Tenant Party was responsible for the cause of such repair, in which case Tenant shall pay the cost.

Prior to the Phase 6 Premises Commencement Date, Landlord shall, following Landlord’s receipt of written request from Tenant, subject to Landlord’s standard non-reliance letter, deliver to Tenant copies of the surrender reports delivered to Landlord by the immediately prior occupant of the Phase 6 Premises.

Except as otherwise set forth in this Lease or the Work Letter: (i) Tenant shall accept the Phase 6 Premises in their “as-is” condition as of the Phase 6 Premises Commencement Date, subject to all applicable Legal Requirements; (ii) Landlord shall have no obligation for any defects in the Phase 6 Premises; and (iii) Tenant’s taking possession of the Phase 6 Premises shall be conclusive evidence that Tenant accepts the Phase 6 Premises and that the Phase 6 Premises were in good condition at the time possession was taken. Any occupancy of the Phase 6 Premises by Tenant before the Phase 6 Premises Commencement Date shall be subject to all of the terms and conditions of this Lease, including the obligation to pay Base Rent and Operating Expenses.

(g) General. Upon request of Landlord, Tenant shall execute and deliver one or more written acknowledgments reflecting the Phase 1 Premises Commencement Date, the Phase 2 Non-Sublease Premises Commencement Date, the Phase 2 Sublease Premises Commencement Date, the Phase 3 Premises Commencement Date, the Phase 4 Premises Commencement Date, and the Phase 5 Premises
Premises Commencement Date, the Phase 6 Premises Commencement Date and the expiration date of the Term when such are established in the form of the “Acknowledgement of Commencement Date” attached to this Lease as Exhibit D; provided, however, Tenant’s failure to execute and deliver such acknowledgment shall not affect Landlord’s rights hereunder. The “Term” of this Lease shall be the Base Term, as defined above on the first page of this Lease and any Extension Terms which Tenant may elect pursuant to Section 40 hereof. The Phase 1 Premises Commencement Date, the Phase 2 Premises Commencement Date, the Phase 3 Premises Commencement Date, the Phase 4 Premises Commencement Date, the Phase 5 Premises Commencement Date and the Phase 6 Premises Commencement Date may each be referred to herein respectively as a “Commencement Date.” The Phase 1 Premises, the Phase 2 Premises, the Phase 3 Premises, the Phase 4 Premises, the Phase 5 Premises and the Phase 6 Premises may each be referred to herein as a “Phase” of the Premises.

Tenant agrees and acknowledges that neither Landlord nor any agent of Landlord has made any representation or warranty with respect to the condition of all or any portion of the Premises or the Project, and/or the suitability of the Premises or the Project for the conduct of Tenant’s business, and Tenant waives any implied warranty that the Premises or the Project are suitable for the Permitted Use. This Lease constitutes the complete agreement of Landlord and Tenant with respect to the subject matter hereof and supersedes any and all prior representations, inducements, promises, agreements, understandings and negotiations which are not contained herein.

3. Rent.

(a) **Base Rent.** Base Rent for the month in which the Phase 1 Premises Commencement Date occurs shall be due and payable on the date that is 60 days prior to the Phase 1 Premises Target Commencement Date and Base Rent for the month in which each subsequent Commencement Date occurs shall be due and payable on or before such Commencement Date. Tenant shall pay to Landlord in advance, without demand, abatement, deduction or set-off, equal monthly installments of Base Rent on or before the first day of each calendar month during the Term hereof beginning with respect to each respective Phase of the Premises on the respective Commencement Date for such Phase of the Premises, in lawful money of the United States of America, at the office of Landlord for payment of Rent set forth above, or to such other person or at such other place as Landlord may from time to time designate in writing. Payments of Base Rent for any fractional calendar month shall be prorated. The obligation of Tenant to pay Base Rent and other sums to Landlord and the obligations of Landlord under this Lease are independent obligations. Tenant shall have no right at any time to abate, reduce, or set-off any Rent (as defined in Section 5) due hereunder except for any abatement as may be expressly provided in this Lease.

(b) **Additional Rent.** In addition to Base Rent, Tenant agrees to pay to Landlord as additional rent (“Additional Rent”): (i) commencing with respect to each respective Phase of the Premises on the respective Commencement Date for such Phase of the Premises, Tenant’s Share of “Operating Expenses” (as defined in Section 5), and (ii) any and all other amounts Tenant assumes or agrees to pay under the provisions of this Lease, including, without limitation, any and all other sums that may become due by reason of any default of Tenant or failure to comply with the agreements, terms, covenants and conditions of this Lease to be performed by Tenant, after any applicable notice and cure period.

4. Base Rent Adjustments.

(a) **Annual Adjustments.** Base Rent shall be increased on January 1, 2019, and on each January 1st thereafter during the Base Term (each an “Adjustment Date”) by multiplying the Base Rent per rentable square foot payable immediately before such Adjustment Date by the Rent Adjustment Percentage and adding the resulting amount to the Base Rent per rentable square foot payable immediately before such Adjustment Date. Base Rent, as so adjusted, shall thereafter be due as provided herein. Base Rent adjustments for any fractional calendar month shall be prorated. For the avoidance of doubt, (i) the Base Rent payable with respect to any Phase of the Premises with respect to
which the Commencement Date occurs in the 2019 calendar year shall be $73.80 per rentable square foot of such Phase per year, which Base Rent shall increase by the Adjustment Percentage on each Adjustment Date, and (ii) the Base Rent payable with respect to any Phase of the Premises with respect to which the Commencement Date occurs in the 2020 calendar year shall be $75.65 per rentable square foot of such Phase per year, which Base Rent shall increase by the Adjustment Percentage on each Adjustment Date.

(b) Additional TI Allowance. In addition to the Tenant Improvement Allowance (as defined in the Work Letter), Landlord shall, subject to the terms of the Work Letter, make available to Tenant the Additional Tenant Improvement Allowance (as defined in the Work Letter). Commencing on the date that any portion of the Additional Tenant Improvement Allowance is first funded and continuing thereafter on the first day of each month during the Base Term, Tenant shall pay the amount necessary to fully amortize the portion of the Additional Tenant Improvement Allowance actually funded by Landlord, if any, in equal monthly payments with interest at a rate of 8.25% per annum over the remainder of the Base Term, which interest shall begin to accrue on the date that Landlord first disburses such Additional Tenant Improvement Allowance or any portion(s) thereof. Tenant acknowledges that because the Additional Tenant Improvement Allowance may be disbursed to Tenant in multiple phases following the Phase 1 Premises Commencement Date, the Additional Rent payable by Tenant pursuant to this Section 4(b) may be adjusted following each such disbursement. Any of the Additional Tenant Improvement Allowance and applicable interest remaining unpaid as of the expiration or earlier termination of the Lease shall be paid to Landlord in a lump sum at the expiration or earlier termination of this Lease.

5. Operating Expense Payments. Landlord shall deliver to Tenant a written estimate of Operating Expenses for each calendar year during the Term (the “Annual Estimate”), which may be revised by Landlord from time to time during such calendar year. Commencing with respect to each respective Phase of the Premises on the respective Commencement Date for such Phase of the Premises, and continuing thereafter on the first day of each month during the Term, Tenant shall pay Landlord an amount equal to 1/12th of Tenant’s Share of the Annual Estimate. Payments for any fractional calendar month shall be prorated.

The term “Operating Expenses” means all costs and expenses of any kind or description whatsoever incurred or accrued each calendar year by Landlord with respect to the Building (including the Building’s Share of Project of all other costs and expenses of any kind or description incurred or accrued by Landlord with respect to the Project and the Condominium (including without limitation all costs of compliance with the PTDM, as hereinafter defined) which are not specific to the Building or any other building located in the Project) (including, without duplication, Taxes (as defined in Section 9), capital repairs and improvements amortized over the lesser of 10 years and the useful life of such capital items, excluding only:

(a) the original construction costs of the Project and renovation prior to the date of the Lease and costs of correcting defects in such original construction or renovation;
(b) capital expenditures for expansion of the Project;
(c) interest, principal payments of Mortgage (as defined in Section 27) debts of Landlord, financing costs and amortization of funds borrowed by Landlord, whether secured or unsecured, and all payments of base rent (but not taxes or operating expenses) under any ground lease or other underlying lease of all or any portion of the Project;
(d) depreciation of the Project (except for capital improvements, the cost of which are includable in Operating Expenses);
(e) advertising, legal and space planning expenses and leasing commissions and other costs and expenses incurred in procuring and leasing space to tenants for the Project, including any leasing office maintained in the Project, free rent and construction allowances for tenants;
(f) legal and other expenses incurred in the negotiation or enforcement of leases;

(g) completing, fixturing, improving, renovating, painting, redecorating or other work, which Landlord pays for or performs for other tenants within their premises, and costs of correcting defects in such work;

(h) costs to be reimbursed by other tenants of the Project or Taxes to be paid directly by Tenant or other tenants of the Project, whether or not actually paid;

(i) salaries, wages, benefits and other compensation paid to officers and employees of Landlord who are not assigned in whole or in part to the operation, management, maintenance or repair of the Project;

(j) general organizational, administrative and overhead costs relating to maintaining Landlord’s existence, either as a corporation, partnership, or other entity, including general corporate, legal and accounting expenses;

(k) costs (including attorneys’ fees and costs of settlement, judgments and payments in lieu thereof) incurred in connection with disputes with tenants, other occupants, or prospective tenants, and costs and expenses, including legal fees, incurred in connection with negotiations or disputes with employees, consultants, management agents, leasing agents, purchasers or mortgagees of the Building;

(l) costs incurred by Landlord due to the violation by Landlord, its employees, agents or contractors or any tenant of the terms and conditions of any lease of space in the Project or any Legal Requirement (as defined in Section 7);

(m) penalties, fines or interest incurred as a result of Landlord’s inability or failure to make payment of Taxes and/or to file any tax or informational returns when due, or from Landlord’s failure to make any payment of Taxes required to be made by Landlord hereunder before delinquency;

(n) overhead and profit increment paid to Landlord or to subsidiaries or affiliates of Landlord for goods and/or services in or to the Project to the extent the same exceeds the costs of such goods and/or services rendered by unaffiliated third parties on a competitive basis;

(o) costs of Landlord’s charitable or political contributions, or of fine art maintained at the Project;

(p) costs in connection with services (including electricity), items or other benefits of a type which are not standard for the Project and which are not available to Tenant without specific charges therefor, but which are provided to another tenant or occupant of the Project, whether or not such other tenant or occupant is specifically charged therefor by Landlord;

(q) costs incurred in the sale or refinancing of the Project;

(r) any costs incurred to remove, study, test or remediate Hazardous Materials in or about the Building or the Project (provided, however, that the foregoing is in no event intended to limit Tenant’s obligations under Section 28 or Section 30 of this Lease);

(s) reserves;

(t) insurance deductibles in excess of deductibles that Tenant can demonstrate are in excess of customary deductible amounts carried by institutional owners of comparable projects in the Cambridge area;
(u) net income taxes of Landlord or the owner of any interest in the Project, franchise, capital stock, gift, estate or inheritance taxes or any federal, state or local documentary taxes imposed against the Project or any portion thereof or interest therein; and

(v) any expenses otherwise includable within Operating Expenses to the extent actually reimbursed by persons other than tenants of the Project under leases for space in the Project.

In addition to the Operating Expenses payable by Tenant pursuant to this Section 5, Tenant shall pay to Landlord administration rent in the amount of 3% of Base Rent and such management fee shall be reflected as a separate line item on the Annual Statement (as defined below).

Within 90 days after the end of each calendar year (or such longer period as may be reasonably required), Landlord shall furnish to Tenant a statement (an "Annual Statement") showing in reasonable detail: (a) the total and Tenant’s Share of actual Operating Expenses for the previous calendar year in line item detail, and (b) the total of Tenant’s payments in respect of Operating Expenses for such year. If Tenant’s Share of actual Operating Expenses for such year exceeds Tenant’s payments of Operating Expenses for such year, the excess shall be due and payable by Tenant as Rent within 30 days after delivery of such Annual Statement to Tenant. If Tenant’s payments of Operating Expenses for such year exceed Tenant’s Share of actual Operating Expenses for such year Landlord shall pay the excess to Tenant within 30 days after delivery of such Annual Statement, except that after the expiration, or earlier termination of the Term or if Tenant is delinquent in its obligation to pay Rent, Landlord shall pay the excess to Tenant after deducting all other amounts due Landlord.

The Annual Statement shall be final and binding upon Tenant unless Tenant, within 120 days after Tenant’s receipt thereof, shall contest any item therein by giving written notice to Landlord, specifying each item contested and the reason therefor. If, during such 120 day period, Tenant reasonably and in good faith questions or contests the accuracy of Landlord’s statement of Tenant’s Share of Operating Expenses, Landlord will provide Tenant with access to Landlord’s books and records relating to the operation of the Project and such information as Landlord reasonably determines to be responsive to Tenant’s questions (the “Expense Information”). If after Tenant’s review of such Expense Information, Landlord and Tenant cannot agree upon the amount of Tenant’s Share of Operating Expenses, then Tenant shall have the right to have a regionally recognized independent public accounting firm selected by Tenant, working pursuant to a fee arrangement other than a contingent fee (at Tenant’s sole cost and expense) and approved by Landlord (which approval shall not be unreasonably withheld, conditioned or delayed), audit and/or review the Expense Information for the year in question (the “Independent Review”). The results of any such Independent Review shall be binding on Landlord and Tenant. If the Independent Review shows that the payments actually made by Tenant with respect to Operating Expenses for the calendar year in question exceeded Tenant’s Share of Operating Expenses for such calendar year, Landlord shall at Landlord’s option either (i) credit the excess amount to the next succeeding installment of estimated Operating Expenses or (ii) pay the excess to Tenant within 30 days after delivery of such statement, except that after the expiration or earlier termination of this Lease or if Tenant is delinquent in its obligation to pay Rent, Landlord shall pay the excess to Tenant after deducting all other amounts due Landlord. If the Independent Review shows that Tenant’s payments with respect to Operating Expenses for such calendar year were less than Tenant’s Share of Operating Expenses for the calendar year, Tenant shall pay the deficiency to Landlord within 30 days after delivery of such statement. If any such Independent Review shows that Tenant has overpaid with respect to Operating Expenses by more than 5% then Landlord shall reimburse Tenant for all costs incurred by Tenant for the Independent Review. Operating Expenses for the calendar years in which Tenant’s obligation to share therein begins and ends shall be prorated. Notwithstanding anything set forth herein to the contrary, if the Building is not at least 95% occupied on average during any year of the Term, Tenant’s Share of Operating Expenses for such year shall be computed as though the Building had been 95% occupied on average during such year.
“Tenant’s Share” shall be the percentage set forth in the Basic Lease Provisions as Tenant’s Share as reasonably adjusted by Landlord for changes in the physical size of the Premises, Building or Project occurring thereafter. Landlord may equitably increase Tenant’s Share for any item of expense or cost reimbursable by Tenant that relates to a repair, replacement, or service that benefits only the Premises or only a portion of the Project that includes the Premises or that varies with occupancy or use. Base Rent, Tenant’s Share of Operating Expenses and all other amounts payable by Tenant to Landlord hereunder are collectively referred to herein as “Rent.”

6. Security Deposit. Tenant shall deposit with Landlord a security deposit (the “Security Deposit”) for the performance of all of Tenant’s obligations hereunder in the amount set forth on page 1 of this Lease, as follows: (i) $33,210 of the Security Deposit shall be delivered to Landlord upon delivery of an executed original of this Lease to Landlord, (ii) $947,286 of the Security Deposit shall be delivered to Landlord on or before the date that is 60 days prior to the Phase 2 Sublease Premises Commencement Date, (iii) $328,734 of the Security Deposit shall be delivered to Landlord on or before the date that is 60 days prior to the Phase 3 Premises Commencement Date, (iv) $321,426 of the Security Deposit shall be delivered to Landlord on or before the date that is 60 days prior to the Phase 4 Premises Commencement Date, (v) $291,384 of the Security Deposit shall be delivered to Landlord on or before the date that is 60 days prior to the Phase 5 Premises Commencement Date, and (vi) $323,640 of the Security Deposit shall be delivered to Landlord on or before the date that is 60 days prior to the Phase 6 Premises Commencement Date. The Security Deposit shall be in the form of an unconditional and irrevocable letter of credit (the “Letter of Credit”): (i) in form and substance satisfactory to Landlord, (ii) naming Landlord as beneficiary, (iii) expressly allowing Landlord to draw upon it at any time from time to time by delivering to the issuer notice that Landlord is entitled to draw thereunder, (iv) issued by Silicon Valley Bank or another FDIC-insured financial institution satisfactory to Landlord, and (v) redeemable by presentation of a sight draft in the State of California, the Commonwealth of Massachusetts or another state reasonably acceptable by Landlord. If Tenant does not provide Landlord with a substitute Letter of Credit complying with all of the requirements hereof at least 10 days before the stated expiration date of any then current Letter of Credit, Landlord shall have the right to draw the full amount of the current Letter of Credit and hold the funds drawn in cash without obligation for interest thereon as the Security Deposit. The Security Deposit shall be held by Landlord as security for the performance of Tenant’s obligations under this Lease. The Security Deposit is not an advance rental deposit or a measure of Landlord’s damages in case of Tenant’s default. Upon each occurrence of a Default (as defined in Section 20), Landlord may use all or any part of the Security Deposit to pay delinquent payments due under this Lease, future rent damages, and the cost of any damage, injury, expense or liability caused by such Default, without prejudice to any other remedy provided herein or provided by law. Landlord’s right to use the Security Deposit under this Section 6 includes the right to use the Security Deposit to pay future rent damages following the termination of this Lease pursuant to Section 21(c) below. Tenant hereby waives the provisions of any law, now or hereafter in force, which provide that Landlord may claim from a security deposit only those sums reasonably necessary to remedy defaults in the payment of Rent, to repair damage caused by Tenant or to clean the Premises, it being agreed that Landlord may, in addition, claim those sums reasonably necessary to compensate Landlord for any other loss or damage, foreseeable or unforeseeable, caused by the act or omission of Tenant or any officer, employee, agent or invitee of Tenant. Upon bankruptcy or other debtor-creditor proceedings against Tenant, the Security Deposit shall be deemed to be applied first to the payment of Rent and other charges due Landlord for periods prior to the filing of such proceedings. Upon any such use of all or any portion of the Security Deposit, Tenant shall, within 5 business days after demand from Landlord, restore the Security Deposit to its original amount. If Tenant shall fully perform every provision of this Lease to be performed by Tenant, the Security Deposit, or any balance thereof (i.e., after deducting therefrom all amounts to which Landlord is entitled under the provisions of this Lease), shall be returned to Tenant (or, at Landlord’s option, to the last assignee of Tenant’s interest hereunder) within 60 days after the expiration or earlier termination of this Lease.

Notwithstanding anything to the contrary contained in this Lease, if Landlord at any time disburses more than 50% of the Additional Tenant Improvement Allowance pursuant to the terms of the Work Letter, the Security Deposit shall, within 10 days after Landlord’s disbursement of more than 50% of the Additional Tenant Improvement Allowance, be increased by an amount equal to $12.00 per rentable square foot of the Phases of the Premises previously Delivered to Landlord and, if applicable, thereafter.
as each remaining Phase of the Premises is Delivered, the portion of the Security Deposit to be delivered as provided above shall be increased by $12.00 per rentable square foot of each applicable Phase. If the amount of the Security Deposit is increased as provided for in the immediately preceding sentence, then Tenant shall either deliver a new Letter of Credit in a form reasonably acceptable to Landlord in the full amount of the increased Security Deposit or an amendment to the existing Letter of Credit increasing the amount of the Letter of Credit to the full amount of the increased Security Deposit.

If Landlord transfers its interest in the Project or this Lease, Landlord shall either (a) transfer any Security Deposit then held by Landlord to a person or entity assuming Landlord’s obligations under this Section 6, or (b) return to Tenant any Security Deposit then held by Landlord and remaining after the deductions permitted herein. Upon such transfer to such transferee or the return of the Security Deposit to Tenant, Landlord shall have no further obligation with respect to the Security Deposit, and Tenant’s right to the return of the Security Deposit shall apply solely against Landlord’s transferee. The Security Deposit is not an advance rental deposit or a measure of Landlord’s damages in case of Tenant’s default. Landlord’s obligation respecting the Security Deposit is that of a debtor, not a trustee, and no interest shall accrue thereon.

7. Use. The Premises shall be used solely for the Permitted Use set forth in the Basic Lease Provisions, and in compliance with all laws, orders, judgments, ordinances, regulations, codes, directives, permits, licenses, covenants and restrictions now or hereafter applicable to the Premises, and to the use and occupancy thereof, including, without limitation, the Americans With Disabilities Act, 42 U.S.C. § 12101, et seq. (together with the regulations promulgated pursuant thereto, “ADA”) (collectively, “Legal Requirements”) and each, a “Legal Requirement”. Tenant shall, upon 5 days’ written notice from Landlord, discontinue any use of the Premises which is declared by any Governmental Authority (as defined in Section 9) having jurisdiction to be a violation of a Legal Requirement. Tenant will not use or permit the Premises to be used for any purpose or in any manner that would void Tenant’s or Landlord’s insurance, increase the insurance risk, or cause the disallowance of any sprinkler or other credits. The use that Tenant has disclosed to Landlord that Tenant will be making of the Premises as of the Phase 1 Premises Commencement Date will not result in the voidance of or an increased insurance risk with respect to the insurance currently being maintained by Landlord. Tenant shall not permit any part of the Premises to be used as a “place of public accommodation”, as defined in the ADA or any similar legal requirement. Tenant shall reimburse Landlord promptly upon demand for any additional premium charged for any such insurance policy by reason of Tenant’s failure to comply with the provisions of this Section or otherwise caused by Tenant’s use and/or occupancy of the Premises. Tenant will use the Premises in a careful, safe and proper manner and will not commit or permit waste, overload the floor or structure of the Premises, subject the Premises to use that would damage the Premises or obstruct or interfere with the rights of Landlord or other tenants or occupants of the Project, including conducting or giving notice of any auction, liquidation, or going out of business sale on the Premises, or using or allowing the Premises to be used for any unlawful purpose. Tenant shall cause any equipment or machinery to be installed in the Premises so as to reasonably prevent sounds or vibrations from the Premises from extending into Common Areas, or other space in the Project. Tenant shall not place any machinery or equipment weighing 500 pounds or more in or upon the Premises or transport or move such items through the Common Areas of the Project or in the Project elevators without the prior written consent of Landlord, which consent shall not be unreasonably withheld, conditioned or delayed. Tenant shall not, without the prior written consent of Landlord, which consent shall not be unreasonably withheld, conditioned or delayed, use the Premises in any manner which will require ventilation, air exchange, heating, gas, steam, electricity or water beyond the existing capacity of the Project as proportionately allocated to the Premises based upon Tenant’s Share as usually furnished for the Permitted Use.

Landlord has disclosed to Tenant that the Project is the subject of an Activity and Use Limitation, which is incorporated herein by reference, and Tenant acknowledges receipt of a copy of such Activity and Use Limitation prior to execution of this Lease.
Tenant, at its sole expense, shall make any alterations or modifications to the interior or the exterior of the Premises or the Project that are required by Legal Requirements (including, without limitation, compliance of the Premises with the ADA) related to Tenant’s particular use or occupancy of the Premises or Tenant’s Alterations. Notwithstanding any other provision herein to the contrary, Tenant shall be responsible for any and all demands, claims, liabilities, losses, costs, expenses, actions, causes of action, damages or judgments, and all reasonable expenses incurred in investigating or resisting the same (including, without limitation, reasonable attorneys’ fees, charges and disbursements and costs of suit) (collectively, “Claims”) arising out of or in connection with Legal Requirements related to Tenant’s particular use or occupancy of the Premises or Tenant’s Alterations, and Tenant shall indemnify, defend, hold and save Landlord harmless from and against any and all Claims arising out of or in connection with any failure of the Premises to comply with any Legal Requirement related to Tenant’s particular use or occupancy of the Premises or Tenant’s Alterations.

8. Holding Over. If, with Landlord’s express written consent, Tenant retains possession of the Premises after the expiration of the Term, (i) unless otherwise agreed in such written consent, such possession shall be subject to immediate termination by Landlord at any time, (ii) all of the other terms and provisions of this Lease (including, without limitation, the adjustment of Base Rent pursuant to Section 4 hereof) shall remain in full force and effect (excluding any expansion or renewal option or other similar right or option) during such holdover period, (iii) Tenant shall continue to pay Base Rent in the amount payable upon the date of the expiration or earlier termination of this Lease or such other amount as Landlord may indicate, in Landlord’s sole and absolute discretion, in such written consent, and (iv) all other payments shall continue under the terms of this Lease. If Tenant remains in possession of the Premises after the expiration or earlier termination of the Term without the express written consent of Landlord, (A) Tenant shall become a tenant at sufferance upon the terms of this Lease except that the monthly rental shall be equal to 150% of Rent in effect during the last 30 days of the Term, and (B) Tenant shall be responsible for all damages suffered by Landlord resulting from or occasioned by any holding over by Tenant for more than 30 days, including consequential damages. No holding over by Tenant, whether with or without consent of Landlord, shall operate to extend this Lease except as otherwise expressly provided, and this Section 8 shall not be construed as consent for Tenant to retain possession of the Premises. Acceptance by Landlord of Rent after the expiration of the Term or earlier termination of this Lease shall not result in a renewal or reinstatement of this Lease.

9. Taxes. Landlord shall pay, as part of Operating Expenses, all taxes, levies, fees, assessments and governmental charges of any kind, existing as of the Phase 1 Premises Commencement Date or thereafter enacted (collectively referred to as “Taxes”), imposed by any federal, state, regional, municipal, local or other governmental authority or agency, including, without limitation, quasi-public agencies (collectively, “Governmental Authority”) during the Term, including, without limitation, all Taxes: (i) imposed on or measured by or based, in whole or in part, on rent payable to (or gross receipts received by) Landlord under this Lease and/or from the rental by Landlord of the Project or any portion thereof, or (ii) based on the square footage, assessed value or other measure or evaluation of any kind of the Premises or the Project, or (iii) assessed or imposed by or on the operation or maintenance of any portion of the Premises or the Project, including parking, or (iv) assessed or imposed by, or at the direction of, or resulting from Legal Requirements, or interpretations thereof, promulgated by, any Governmental Authority, (v) imposed as a license or other fee, charge, tax or assessment on Landlord’s business or occupation of leasing space in the Project, or (vi) assessed or imposed by or on the operation or maintenance of any portion or whole of the Condominium (provided that to the extent any Taxes are assessed against the Condominium as a whole, such amounts shall be allocated among the buildings located in the Condominium based on the square footage of the buildings in question, unless Landlord reasonably determines that such allocation should be made on another basis). Landlord may contest by appropriate legal proceedings the amount, validity, or application of any Taxes or liens securing Taxes. Taxes shall not include any net income taxes imposed on Landlord except to the extent such net income taxes are in substitution for any Taxes payable hereunder. If any Such Tax is levied or assessed directly against Tenant, then Tenant shall be responsible for and shall pay the same at such times and in such manner as the taxing authority shall require. Tenant shall pay, prior to delinquency, any and all Taxes levied or assessed against any personal property or trade fixtures placed by Tenant in the Premises, whether levied or assessed against Landlord or Tenant. If any Taxes on Tenant’s personal property or trade fixtures are levied against Landlord or Landlord’s property, or if the assessed valuation
of the Project is increased by a value attributable to improvements in or alterations to the Premises, whether owned by Landlord or Tenant and whether or not affixed to the real property so as to become a part thereof, higher than the base valuation on which Landlord from time-to-time allocates Taxes to all tenants in the Project, Landlord shall have the right, but not the obligation, to pay such Taxes. Landlord’s determination of any excess assessed valuation shall be binding and conclusive, absent manifest error. The amount of any such payment by Landlord shall constitute Additional Rent due from Tenant to Landlord immediately upon demand.

10. Parking. Subject to all matters of record, Force Majeure, a Taking (as defined in Section 19 below) and the exercise by Landlord of its rights hereunder, commencing with respect to each Phase of the Premises on the Commencement Date for such Phase, Landlord shall make available and Tenant shall have the right to use 0.9 parking spaces per 1,000 rentable square feet of each Phase of the Premises in the Technology Square Garage (“Parking Space Cap”) on a non-exclusive basis at market rates in those areas designated for non-reserved parking, subject in each case to Landlord’s reasonable rules and regulations. Tenant shall pay to Landlord or as directed by Landlord, monthly as Additional Rent hereunder, the market rate for each parking space, as reasonably determined by Landlord from time to time, which as of the date hereof shall be $275.00 per space per month. Prior to the Commencement Date of each respective Phase of the Premises, Tenant shall deliver written notice to Landlord reflecting the number of parking spaces, up to the Parking Space Cap (as it relates to the applicable Phase of the Premises), that Tenant has elected to use as of such Commencement Date. Subject to the immediately following sentence, Tenant shall have the right, upon 30 days’ written notice to Landlord, to increase or decrease the number of parking spaces then being used by Tenant; provided, however, that in no event shall Tenant be entitled at any time to use any parking spaces in excess of the Parking Space Cap. If Tenant has delivered written notice to Landlord requesting additional parking spaces and Landlord determines that the additional parking spaces desired by Tenant are available for use by Tenant, Landlord shall notify Tenant in writing and Tenant shall commence leasing and paying for such additional parking spaces on the date that is 30 days after Landlord’s receipt of Tenant’s written notice. Landlord shall not be responsible for enforcing Tenant’s parking rights against any third parties, including other tenants of the Project. Tenant shall, at Tenant’s sole expense, for so long as the Parking and Traffic Demand Management Plan dated May 9, 1999 as approved by the City of Cambridge on July 9, 1999, including the conditions set forth in such approval (as amended from time to time, the “PTDM”), remains applicable to the Condominium, (i) offer to subsidize mass transit monthly passes for all of its employees; (ii) implement a Commuter Choice Program; (iii) discourage single-occupant vehicle (“SOV”) use by its employees; (iv) promote alternative modes of transportation and use of alternative work hours; (v) meet with Landlord and/or its representatives no more than quarterly discuss transportation programs and initiatives; (vi) participate in annual surveys monitoring transportation programs and initiatives at Technology Square; (vii) cooperate with Landlord in connection with transportation programs and initiatives promulgated pursuant to the PTDM; (viii) provide alternative work programs (such as telecommuting, flex-time and compressed work weeks) to its employees in order to reduce traffic impacts in Cambridge during peak commuter hours; and (ix) otherwise cooperate with Landlord in encouraging employees to seek alternate modes of transportation.

11. Utilities, Services. Landlord shall provide, subject to the terms of this Section 11, water, electricity, heat, light, power, sewer, other utilities (including gas and fire sprinklers to the extent the Project is plumbed for such services), and with respect to the Common Areas, refuse and trash collection and janitorial services (collectively, “Utilities”). Landlord shall pay, as Operating Expenses or subject to Tenant’s reimbursement obligation, for all Utilities used on the Premises, all maintenance charges for Utilities, and any storm sewer charges or other similar charges for Utilities imposed by any Governmental Authority or Utility provider, and any taxes, penalties (excluding penalties resulting from Landlord’s failure to pay such amounts, except to the extent Landlord’s failure results from Tenant’s failure to pay Operating Expenses due hereunder), surcharges or similar charges thereon. Landlord may cause, at Tenant’s expense, any other Utilities to be separately metered or charged directly to Tenant by the provider. Tenant shall pay directly to the Utility provider, prior to delinquency, any separately metered Utilities and services which may be furnished to Tenant or the Premises during the Term. Tenant shall pay, as part of Operating Expenses, its share of all charges for jointly metered Utilities based upon consumption, as
reasonably determined by Landlord. No interruption or failure of Utilities, from any cause whatsoever other than Landlord’s willful misconduct, shall result in eviction or constructive eviction of Tenant, termination of this Lease or the abatement of Rent. Tenant agrees to limit use of water and sewer with respect to Common Areas to normal restroom use. Tenant shall be responsible for obtaining and paying for its own janitorial services for the Premises.

Notwithstanding anything to the contrary set forth herein, if (i) a stoppage of an Essential Service (as defined below) to the Premises shall occur and such stoppage is due solely to the gross negligence or willful misconduct of Landlord and not due in any part to any act or omission on the part of Tenant or any Tenant Party or any matter beyond Landlord’s reasonable control (any such stoppage being hereinafter referred to as a “Service Interruption”), and (ii) such Service Interruption continues for more than 5 consecutive business days after Landlord shall have received written notice thereof from Tenant, and (iii) as a result of such Service Interruption, the conduct of Tenant’s normal operations in the Premises are materially and adversely affected, then, there shall be an abatement of one day’s Base Rent and Operating Expenses for each day during which such Service Interruption continues after such 5 business day period; provided, however, that if any part of the Premises is reasonably useable for Tenant’s normal business operations or if Tenant conducts all or any part of its operations in any portion of the Premises notwithstanding such Service Interruption, then the amount of each daily abatement of Base Rent and Operating Expenses shall be equitably proportionate to the nature and extent of the interruption of Tenant’s normal operations or ability to use the Premises. The rights granted to Tenant under this paragraph shall be Tenant’s sole and exclusive remedy resulting from a failure of Landlord to provide services, and Landlord shall not otherwise be liable for any loss or damage suffered or sustained by Tenant resulting from any failure or cessation of services. For purposes hereof, the term “Essential Services” shall mean the following services: HVAC service, water, sewer and electricity, but in each case only to the extent that Landlord has an obligation to provide such HVAC service, water, sewer and electricity to Tenant under this Lease.

Landlord’s sole obligation for either providing emergency generators or providing emergency back-up power to Tenant shall be: (i) to provide emergency generators with not less than a capacity of 4 watts per rentable square foot of the then existing Premises, and (ii) to contract with a third party to maintain the emergency generators as per the manufacturer’s standard maintenance guidelines. Notwithstanding anything to the contrary contained herein, Landlord shall, at least once per month as part of the maintenance of the Building, run the emergency generator for a period reasonably determined by Landlord for the purpose of determining whether it operates when started. Landlord shall, upon written request from Tenant, make available the maintenance contract and maintenance records for the emergency generators for the 12 month period immediately preceding Landlord’s receipt of Tenant’s written request. Landlord shall have no obligation to supervise, oversee or confirm that the third party maintaining the emergency generators is maintaining the generators as per the manufacturer’s standard guidelines or otherwise. During any period of replacement, repair or maintenance of the emergency generators when the emergency generators are not operational, including any delays thereto due to the inability to obtain parts or replacement equipment, Landlord shall have no obligation to provide Tenant with an alternative back-up generator or generators or alternative sources of back-up power. Tenant expressly acknowledges and agrees that Landlord does not guaranty that such emergency generators will be operational at all times or that emergency power will be available to the Premises when needed.

12. Alterations and Tenant’s Property. Any alterations, additions, or improvements made to the Premises by or on behalf of Tenant, including additional locks or bolts of any kind or nature upon any doors or windows in the Premises, but excluding installation, removal or realignment of furniture systems (other than removal of furniture systems owned or paid for by Landlord) not involving any modifications to the structure or connections (other than by ordinary plugs or jacks) to Building Systems (as defined in Section 13) (“Alterations”) shall be subject to Landlord’s prior written consent, which may be given or withheld in Landlord’s sole discretion if any such Alteration affects the structure or Building Systems, but which shall otherwise not be unreasonably withheld or delayed. If Landlord approves any Alterations, Landlord may impose such conditions on Tenant in connection with the commencement, performance and completion of such Alterations as Landlord may deem appropriate in Landlord’s
reasonable discretion. Any request for approval shall be in writing, delivered not less than 15 business days in advance of any proposed construction, and accompanied by plans, specifications, bid proposals, work contracts and such other information concerning the nature and cost of the alterations as may be reasonably requested by Landlord, including the identities and mailing addresses of all persons performing work or supplying materials. Landlord's right to review plans and specifications and to monitor construction shall be solely for its own benefit, and Landlord shall have no duty to ensure that such plans and specifications or construction comply with applicable Legal Requirements. Tenant shall cause, at its sole cost and expense, all Alterations to comply with insurance requirements and with Legal Requirements and shall implement at its sole cost and expense any alteration or modification required by Legal Requirements as a result of any Alterations (subject to the terms of Section 7 above). Tenant shall pay to Landlord, as Additional Rent, on demand an amount equal to the reasonable out-of-pocket costs incurred by Landlord in connection with any Alteration. Before Tenant begins any Alteration, Landlord may post on and about the Premises notices of non-responsibility pursuant to applicable law. Tenant shall reimburse Landlord for, and indemnify and hold Landlord harmless from, any expense incurred by Landlord by reason of faulty work done by Tenant or its contractors, delays caused by such work, or inadequate cleanup.

Tenant shall, with respect to all Alterations, provide (and cause each contractor or subcontractor to provide) certificates of insurance for workers’ compensation and other coverage in amounts and from an insurance company satisfactory to Landlord protecting Landlord against liability for personal injury or property damage during construction. Upon completion of any Alterations, Tenant shall deliver to Landlord: (i) sworn statements setting forth the names of all contractors and subcontractors who did the work and final lien waivers from all such contractors and subcontractors; and (ii) “as built” plans for any such Alteration.

Except for Removable Installations (as hereinafter defined), all Installations (as hereinafter defined) shall be and shall remain the property of Landlord during the Term and following the expiration or earlier termination of the Term, shall not be removed by Tenant at any time during the Term, and shall remain upon and be surrendered with the Premises as a part thereof, provided, however, that an Installation may be removed by Tenant, at Tenant’s cost and expense, following the expiration of the useful life of such Installation so long as such Installation is replaced with an Installation of equal or better quality. Notwithstanding the foregoing, Landlord may, at the time its approval of any such Installation is requested, notify Tenant that Landlord requires that Tenant remove such Installation upon the expiration or earlier termination of the Term, in which event Tenant shall remove such Installation in accordance with the immediately succeeding sentence. Upon the expiration or earlier termination of the Term, Tenant shall remove (i) all wires, cables or similar equipment which Tenant has installed in the Premises or in the risers or plenums of the Building, (ii) any Installations for which Landlord has given Tenant notice of removal in accordance with the immediately preceding sentence, and (iii) all of Tenant’s Property (as hereinafter defined), and Tenant shall restore and repair any damage caused by or occasioned as a result of such removal, including, without limitation, capping off all such connections behind the walls of the Premises and repairing any holes. During any restoration period beyond the expiration or earlier termination of the Term, Tenant shall pay Rent to Landlord as provided herein as if said space were otherwise occupied by Tenant. If Landlord is requested by Tenant or any lender, lessor or other person or entity claiming an interest in any of Tenant’s Property to waive any lien Landlord may have against any of Tenant’s Property, and Landlord consents to such waiver, then Landlord shall be entitled to be paid as administrative rent a fee of $1,000 per occurrence for its time and effort in preparing and negotiating such a waiver of lien.

Other than (i) the items, if any, listed on Exhibit F attached hereto and any items agreed by Landlord in writing to be included on Exhibit F in the future (“Removable Installations”), and (ii) any trade fixtures, machinery, equipment and other personal property not paid for with the TI Fund which may be removed without material damage to the Premises, which damage shall be repaired (including capping or terminating utility hook-ups behind walls) by Tenant during the Term (collectively, “Tenant’s Property”), all property of any kind paid for by Landlord, all Alterations, real property fixtures, built-in machinery and equipment, built-in casework and cabinets and other similar additions and improvements

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built into the Premises so as to become an integral part of the Premises such as fume hoods which penetrate the roof or plenum area, built-in cold rooms, built-in warm rooms, walk-in cold rooms, walk-in warm rooms, deionized water systems, glass washing equipment, autoclaves, chillers, built-in plumbing, electrical and mechanical equipment and systems, and any power generator and transfer switch (collectively, “Installations”) shall be and shall remain the property of Landlord during the Term and following the expiration or earlier termination of the Term, shall not be removed by Tenant at any time during the Term and shall remain upon and be surrendered with the Premises as a part thereof in accordance with Section 28 following the expiration or earlier termination of this Lease; provided, however, that Landlord shall, at the time its approval of such Installation is requested notify Tenant if it has elected to cause Tenant to remove such Installation upon the expiration or earlier termination of this Lease. If Landlord so elects, Tenant shall remove such Installation upon the expiration or earlier termination of this Lease and restore any damage caused by or occasioned as a result of such removal, including, when removing any of Tenant’s Property which was plumbed, wired or otherwise connected to any of the Building Systems, capping off all such connections behind the walls of the Premises and repairing any holes. During any such restoration period, Tenant shall pay Rent to Landlord as provided herein as if said space were otherwise occupied by Tenant.

13. Landlord’s Repairs. Landlord, as an Operating Expense (except to the extent the cost thereof is excluded from Operating Expenses pursuant to Section 5 hereof), shall maintain all of the structural, exterior, parking and other Common Areas of the Project, including HVAC, plumbing, fire sprinklers, elevators and all other building systems serving the Premises and other portions of the Project (“Building Systems”), in good repair, reasonable wear and tear and uninsured losses and damages caused by Tenant, or by any of Tenant’s agents, servants, employees, invitees and contractors (collectively, “Tenant Parties”) excluded. Losses and damages caused by Tenant or any Tenant Party shall be repaired by Landlord, to the extent not covered by insurance, at Tenant’s sole cost and expense. Landlord reserves the right to stop Building Systems services when necessary (i) by reason of accident or emergency, or (ii) for planned repairs, alterations or improvements, which are, in the judgment of Landlord, desirable or necessary to be made, until said repairs, alterations or improvements shall have been completed. Landlord shall have no responsibility or liability for failure to supply Building Systems services during any such period of interruption; provided, however, that Landlord shall, except in case of emergency, make a commercially reasonable effort to give Tenant 24 hours advance notice of any planned stoppage of Building Systems services for routine maintenance, repairs, alterations or improvements. Tenant shall promptly give Landlord written notice of any repair required by Landlord pursuant to this Section, after which Landlord shall have a reasonable opportunity to effect such repair. Landlord shall not be liable for any failure to make any repairs or to perform any maintenance unless such failure shall persist for an unreasonable time after Tenant’s written notice of the need for such repairs or maintenance. Tenant waives its rights under any state or local law to terminate this Lease or to make such repairs at Landlord’s expense and agrees that the parties’ respective rights with respect to such matters shall be solely as set forth herein. Repairs required as the result of fire, earthquake, flood, vandalism, war, or similar cause of damage or destruction shall be controlled by Section 18.

14. Tenant’s Repairs. Subject to Section 12 hereof, Tenant, at its expense, shall repair, replace and maintain in good condition, subject to reasonable wear and tear and damage by fire and other casualty excepted, all portions of the Premises, including, without limitation, entries, doors, ceilings, interior windows, interior walls, and the interior side of demising walls. Such repair and replacement may include capital expenditures and repairs whose benefit may extend beyond the Term. Should Tenant fail to make any such repair or replacement or fail to maintain the Premises, Landlord shall give Tenant notice of such failure. If Tenant fails to commence cure of such failure within 10 days of Landlord’s notice, and thereafter diligently prosecute such cure to completion, Landlord may perform such work and shall be reimbursed by Tenant within 10 days after demand therefor; provided, however, that if such failure by Tenant creates or could create an emergency, Landlord may immediately commence cure of such failure and shall thereafter be entitled to recover the costs of such cure from Tenant. Subject to Sections 17 and 18, Tenant shall bear the full uninsured cost of any repair or replacement to any part of the Project that results from damage caused by Tenant or any Tenant Party and any repair that benefits only the Premises.
15. **Mechanic’s Liens.** Tenant shall discharge, by bond or otherwise, any mechanic’s lien filed against the Premises or against the Project for work claimed to have been done for, or materials claimed to have been furnished to, Tenant within 10 days after Tenant receives notice of the filing thereof, at Tenant’s sole cost and shall otherwise keep the Premises and the Project free from any liens arising out of work performed, materials furnished or obligations incurred by Tenant. Should Tenant fail to discharge any lien described herein, Landlord shall have the right, but not the obligation, to pay such claim or post a bond or otherwise provide security to eliminate the lien as a claim against title to the Project and the cost thereof shall be immediately due from Tenant as Additional Rent. If Tenant shall lease or finance the acquisition of office equipment, furnishings, or other personal property of a removable nature utilized by Tenant in the operation of Tenant’s business, Tenant warrants that any Uniform Commercial Code Financing Statement filed as a matter of public record by any lessor or creditor of Tenant will upon its face or by exhibit thereto indicate that such Financing Statement is applicable only to removable personal property of Tenant located within the Premises. In no event shall the address of the Project be furnished on the statement without qualifying language as to applicability of the lien only to removable personal property, located in an identified suite held by Tenant.

16. **Indemnification.** Tenant hereby indemnifies and agrees to defend, save and hold Landlord harmless from and against any and all Claims for injury or death to persons or damage to property occurring within or about the Premises, arising directly or indirectly out of use or occupancy of the Premises or a breach or default by Tenant in the performance of any of its obligations hereunder, unless caused solely by the willful misconduct or negligence of Landlord. Landlord shall not be liable to Tenant for, and Tenant assumes all risk of damage to, personal property (including, without limitation, loss of records kept within the Premises). Tenant further waives any and all Claims for injury to Tenant’s business or loss of income relating to any such damage or destruction of personal property (including, without limitation, any loss of records). Landlord shall not be liable for any damages arising from any act, omission or neglect of any tenant in the Project or of any other third party.

17. **Insurance.** Landlord shall maintain all risk property and, if applicable, sprinkler damage insurance covering the full replacement cost of the Project or such lesser coverage amount as Landlord may elect provided such coverage amount is not less than 90% of such full replacement cost. Landlord shall further procure and maintain commercial general liability insurance with a single loss limit of not less than $5,000,000 for bodily injury and property damage with respect to the Project. Landlord may, but is not obligated to, maintain such other insurance and additional coverages as it may deem necessary, including, but not limited to, flood, environmental hazard and earthquake, loss or failure of building equipment, errors and omissions, rental loss during the period of repair or rebuilding, workers’ compensation insurance and fidelity bonds for employees employed to perform services and insurance for any improvements installed by Tenant or which are in addition to the standard improvements customarily furnished by Landlord without regard to whether or not such are made a part of the Project. All such insurance shall be included as part of the Operating Expenses. The Project may be included in a blanket policy (in which case the cost of such insurance allocable to the Project will be determined by Landlord based upon the insurer’s cost calculations). Tenant shall also reimburse Landlord for any increased premiums or additional insurance which Landlord reasonably deems necessary as a result of Tenant’s particular use of the Premises.

Tenant, at its sole cost and expense, shall maintain during the Term: all risk property insurance with business interruption and extra expense coverage, covering the full replacement cost of all property and improvements installed or placed in the Premises by Tenant at Tenant’s expense; workers’ compensation insurance with no less than the minimum limits required by law; employer’s liability insurance with such limits as required by law; and commercial general liability insurance, with a minimum limit of not less than $2,000,000 per occurrence for bodily injury and property damage with respect to the Premises. The commercial general liability insurance policy shall name Alexandria Real Estate Equities, Inc. and Landlord, its officers, directors, employees and managers, and the Additional Insured Parties (as defined in the next succeeding paragraph) (collectively, “Landlord Parties”), as additional insureds; insure on an occurrence and not a claims-made basis; be issued by insurance companies which have a rating of not less than policyholder rating of A- and financial category rating of at least Class VIII in “Best’s
Insurance Guide”; contain a hostile fire endorsement and a contractual liability endorsement; and provide primary coverage to Landlord (any policy issued to Landlord providing duplicate or similar coverage shall be deemed excess over Tenant’s policies). Tenant shall (i) provide Landlord with 30 days advance written notice of cancellation of such commercial general liability policy, and (ii) request Tenant’s insurer to endeavor to provide 30 days advance written notice to Landlord of cancellation of such commercial general liability policy (or 10 days in the event of a cancellation due to non-payment of premium). Certificates of insurance showing the limits of coverage required hereunder and showing Landlord as an additional insured, along with reasonable evidence of the payment of premiums for the applicable period, shall be delivered to Landlord by Tenant upon commencement of the Term and upon each renewal of said insurance. Tenant’s policy may be a “blanket policy” with an aggregate per location endorsement which specifically provides that the amount of insurance shall not be prejudiced by other losses covered by the policy. Tenant shall, at least 5 days prior to the expiration of such policies, furnish Landlord with renewal certificates.

In each instance where insurance is to name Landlord as an additional insured, Tenant shall upon written request of Landlord also designate and furnish certificates so evidencing Landlord as additional insured to the following parties (collectively "Additional Insured Parties"): (i) any lender of Landlord holding a security interest in the Project or any portion thereof and any servicer in connection therewith, (ii) the landlord under any lease wherein Landlord is tenant of the real property on which the Project is located, if the interest of Landlord is or shall become that of a tenant under a ground or other underlying lease rather than that of a fee owner, (iii) any management company retained by Landlord to manage the Project, (iv) the condominium association with respect to the Condominium, (v) any member, partner or shareholder of Landlord or the owner of any beneficial interest therein and/or (vi) any other party reasonably designated by Landlord.

The property insurance obtained by Landlord and Tenant shall include a waiver of subrogation by the insurers and all rights based upon an assignment from its insured, against Landlord or Tenant, and their respective officers, directors, employees, managers, agents, invitees and contractors (“Related Parties”), in connection with any loss or damage thereby insured against. Neither party nor its respective Related Parties shall be liable to the other for loss or damage caused by any risk insured against under property insurance required to be maintained hereunder, and each party waives any claims against the other party, and its respective Related Parties, for such loss or damage. The failure of a party to insure its property shall not void this waiver. Landlord and its respective Related Parties shall not be liable for, and Tenant hereby waives all claims against such parties for, business interruption and losses occasioned thereby sustained by Tenant or any person claiming through Tenant resulting from any accident or occurrence in or upon the Premises or the Project from any cause whatsoever. If the foregoing waivers shall contravene any law with respect to exculpatory agreements, the liability of Landlord or Tenant shall be deemed not released but shall be secondary to the other’s insurer.

Landlord may require insurance policy limits to be raised to conform with requirements of Landlord’s lender and/or to bring coverage limits to levels then being generally required of new tenants within the Project; provided, however, that the increased amount of coverage is consistent with coverage amounts then being required by institutional owners of similar projects with tenants occupying similar size premises in the geographical area in which the Project is located.

18. Restoration. If, at any time during the Term, the Premises, or the Building are damaged or destroyed by a fire or other insured casualty, Landlord shall notify Tenant within 60 days after discovery of such damage as to the amount of time Landlord reasonably estimates it will take to restore the Building or the Premises, as applicable (the “Restoration Period”). If the Restoration Period is estimated to exceed 12 months (the “Maximum Restoration Period”), Landlord may, in such notice, elect to terminate this Lease as of the date that is 75 days after the date of discovery of such damage or destruction; provided, however, that notwithstanding Landlord’s election to restore, Tenant may elect to terminate this Lease by written notice to Landlord delivered within 5 business days of receipt of a notice from Landlord estimating a Restoration Period for the Premises longer than the Maximum Resto
receipt of sufficient insurance proceeds (with any deductible to be treated as a current Operating Expense), promptly restore the Premises (excluding the improvements installed by Tenant or by Landlord and paid for by Tenant), subject to delays arising from the collection of insurance proceeds, from Force Majeure events, or as needed to obtain any license, clearance or other authorization of any kind required to enter into and restore the Premises issued by any Governmental Authority having jurisdiction over the use, storage, handling, treatment, generation, release, disposal, removal or remediation of Hazardous Materials (as defined in Section 30) in, on or about the Premises (collectively referred to herein as “Hazardous Materials Clearances”); provided, however, that if repair or restoration of the Premises is not substantially complete as of the end of the Maximum Restoration Period or, if longer, the Restoration Period, Landlord may, in its sole and absolute discretion, elect not to proceed with such repair and restoration, or Tenant may by written notice to Landlord delivered within 5 business days of the expiration of the Maximum Restoration Period or, if longer, the Restoration Period, elect to terminate this Lease, in which event Landlord shall be relieved of its obligation to make such repairs or restoration and this Lease shall terminate as of the date that is 75 days after the later of: (i) discovery of such damage or destruction, or (ii) the date all required Hazardous Materials Clearances are obtained, but Landlord shall retain any Rent paid and the right to any Rent payable by Tenant prior to such election by Landlord or Tenant. Notwithstanding anything to the contrary contained herein, if a portion of the Project not including the Premises is damaged or destroyed such that, in Landlord’s reasonable discretion, such damage or destruction would impair Landlord’s operation or redevelopment of the Project, Landlord shall have the right to terminate this Lease as of the date that is 75 days after the date of discovery of such damage or destruction if Landlord terminates the leases of other similarly situated tenants in the Building.

Tenant, at its expense, shall promptly perform, subject to delays arising from the collection of insurance proceeds, from Force Majeure (as defined in Section 34) events or to obtain Hazardous Material Clearances, all repairs or restoration not required to be done by Landlord and shall promptly re-enter the Premises and commence doing business in accordance with this Lease. Notwithstanding the foregoing, either Landlord or Tenant may terminate this Lease upon written notice to the other if the Premises are damaged during the last year of the Term and Landlord reasonably estimates that it will take more than 2 months to repair such damage; provided, however, that such notice is delivered within 10 business days after the date that Landlord provides Tenant with written notice of the estimated Restoration Period. Notwithstanding anything to the contrary contained herein, Landlord shall also have the right to terminate this Lease if insurance proceeds are not available for such restoration. Rent shall be abated from the date all required Hazardous Material Clearances are obtained until the Premises are repaired and restored, in the proportion which the area of the Premises, if any, which is not usable by Tenant bears to the total area of the Premises, unless Landlord provides Tenant with other space during the period of repair that is suitable for the temporary conduct of Tenant’s business. In the event that no Hazardous Material Clearances are required to be obtained by Tenant with respect to the Premises, rent abatement shall commence on the date of discovery of the damage or destruction. Such abatement shall be the sole remedy of Tenant, and except as provided in this Section 18, Tenant waives any right to terminate the Lease by reason of damage or casualty loss.

The provisions of this Lease, including this Section 18, constitute an express agreement between Landlord and Tenant with respect to any and all damage to, or destruction of, all or any part of the Premises, or any other portion of the Project, and any statute or regulation which is now or may hereafter by in effect shall have no application to this Lease or any damage or destruction to all or any part of the Premises or any other portion of the Project, the parties hereby expressly agreeing that this Section 18 sets forth their entire understanding and agreement with respect to such matters.

19. Condemnation. If the whole or any material part of the Premises or the Project is taken for any public or quasi-public use under governmental law, ordinance, or regulation, or by right of eminent domain, or by private purchase in lieu thereof (a “Taking” or “Taken”), and the Taking would in Landlord’s reasonable judgment, materially interfere with or impair Landlord’s ownership or operation of the Project or would in the reasonable judgment of Landlord and Tenant either prevent or materially interfere with Tenant’s use of the Premises (as resolved, if the parties are unable to agree, by arbitration by a single arbitrator with the qualifications and experience appropriate to resolve the matter and appointed pursuant...
to and acting in accordance with the rules of the American Arbitration Association), then upon written notice by Landlord or Tenant to the other, then upon written notice by Landlord this Lease shall terminate and Rent shall be apportioned as of said date. If part of the Premises shall be Taken, and this Lease is not terminated as provided above, Landlord shall promptly restore the Premises and the Project as nearly as is commercially reasonable under the circumstances to their condition prior to such partial Taking and the rentable square footage of the Building, the rentable square footage of the Premises, Tenant’s Share of Operating Expenses and the Rent payable hereunder during the unexpired Term shall be reduced to such extent as may be fair and reasonable under the circumstances. Upon any such Taking, Landlord shall be entitled to receive the entire price or award from any such Taking without any payment to Tenant, and Tenant hereby assigns to Landlord Tenant’s interest, if any, in such award. Tenant shall have the right, to the extent that same shall not diminish Landlord’s award, to make a separate claim against the condemning authority (but not Landlord) for such compensation as may be separately awarded or recoverable by Tenant for moving expenses and damage to Tenant’s trade fixtures, if a separate award for such items is made to Tenant. Tenant hereby waives any and all rights it might otherwise have pursuant to any provision of state law to terminate this Lease upon a partial Taking of the Premises or the Project.

20. Events of Default. Each of the following events shall be a default (“Default”) by Tenant under this Lease:

(a) Payment Defaults. Tenant shall fail to pay any installment of Rent or any other payment hereunder when due; provided, however, that Landlord will give Tenant notice and an opportunity to cure any failure to pay Rent within 5 days of any such notice not more than once in any 12 month period and Tenant agrees that such notice shall be in lieu of and not in addition to, or shall be deemed to be, any notice required by law.

(b) Insurance. Any insurance required to be maintained by Tenant pursuant to this Lease shall be canceled or terminated or shall expire or shall be reduced or materially changed, or Landlord shall receive a notice of nonrenewal of any such insurance and Tenant shall fail to obtain replacement insurance at least 20 days before the expiration of the current coverage.

(c) Abandonment. Tenant shall abandon the Premises.

(d) Improper Transfer. Tenant shall assign, sublease or otherwise transfer all or any portion of Tenant’s interest in this Lease or the Premises except as expressly permitted herein, or Tenant’s interest in this Lease shall be attached, executed upon, or otherwise judicially seized and such action is not released within 90 days of the action.

(e) Liens. Tenant shall fail to discharge or otherwise obtain the release of any lien placed upon the Premises in violation of this Lease within 10 days after Tenant receives notice that any such lien is filed against the Premises.

(f) Insolvency Events. Tenant or any guarantor or surety of Tenant’s obligations hereunder shall: (A) make a general assignment for the benefit of creditors; (B) commence any case, proceeding or other action seeking to have an order for relief entered on its behalf as a debtor or to adjudicate it a bankrupt or insolvent, or seeking reorganization, arrangement, adjustment, liquidation, dissolution or composition of it or its debts or seeking appointment of a receiver, trustee, custodian or other similar official for it or for all or of any substantial part of its property (collectively a “ Proceeding for Relief”); (C) become the subject of any Proceeding for Relief which is not dismissed within 90 days of its filing or entry; or (D) die or suffer a legal disability (if Tenant, guarantor, or surety is an individual) or be dissolved or otherwise fail to maintain its legal existence (if Tenant, guarantor or surety is a corporation, partnership or other entity).

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(g) **Estoppel Certificate or Subordination Agreement.** Tenant fails to execute any document required from Tenant under Sections 23 or 27 within 5 business days after a second notice requesting such document.

(h) **Other Defaults.** Tenant shall fail to comply with any provision of this Lease other than those specifically referred to in this Section 20, and, except as otherwise expressly provided herein, such failure shall continue for a period of 30 days after written notice thereof from Landlord to Tenant.

Any notice given under Section 20(h) hereof shall: (i) specify the alleged default, (ii) demand that Tenant cure such default, (iii) be in lieu of, and not in addition to, or shall be deemed to be, any notice required under any provision of applicable law, and (iv) not be deemed a forfeiture or a termination of this Lease unless Landlord elects otherwise in such notice; provided that if the nature of Tenant’s default pursuant to Section 20(h) is such that it cannot be cured by the payment of money and reasonably requires more than 30 days to cure, then Tenant shall not be deemed to be in default if Tenant commences such cure within said 30 day period and thereafter diligently prosecutes the same to completion; provided, however, that such cure shall be completed no later than 60 days from the date of Landlord’s notice.

21. **Landlord’s Remedies.**

(a) **Payment By Landlord; Interest.** Upon a Default by Tenant hereunder, Landlord may, without waiving or releasing any obligation of Tenant hereunder, make such payment or perform such act. All sums so paid or incurred by Landlord, together with interest thereon, from the date such sums were paid or incurred, at the annual rate equal to 12% per annum or the highest rate permitted by law (the “Default Rate”), whichever is less, shall be payable to Landlord on demand as Additional Rent. Nothing herein shall be construed to create or impose a duty on Landlord to mitigate any damages resulting from Tenant’s Default hereunder.

(b) **Late Payment Rent.** Late payment by Tenant to Landlord of Rent and other sums due will cause Landlord to incur costs not contemplated by this Lease, the exact amount of which will be extremely difficult and impracticable to ascertain. Such costs include, but are not limited to, processing and accounting charges and late charges which may be imposed on Landlord under any Mortgage covering the Premises. Therefore, if any installment of Rent due from Tenant is not received by Landlord within 5 days after the date such payment is due, Tenant shall pay to Landlord an additional sum of 6% of the overdue Rent as a late charge. Notwithstanding the foregoing, before assessing a late charge the first time in any calendar year, Landlord shall provide Tenant written notice of the delinquency and will waive the right if Tenant pays such delinquency within 5 days thereafter. The parties agree that this late charge represents a fair and reasonable estimate of the costs Landlord will incur by reason of late payment by Tenant. In addition to the late charge, Rent not paid when due shall bear interest at the Default Rate from the 5th day after the date due until paid.

(c) **Remedies.** Upon the occurrence of a Default, Landlord, at its option, without further notice or demand to Tenant, shall have in addition to all other rights and remedies provided in this Lease, at law or in equity, the option to pursue any one or more of the following remedies, each and all of which shall be cumulative and nonexclusive, without any notice or demand whatsoever. No cure in whole or in part of such Default by Tenant after Landlord has taken any action beyond giving Tenant notice of such Default to pursue any remedy provided for herein (including retaining counsel to file an action or otherwise pursue any remedies) shall in any way affect Landlord’s right to pursue such remedy or any other remedy provided Landlord herein or under law or in equity, unless Landlord, in its sole discretion, elects to waive such Default.

(i) This Lease and the Term and estate hereby granted are subject to the limitation that whenever a Default shall have happened and be continuing, Landlord shall have the right, at its election, then or thereafter while any such Default shall continue and notwithstanding the fact that Landlord may have some other remedy hereunder or at law or in equity, to give Tenant written notice of Landlord’s intention to terminate this Lease on a date specified in such notice, which date shall be not

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less than 5 days after the giving of such notice, and upon the date so specified, this Lease and the estate hereby granted shall expire and terminate with the
same force and effect as if the date specified in such notice were the date hereinbefore fixed for the expiration of this Lease, and all right of Tenant hereunder
shall expire and terminate, and Tenant shall be liable as hereinafter provided in this Section 21(c). If any such notice is given, Landlord shall have, on such
date so specified, the right of re-entry and possession of the Premises and the right to remove all persons and property therefrom and to store such property in
a warehouse or elsewhere at the risk and expense, and for the account, of Tenant. Should Landlord elect to re-enter as herein provided or should Landlord
take possession pursuant to legal proceedings or pursuant to any notice provided for by law, Landlord may from time to time re-let the Premises or any part
thereof for such term or terms and at such rental or rentals and upon such terms and conditions as Landlord may deem advisable, with the right to make commercially reasonable alterations in and repairs to the Premises.

(ii) In the event of any termination of this Lease as in this Section 21 provided or as required or permitted by law or in equity, Tenant shall forthwith quit and surrender the Premises to Landlord, and Landlord may, without further notice, enter upon, re-enter, possess and repossess the same by summary proceedings, ejectment or otherwise, and again have, repossess and enjoy the same as if this Lease had not been made, and in any such event Tenant and no person claiming through or under Tenant by virtue of any law or an order of any court shall be entitled to possession or to remain in possession of the Premises. Landlord, at its option, notwithstanding any other provision of this Lease, shall be entitled to recover from Tenant, as and for liquidated damages, the sum of:

(A) all Base Rent, Additional Rent and other amounts payable by Tenant hereunder then due or accrued and unpaid: and

(B) the amount equal to the aggregate of all unpaid Base Rent and Additional Rent which would have been payable if this Lease had not been terminated prior to the end of the Term then in effect, discounted to its then present value in accordance with accepted financial practice using a rate of 5% per annum, for loss of the bargain; and

(C) all other damages and expenses (including attorneys’ fees and expenses), if any, which Landlord shall have sustained by reason of the breach of any provision of this Lease; less

(D) the net proceeds of any re-letting actually received by Landlord and the amount of damages which Tenant proves could have been avoided had Landlord taken reasonable steps to mitigate its damages.

(iii) Nothing herein contained shall limit or prejudice the right of Landlord, in any bankruptcy or insolvency proceeding, to prove for and obtain as liquidated damages by reason of such termination an amount equal to the maximum allowed by any bankruptcy or insolvency proceedings, or to prove for and obtain as liquidated damages by reason of such termination, an amount equal to the maximum allowed by any statute or rule of law, but in each case not more than the amount to which Landlord would otherwise be entitled under this Section 21.

(iv) Nothing in this Section 21 shall be deemed to affect the right of either party to indemnifications pursuant to this Lease.

(v) If Landlord terminates this Lease upon the occurrence of a Default, Tenant will quit and surrender the Premises to Landlord or its agents, and Landlord may, without further notice, enter upon, re-enter and repossess the Premises by summary proceedings, ejectment or otherwise. The words “enter”, “re-enter”, and “re-entry” are not restricted to their technical legal meanings.
(vi) If either party shall be in default in the observance or performance of any provision of this Lease, and an action shall be brought for the enforcement thereof, the non-prevailing party shall pay to the prevailing party all fees, costs and other expenses which may become payable as a result thereof or in connection therewith, including attorneys’ fees and expenses.

(vii) If Tenant shall default in the keeping, observance or performance of any covenant, agreement, term, provision or condition herein contained, Landlord, without thereby waiving such default, may perform the same for the account and at the expense of Tenant (a) immediately or at any time thereafter and without notice in the case of emergency or in case such default will result in a violation of any legal or insurance requirements, or in the imposition of any lien against all or any portion of the Premises (but only after Tenant has failed to respond to such lien as permitted by Section 15 within the time period provided in Section 15), and (b) in any other case if such default continues after any applicable notice and cure period provided in Section 21. All reasonable costs and expenses incurred by Landlord in connection with any such performance by it for the account of Tenant and also all reasonable costs and expenses, including attorneys’ fees and disbursements incurred by Landlord in any action or proceeding (including any summary dispossess proceeding) brought by Landlord to enforce any obligation of Tenant under this Lease and/or right of Landlord in or to the Premises, shall be paid by Tenant to Landlord within 10 days after demand.

(viii) Independent of the exercise of any other remedy of Landlord hereunder or under applicable law, Landlord may conduct an environmental test of the Premises as generally described in Section 30(d), at Tenant’s expense, to the extent provided in Section 30(d).

(ix) In the event that Tenant is in Default under this Lease, whether or not Landlord exercises its right to terminate or any other remedy, Tenant shall reimburse Landlord upon demand for any costs and expenses that Landlord may incur in connection with any such Default, as provided in this Section 21(c). Such costs shall include legal fees and costs incurred for the negotiation of a settlement, enforcement of rights or otherwise. Tenant shall also indemnify Landlord against and hold Landlord harmless from all costs, expenses, demands and liability, including without limitation, legal fees and costs incurred if Landlord shall become or be made a party to any claim or action instituted by Tenant against any third party, or by any third party against Tenant, or by or against any person holding any interest under or using the Premises by license of or agreement with Tenant.

(x) Except as otherwise provided in this Section 21, no right or remedy herein conferred upon or reserved to Landlord is intended to be exclusive of any other right or remedy, and every right and remedy shall be cumulative and in addition to any other legal or equitable right or remedy given hereunder, or now or hereafter existing. No waiver of any provision of this Lease shall be deemed to have been made unless expressly so made in writing. Landlord shall be entitled, to the extent permitted by law, to seek injunctive relief in case of the violation, or attempted or threatened violation, of any provision of this Lease, or to seek a decree compelling observance or performance of any provision of this Lease, or to seek any other legal or equitable remedy.

22. Assignment and Subleasing

(a) General Prohibition. Without Landlord’s prior written consent subject to and on the conditions described in this Section 22, Tenant shall not, directly or indirectly, voluntarily or by operation of law, assign this Lease or sublease the Premises or any part thereof or mortgage, pledge, or hypothecate its leasehold interest or grant any concession or license within the Premises, and any attempt to do any of the foregoing shall be void and of no effect. If Tenant is a corporation, partnership or limited liability company, the shares or other ownership interests thereof which are not actively traded upon a stock exchange or in the over-the-counter market, a transfer or series of transfers whereby 50% or more of the issued and outstanding shares or other ownership interests of such corporation are, or voting control is, transferred (but excepting transfers upon deaths of individual owners) from a person or persons or entity or entities which were owners thereof at time of execution of this Lease to persons or entities who were not owners of shares or other ownership interests of the corporation, partnership or
limited liability company at time of execution of this Lease, shall be deemed an assignment of this Lease requiring the consent of Landlord as provided in this Section 22. Notwithstanding the foregoing, Tenant shall have the right to obtain financing from institutional investors (including venture capital funding and corporate partners) which regularly invest in private biotechnology companies or undergo a public offering which results in a change in control of Tenant without such change of control constituting an assignment under this Section 22 requiring Landlord consent, provided that (i) Tenant notifies Landlord in writing of the financing within 5 business days after the closing of the financing, and (ii) provided that in no event shall such financing result in a change in use of the Premises from the use contemplated by Tenant at the commencement of the Term.

(b) Permitted Transfers. If Tenant desires to assign, sublease, hypothecate or otherwise transfer this Lease or sublet the Premises other than pursuant to a Permitted Assignment (as defined below), then at least 15 business days, but not more than 45 business days, before the date Tenant desires the assignment or sublease to be effective (the “Assignment Date”), Tenant shall give Landlord a notice (the “Assignment Notice”) containing such information about the proposed assignee or sublessee, including the proposed use of the Premises and any Hazardous Materials proposed to be used, stored, handled, treated, generated in or released or disposed of from the Premises, the Assignment Date, any relationship between Tenant and the proposed assignee or sublessee, and all material terms and conditions of the proposed assignment or sublease, including a copy of any proposed assignment or sublease in its final form, and such other information as Landlord may deem reasonably necessary or appropriate to its consideration whether to grant its consent. Landlord may, by giving written notice to Tenant within 15 business days after receipt of the Assignment Notice: (i) grant such consent, (ii) refuse such consent, in its reasonable discretion; or (iii) if the assignment or sublease is for the entire Premises for the remainder of the Term, terminate this Lease with respect to the space described in the Assignment Notice as of the Assignment Date (an “Assignment Termination”). Among other reasons, it shall be reasonable for Landlord to withhold its consent in any of these instances: (1) the proposed assignee or subtenant is a governmental agency; (2) in Landlord’s reasonable judgment, the use of the Premises by the proposed assignee or subtenant would entail any alterations that would lessen the value of the leasehold improvements in the Premises, or would require increased services by Landlord; (3) in Landlord’s reasonable judgment, the proposed assignee or subtenant is engaged in areas of scientific research or other business concerns that are controversial; (4) in Landlord’s reasonable judgment, the proposed assignee or subtenant lacks the creditworthiness to support the financial obligations it will incur under the proposed assignment or sublease; (5) in Landlord’s reasonable judgment, the character, reputation, or business of the proposed assignee or subtenant is inconsistent with the desired tenant-mix or the quality of other tenancies in the Project or is inconsistent with the type and quality of the nature of the Building; (6) Landlord has received from any prior landlord to the proposed assignee or subtenant a negative report concerning such prior landlord’s experience with the proposed assignee or subtenant; (7) Landlord has experienced previous defaults by or is in litigation with the proposed assignee or subtenant; (8) the use of the Premises by the proposed assignee or subtenant will violate any applicable Legal Requirement; (9) the proposed assignee or subtenant, or any entity that, directly or indirectly, controls, is controlled by, or is under common control with the proposed assignee or subtenant, is then an occupant of the Project; (10) the proposed assignee or subtenant is an entity with whom Landlord is negotiating to lease space in the Project; or (11) the assignment or sublease is prohibited by Landlord’s lender. Landlord shall use reasonable efforts to respond to each of Tenant’s Assignment Notice within 15 business days after Landlord’s receipt of such Assignment Notice along with all documentation required to be delivered hereunder. If Landlord fails to respond within such 15 business day period, then Tenant shall provide Landlord with a second written notice stating in bold and all caps 12 point font that Landlord’s failure to respond to Tenant’s Assignment Notice within 5 business days after Landlord’s receipt of the second notice shall be deemed approval by Landlord, and if Landlord does not respond within such 5 business day period, then Landlord shall be deemed to have approved such Assignment Notice request. If Landlord delivers notice of its election to exercise an Assignment Termination, Tenant shall have the right to withdraw such Assignment Notice by written notice to Landlord of such election within 5 business days after Landlord’s notice electing to exercise the Assignment Termination. If Tenant withdraws such Assignment Notice, this Lease shall continue in full force and effect. If Tenant does not withdraw such Assignment Notice, this Lease, and the term and estate herein granted, shall terminate as

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of the Assignment Date with respect to the space described in such Assignment Notice. No failure of Landlord to exercise any such option to terminate this Lease, or to deliver a timely notice in response to the Assignment Notice, shall be deemed to be Landlord’s consent to the proposed assignment, sublease or other transfer. Tenant shall pay to Landlord a fee equal to One Thousand Five Hundred Dollars ($1,500) in connection with its consideration of any Assignment Notice and/or its preparation or review of any consent documents. Notwithstanding the foregoing, Landlord’s consent to an assignment of this Lease or a subletting of any portion of the Premises to any entity controlling, controlled by or under common control with Tenant (a “Control Permitted Assignment”) shall not be required, provided that Landlord shall have the right to approve the form of any such sublease or assignment, which approval shall not be unreasonably withheld, conditioned or delayed. In addition, Tenant shall have the right to assign this Lease, upon 30 days prior written notice to Landlord but without obtaining Landlord’s prior written consent, to a corporation or other entity which is a successor-in-interest to Tenant, by way of merger, consolidation or corporate reorganization, or by the purchase of all or substantially all of the assets or the ownership interests of Tenant provided that (i) such merger or consolidation, or such acquisition or assumption, as the case may be, is for a good business purpose and not principally for the purpose of transferring the Lease, and (ii) the net worth (as determined in accordance with generally accepted accounting principles (“GAAP”)) of the assignee is not less than the greater of the net worth (as determined in accordance with GAAP) of Tenant as of (A) the Phase 1 Premises Commencement Date, or (B) as of the date of Tenant’s most current quarterly or annual financial statements, and (iii) such assignee shall agree in writing to assume all of the terms, covenants and conditions of this Lease (a “Corporate Permitted Assignment”). Control Permitted Assignments and Corporate Permitted Assignments are hereinafter referred to as “Permitted Assignments.”

Notwithstanding anything to the contrary contained in this Lease, Tenant may from time to time enter into license agreements (each, a “Shared Space Arrangement”) with respect to up to 50% of the Premises in the aggregate with affiliates and partners of Tenant to use portions of the Premises as “Shared Space Area” and such license agreements shall not require Landlord’s consent under Section 22 of the Lease but Tenant shall be required to provide Landlord with a copy of each such license agreement and, prior to the effective date of each such license agreement, Tenant and each licensee shall be required to execute Landlord’s form of acknowledgment pursuant to which Tenant and the licensee acknowledge and agree, among other things, that: (i) the terms of the Shared Space Arrangement are subject and subordinate to the terms of this Lease, (ii) if this Lease terminates, then the Shared Space Arrangement shall terminate concurrently therewith, (iii) each licensee shall, during the term of its applicable Shared Space Arrangement, maintain the same insurance as is required of Tenant under this Lease and provide Landlord with insurance certificates evidencing the same and naming the Landlord Parties as additional insureds, and (iv) the waivers and releases set forth in the second to last paragraph of Section 17 that apply as between Landlord and Tenant shall also apply as between Landlord and licensee. Tenant shall be fully responsible for the conduct of such companies within the Shared Space Area and the Project, and Tenant’s indemnification obligations set forth in the Lease shall apply with respect to the conduct of such parties within the Shared Space Area and Project. Tenant shall be required to reimburse Landlord for all reasonable legal expenses incurred by Landlord in connection with each such Shared Space Arrangement.

(c) Additional Conditions. As a condition to any such assignment or subletting, whether or not Landlord’s consent is required, Landlord may require:

(i) that any assignee or subtenant agree, in writing at the time of such assignment or subletting, that if Landlord gives such party notice that Tenant is in Default under this Lease, such party shall make all payments otherwise due Tenant directly to Landlord, which payments will be received by Landlord without any liability except to credit such payment against those due under the Lease, and any such third party shall agree to attorn to Landlord or its successors and assigns should this Lease be terminated for any reason; provided, however, in no event shall Landlord or its successors or assigns be obligated to accept such attornment; and
(ii) A list of Hazardous Materials, certified by the proposed assignee or sublessee to be true and correct, which the proposed assignee or sublessee intends to use, store, handle, treat, generate in or release or dispose of from the Premises, together with copies of all documents relating to such use, storage, handling, treatment, generation, release or disposal of Hazardous Materials by the proposed assignee or subtenant in the Premises or on the Project, prior to the proposed assignment or subletting, including, without limitation: permits; approvals; reports and correspondence; storage and management plans; plans relating to the installation of any storage tanks to be installed in or under the Project (provided, said installation of tanks shall only be permitted after Landlord has given its written consent to do so, which consent may be withheld in Landlord’s sole and absolute discretion); and all closure plans or any other documents required by any and all federal, state and local Governmental Authorities for any storage tanks installed in, on or under the Project for the closure of any such tanks. Neither Tenant nor any such proposed assignee or subtenant is required, however, to provide Landlord with any portion(s) of the such documents containing information of a proprietary nature which, in and of themselves, do not contain a reference to any Hazardous Materials or hazardous activities.

(d) No Release of Tenant, Sharing of Excess Rents. Notwithstanding any assignment or subletting, Tenant and any guarantor or surety of Tenant’s obligations under this Lease shall at all times remain fully and primarily responsible and liable for the payment of Rent and for compliance with all of Tenant’s other obligations under this Lease. If the Rent due and payable by a sublessee or assignee (or a combination of the rental payable under such sublease or assignment plus any bonus or other consideration therefor or incident thereto in any form) exceeds the sum of the rental payable under this Lease (excluding however, any Rent payable under this Section and actual and reasonable brokerage fees, legal costs and any design or construction fees directly related to and required pursuant to the terms of any such sublease) (“Excess Rent”), then Tenant shall be bound and obligated to pay Landlord as Additional Rent hereunder 50% of such Excess Rent within 10 days following receipt thereof by Tenant. If Tenant shall sublet the Premises or any part thereof, Tenant hereby immediately and irrevocably assigns to Landlord, as security for Tenant’s obligations under this Lease, all rent from any such subletting, and Landlord as assignee and as attorney-in-fact for Tenant, or a receiver for Tenant appointed on Landlord’s application, may collect such rent and apply it toward Tenant’s obligations under this Lease; except that, until the occurrence of a Default, Tenant shall have the right to collect such rent.

(e) No Waiver. The consent by Landlord to an assignment or subletting shall not relieve Tenant or any assignees of this Lease or any sublessees of the Premises from obtaining the consent of Landlord to any further assignment or subletting nor shall it release Tenant or any assignee or sublessee of Tenant from full and primary liability under the Lease. The acceptance of Rent hereunder, or the acceptance of performance of any other term, covenant, or condition thereof, from any other person or entity shall not be deemed to be a waiver of any of the provisions of this Lease or a consent to any subletting, assignment or other transfer of the Premises.

(f) Prior Conduct of Proposed Transferee. Notwithstanding any other provision of this Section 22, if (i) the proposed assignee or sublessee of Tenant has been required by any prior landlord, lender or Governmental Authority to take remedial action in connection with Hazardous Materials contaminating a property, where the contamination resulted from such party’s action or use of the property in question, (ii) the proposed assignee or sublessee is subject to an enforcement order issued by any Governmental Authority in connection with the use, storage, handling, treatment, generation, release or disposal of Hazardous Materials (including, without limitation, any order related to the failure to make a required reporting to any Governmental Authority), or (iii) because of the existence of a pre-existing environmental condition in the vicinity of or underlying the Project, the risk that Landlord would be targeted as a responsible party in connection with the remediation of such pre-existing environmental condition would be materially increased or exacerbated by the proposed use of Hazardous Materials by such proposed assignee or sublessee, Landlord shall have the absolute right to refuse to consent to any assignment or subletting to any such party.
23. **Estoppel Certificate.** Tenant shall, within 10 business days of written notice from Landlord, execute, acknowledge and deliver a statement in writing in any form reasonably requested by a proposed lender or purchaser, (i) certifying that this Lease is unmodified and in full force and effect (or, if modified, stating the nature of such modification and certifying that this Lease as so modified is in full force and effect) and the dates to which the rental and other charges are paid in advance, if any, (ii) acknowledging that there are not any uncured defaults on the part of Landlord hereunder, or specifying such defaults if any are claimed, and (iii) setting forth such further information with respect to the status of this Lease or the Premises as may be requested thereon. Any such statement may be relied upon by any prospective purchaser or encumbrancer of all or any portion of the real property of which the Premises are a part. Tenant’s failure to deliver such statement within such time shall be conclusive upon Tenant that the Lease is in full force and effect and without modification except as may be represented by Landlord in any certificate prepared by Landlord and delivered to Tenant for execution.

24. **Quiet Enjoyment.** So long as Tenant is not in Default under this Lease, Tenant shall, subject to the terms of this Lease, at all times during the Term, have peaceful and quiet enjoyment of the Premises against any person claiming by, through or under Landlord.

25. **Prorations.** All prorations required or permitted to be made hereunder shall be made on the basis of a 360 day year and 30 day months.

26. **Rules and Regulations.** Tenant shall, at all times during the Term and any extension thereof, comply with all reasonable rules and regulations at any time or from time to time established by Landlord covering use of the Premises and the Project. The current rules and regulations are attached hereto as Exhibit E. If there is any conflict between said rules and regulations and other provisions of this Lease, the terms and provisions of this Lease shall control. Landlord shall not have any liability or obligation for the breach of any rules or regulations by other tenants in the Project and shall not enforce such rules and regulations in a discriminatory manner.

27. **Subordination.** This Lease and Tenant’s interest and rights hereunder are hereby made and shall be subject and subordinate at all times to the lien of any Mortgage now existing or hereafter created on or against the Project or the Premises, and all amendments, restatements, renewals, modifications, consolidations, refinancing, assignments and extensions thereof, without the necessity of any further instrument or act on the part of Tenant; provided, however, that so long as there is no Default hereunder, Tenant’s right to possession of the Premises and Tenant’s other rights under this Lease shall not be disturbed by the Holder of any such Mortgage. Tenant agrees, at the election of the Holder of any such Mortgage, to attorn to any such Holder. Tenant agrees upon demand to execute, acknowledge and deliver such instruments, confirming such subordination, and such instruments of attornment as shall be requested by any such Holder, provided any such instruments contain appropriate non-disturbance provisions assuring Tenant’s quiet enjoyment of the Premises as set forth in Section 24 hereof. Notwithstanding the foregoing, any such Holder may at any time subordinate its Mortgage to this Lease, without Tenant’s consent, by notice in writing to Tenant, and thereupon this Lease shall be deemed prior to such Mortgage without regard to their respective dates of execution, delivery or recording and in that event such Holder shall have the same rights with respect to this Lease as though this Lease had been executed prior to the execution, delivery and recording of such Mortgage and had been assigned to such Holder. The term “Mortgage” whenever used in this Lease shall be deemed to include deeds of trust, security assignments, ground leases or other superior leases and any other encumbrances, and any reference to the “Holder” of a Mortgage shall be deemed to include the beneficiary under a deed of trust. As of the date of this Lease, there is no existing Mortgage encumbering the Project.

28. **Surrender.** Upon the expiration of the Term or earlier termination of Tenant’s right of possession, Tenant shall surrender the Premises to Landlord in the same condition as received, subject to any Alterations or Installations permitted by Landlord to remain in the Premises, free of Hazardous Materials brought upon, kept, used, stored, handled, treated, generated in, or released or disposed of from, the Premises by any person other than a Landlord Party (collectively, “Tenant HazMat Operations”) and released of all Hazardous Materials Clearances, broom clean, ordinary wear and tear and casualty loss and condemnation covered by Sections 18 and 19 excepted. At least 3 months prior to the surrender of the Premises, Tenant shall deliver to Landlord a narrative description of the actions.
proposed (or required by any Governmental Authority) to be taken by Tenant in order to surrender the Premises (including any Installations permitted by Landlord to remain in the Premises) at the expiration or earlier termination of the Term, free from any residual impact from the Tenant HazMat Operations and otherwise released for unrestricted use and occupancy (the “Surrender Plan”). Such Surrender Plan shall be accompanied by a current listing of (i) all Hazardous Materials licenses and permits held by or on behalf of any Tenant Party with respect to the Premises, and (ii) all Hazardous Materials used, stored, handled, treated, generated, released or disposed of from the Premises, and shall be subject to the review and approval of Landlord’s environmental consultant. In connection with the review and approval of the Surrender Plan, upon the request of Landlord, Tenant shall deliver to Landlord or its consultant such additional non-proprietary information concerning Tenant HazMat Operations as Landlord shall request. On or before such surrender, Tenant shall deliver to Landlord evidence that the approved Surrender Plan shall have been satisfactorily completed and Landlord shall have the right, subject to reimbursement at Tenant’s expense as set forth below, to cause Landlord’s environmental consultant to inspect the Premises and perform such additional procedures as may be deemed reasonably necessary to confirm that the Premises are, as of the effective date of such surrender or early termination of the Lease, free from any residual impact from Tenant HazMat Operations. Tenant shall reimburse Landlord, as Additional Rent, for the actual, reasonable out-of-pocket expense incurred by Landlord for Landlord’s environmental consultant to review and approve the Surrender Plan and to visit the Premises and verify satisfactory completion of the same, which cost shall not exceed $5,000. Landlord shall have the unrestricted right to deliver such Surrender Plan and any report by Landlord’s environmental consultant with respect to the surrender of the Premises to third parties.

If Tenant shall fail to prepare or submit a Surrender Plan approved by Landlord, or if Tenant shall fail to complete the approved Surrender Plan, or if such Surrender Plan, whether or not approved by Landlord, shall fail to adequately address any residual effect of Tenant HazMat Operations in, on or about the Premises, Landlord shall have the right to take such actions as Landlord may deem reasonable or appropriate to assure that the Premises and the Project are surrendered free from any residual impact from Tenant HazMat Operations, the cost of which actions shall be reimbursed by Tenant as Additional Rent, without regard to the limitation set forth in the first paragraph of this Section 28.

Tenant shall immediately return to Landlord all keys and/or access cards to parking, the Project, restrooms or all or any portion of the Premises furnished to or otherwise procured by Tenant. If any such access card or key is lost, Tenant shall pay to Landlord, at Landlord’s election, either the cost of replacing such lost access card or key or the cost of reprogramming the access security system in which such access card was used or changing the lock or locks opened by such lost key. Any Tenant’s Property, Alterations and property not so removed by Tenant as permitted or required herein shall be deemed abandoned and may be stored, removed, and disposed of by Landlord at Tenant’s expense, and Tenant waives all claims against Landlord for any damages resulting from Landlord’s retention and/or disposition of such property. All obligations of Tenant hereunder not fully performed as of the termination of the Term, including the obligations of Tenant under Section 30 hereof, shall survive the expiration or earlier termination of the Term, including, without limitation, indemnity obligations, payment obligations with respect to Rent and obligations concerning the condition and repair of the Premises.

29. **Waiver of Jury Trial.** TENANT AND LANDLORD WAIVE ANY RIGHT TO TRIAL BY JURY OR TO HAVE A JURY PARTICIPATE IN RESOLVING ANY DISPUTE, WHETHER SOUNDING IN CONTRACT, TORT, OR OTHERWISE, BETWEEN LANDLORD AND TENANT ARISING OUT OF THIS LEASE OR ANY OTHER INSTRUMENT, DOCUMENT, OR AGREEMENT EXECUTED OR DELIVERED IN CONNECTION HEREWITH OR THE TRANSACTIONS RELATED HERETO.

30. **Environmental Requirements.**

(a) **Prohibition/Compliance/Indemnity.** Tenant shall not cause or permit any Hazardous Materials (as hereinafter defined) to be brought upon, kept, used, stored, handled, treated, generated in or about, or released or disposed of from, the Premises or the Project in violation of applicable Environmental Requirements (as hereinafter defined) by Tenant or any Tenant Party. If Tenant breaches
the obligation stated in the preceding sentence, or if the presence of Hazardous Materials in the Premises during the Term or any holding over results in contamination of the Premises, the Project or any adjacent property or if contamination of the Premises, the Project or any adjacent property by Hazardous Materials brought into, kept, used, stored, handled, treated, generated in or about, or released or disposed of from, the Premises by anyone other than Landlord and Landlord’s employees, agents and contractors otherwise occurs during the Term or any holding over, Tenant hereby indemnifies and shall defend and hold Landlord, its officers, directors, employees, agents and contractors harmless from any and all actions (including, without limitation, remedial or enforcement actions of any kind, administrative or judicial proceedings, and orders or judgments arising out of or resulting therefrom), costs, claims, damages (including, without limitation, punitive damages and damages based upon diminution in value of the Premises or the Project, the loss of, or restriction on, use of the Premises or any portion of the Project), expenses (including, without limitation, attorneys’, consultants’ and experts’ fees, court costs and amounts paid in settlement of any claims or actions), fines, forfeitures or other civil, administrative or criminal penalties, injunctive or other relief (whether or not based upon personal injury, property damage, or contamination of, or adverse effects upon, the environment, water tables or natural resources), liabilities or losses (collectively, "Environmental Claims") which arise during or after the Term as a result of such contamination. This indemnification of Landlord by Tenant includes, without limitation, costs incurred in connection with any investigation of site conditions or any cleanup, treatment, remedial, removal, or restoration work required by any federal, state or local Governmental Authority because of Hazardous Materials present in the air, soil or ground water above, on, or under the Premises. Without limiting the foregoing, if the presence of any Hazardous Materials on the Premises, the Building, the Project or any adjacent property caused or permitted by Tenant or any Tenant Party results in any contamination of the Premises, the Building, the Project or any adjacent property, Tenant shall promptly take all actions at its sole expense and in accordance with applicable Environmental Requirements as are necessary to return the Premises, the Building, the Project or any adjacent property to the condition existing prior to the time of such contamination, provided that Landlord’s approval of such action shall first be obtained, which approval shall not unreasonably be withheld so long as such actions would not potentially have any material adverse long-term or short-term effect on the Premises, the Building or the Project. Notwithstanding anything to the contrary contained in this Section 30, Tenant shall not be responsible for, and the indemnification and hold harmless obligation set forth in this paragraph shall not apply to (i) contamination in the Premises which Tenant can prove to Landlord’s reasonable satisfaction existed in the Premises immediately prior to the Phase 1 Premises Commencement Date, or (ii) the presence of any Hazardous Materials in the Premises which Tenant can prove to Landlord’s reasonable satisfaction migrated from outside of the Premises into the Premises, unless in either case, the presence of such Hazardous Materials (x) is the result of a breach by Tenant of any of its obligations under this Lease, or (y) was caused, contributed to or exacerbated by Tenant and any Tenant Party.

(b) Business. Landlord acknowledges that it is not the intent of this Section 30 to prohibit Tenant from using the Premises for the Permitted Use. Tenant may operate its business according to prudent industry practices so long as the use or presence of Hazardous Materials is strictly and properly monitored according to all then applicable Environmental Requirements. As a material inducement to Landlord to allow Tenant to use Hazardous Materials in connection with its business, Tenant agrees to deliver to Landlord prior to the Phase 1 Premises Commencement Date a list identifying each type of Hazardous Materials to be brought upon, kept, used, stored, handled, treated, generated on, or released or disposed of from, the Premises and setting forth any and all governmental approvals or permits required in connection with the presence, use, storage, handling, treatment, generation, release or disposal of such Hazardous Materials on or from the Premises ("Hazardous Materials List"). Tenant shall deliver to Landlord an updated list at any additional time that Tenant is required to deliver a Hazardous Materials List to any Governmental Authority (e.g., the fire department) in connection with its use or occupancy of the Premises. Tenant shall deliver to Landlord true and correct copies of the following documents (the "Haz Mat Documents") relating to the use, storage, handling, treatment, generation, release or disposal of Hazardous Materials prior to the Phase 1 Premises Commencement Date, or if unavailable at that time, concurrent with the receipt from or submission to a Governmental Authority: permits; approvals; reports and correspondence; storage and management plans, notice of violations of any Legal Requirements; plans relating to the installation of any storage tanks to be installed
in or under the Project (provided, said installation of tanks shall only be permitted after Landlord has given Tenant its written consent to do so, which consent may be withheld at Landlord’s sole and absolute discretion); all closure plans or any other documents required by any and all federal, state and local Governmental Authorities for any storage tanks installed in, on or under the Project for the closure of any such tanks; and a Surrender Plan (to the extent surrender in accordance with Section 28 cannot be accomplished in 3 months). Tenant is not required, however, to provide Landlord with any portion(s) of the Haz Mat Documents containing information of a proprietary nature which, in and of themselves, do not contain a reference to any Hazardous Materials or hazardous activities. It is not the intent of this Section to provide Landlord with information which could be detrimental to Tenant’s business if such information become possessed by Tenant’s competitors.

(c) **Tenant Representation and Warranty.** Tenant hereby represents and warrants to Landlord that (i) neither Tenant nor any of its legal predecessors has been required by any prior landlord, lender or Governmental Authority at any time to take remedial action in connection with Hazardous Materials contaminating a property which contamination was permitted by Tenant of such predecessor or resulted from Tenant’s or such predecessor’s action or use of the property in question, and (ii) Tenant is not subject to any enforcement order issued by any Governmental Authority in connection with the use, storage, handling, treatment, generation, release or disposal of Hazardous Materials (including, without limitation, any order related to the failure to make a required reporting to any Governmental Authority). If Landlord determines that this representation and warranty was not true as of the date of this lease, Landlord shall have the right to terminate this Lease in Landlord’s sole and absolute discretion.

(d) **Testing.** Landlord shall have the right to conduct annual tests of the Premises to determine whether any contamination of the Premises or the Project has occurred as a result of Tenant’s use. Tenant shall be required to pay the cost of such annual test of the Premises if there is violation of this Section 30 or if contamination for which Tenant is responsible under this Section 30 is identified; provided, however, that if Tenant conducts its own tests of the Premises using third party contractors and test procedures acceptable to Landlord which tests are certified to Landlord, Landlord shall accept such tests in lieu of the annual tests to be paid for by Tenant. In addition, at any time, and from time to time, prior to the expiration or earlier termination of the Term, Landlord shall have the right to conduct appropriate tests of the Premises and the Project to determine if contamination has occurred as a result of Tenant’s use of the Premises. In connection with such testing, upon the request of Landlord, Tenant shall deliver to Landlord or its consultant such non-proprietary information concerning the use of Hazardous Materials in or about the Premises by Tenant or any Tenant Party. If contamination has occurred for which Tenant is liable under this Section 30, Tenant shall pay all costs to conduct such tests. If no such contamination for which Tenant is liable under this Section 30 is found, Landlord shall pay the costs of such tests (which shall not constitute an Operating Expense). Landlord shall provide Tenant with a copy of all third party, non-confidential reports and tests of the Premises made by or on behalf of Landlord during the Term without representation or warranty and subject to a confidentiality agreement. Tenant shall, at its sole cost and expense, promptly and satisfactorily remediate any environmental conditions identified by such testing for which Tenant is liable under this Lease in accordance with all Environmental Requirements. Landlord’s receipt of or satisfaction with any environmental assessment in no way waives any rights which Landlord may have against Tenant.

(e) **Underground Tanks.** If underground or other storage tanks storing Hazardous Materials located on the Premises or the Project are used by Tenant or are hereafter placed on the Premises or the Project by Tenant, Tenant shall install, use, monitor, operate, maintain, upgrade and manage such storage tanks, maintain appropriate records, obtain and maintain appropriate insurance, implement reporting procedures, properly close any underground storage tanks, and take or cause to be taken all other actions necessary or required under applicable state and federal Legal Requirements, as such now exists or may hereafter be adopted or amended in connection with the installation, use, maintenance, management, operation, upgrading and closure of such storage tanks.
(f) Tenant's Obligations. Tenant’s obligations under this Section 30 shall survive the expiration or earlier termination of the Lease. During any period of time after the expiration or earlier termination of this Lease required by Tenant or Landlord to complete the removal from the Premises of any Hazardous Materials (including, without limitation, the release and termination of any licenses or permits restricting the use of the Premises and the completion of the approved Surrender Plan), Tenant shall continue to pay the full Rent in accordance with this Lease for any portion of the Premises not relet by Landlord in Landlord’s sole discretion, which Rent shall be prorated daily.

(g) Definitions. As used herein, the term “Environmental Requirements” means all applicable present and future statutes, regulations, ordinances, rules, codes, judgments, orders or other similar enactments of any Governmental Authority regulating or relating to health, safety, or environmental conditions on, under, or about the Premises or the Project, or the environment, including without limitation, the following: the Comprehensive Environmental Response, Compensation and Liability Act; the Resource Conservation and Recovery Act; and all state and local counterparts thereto, and any regulations or policies promulgated or issued thereunder. As used herein, the term “Hazardous Materials” means and includes any substance, material, waste, pollutant, or contaminant listed or defined as hazardous or toxic, or regulated by reason of its impact or potential impact on humans, animals and/or the environment under any Environmental Requirements, asbestos and petroleum, including crude oil or any fraction thereof, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas). As defined in Environmental Requirements, Tenant is and shall be deemed to be the “operator” of Tenant’s “facility” and the “owner” of all Hazardous Materials brought on the Premises by Tenant or any Tenant Party, and the wastes, by-products, or residues generated, resulting, or produced therefrom.

31. Tenant’s Remedies/Limitation of Liability. Landlord shall not be in default hereunder unless Landlord fails to perform any of its obligations hereunder within 30 days after written notice from Tenant specifying such failure (unless such performance will, due to the nature of the obligation, require a period of time in excess of 30 days, then after such period of time as is reasonably necessary). Upon any default by Landlord, Tenant shall give notice by registered or certified mail to any Holder of a Mortgage covering the Premises and to any landlord of any lease of property in or on which the Premises are located and Tenant shall offer such Holder and/or landlord a reasonable opportunity to cure the default, including time to obtain possession of the Project by power of sale or a judicial action if such should prove necessary to effect a cure; provided Landlord shall have furnished to Tenant in writing the names and addresses of all such persons who are to receive such notices. All obligations of Landlord hereunder shall be construed as covenants, not conditions; and, except as may be otherwise expressly provided in this Lease, Tenant may not terminate this Lease for breach of Landlord’s obligations hereunder.

All obligations of Landlord under this Lease will be binding upon Landlord only during the period of its ownership of the Premises and not thereafter. The term “Landlord” in this Lease shall mean only the owner for the time being of the Premises. Upon the transfer by such owner of its interest in the Premises, such owner shall thereupon be released and discharged from all obligations of Landlord thereafter accruing, but such obligations shall be binding during the Term upon each new owner for the duration of such owner’s ownership. Nothing contained in this paragraph is intended to excuse any new owner of the Project from curing any then existing defaults of Landlord under this Lease following the date that the Project is transferred to such new owner.

32. Inspection and Access. Landlord and its agents, representatives, and contractors may enter the Premises at any reasonable time upon reasonable prior notice to Tenant to inspect the Premises and to make such repairs as may be required or permitted pursuant to this Lease and for any other business purpose. Landlord and Landlord’s representatives may enter the Premises during business hours on not less than 48 hours advance written notice (except in the case of emergencies in which case no such notice shall be required and such entry may be at any time) for the purpose of effecting any such repairs, inspecting the Premises, showing the Premises to prospective purchasers and, during the last year of the Term, to prospective tenants or for any other business purpose. Landlord shall use reasonable efforts to minimize interference with Tenant’s operations in the Premises in connection with Landlord’s entry into the Premises pursuant to this paragraph. Landlord may erect a suitable sign on the Premises stating the Premises are available to let or that the Project is available for
sale. Landlord may grant easements, make public dedications, designate Common Areas and create restrictions on or about the Premises, provided that no such easement, dedication, designation or restriction materially, adversely affects Tenant’s use or occupancy of the Premises for the Permitted Use. At Landlord’s request, Tenant shall execute such instruments as may be necessary for such easements, dedications or restrictions. Tenant shall at all times, except in the case of emergencies, have the right to escort Landlord or its agents, representatives, contractors or guests while the same are in the Premises, provided such escort does not materially and adversely affect Landlord’s access rights hereunder.

33. **Security.** Tenant acknowledges and agrees that security devices and services, if any, while intended to deter crime may not in given instances prevent theft or other criminal acts and that Landlord is not providing any security services with respect to the Premises. Tenant agrees that Landlord shall not be liable to Tenant for, and Tenant waives any claim against Landlord with respect to, any loss by theft or any other damage suffered or incurred by Tenant in connection with any unauthorized entry into the Premises or any other breach of security with respect to the Premises. Tenant shall be solely responsible for the personal safety of Tenant’s officers, employees, agents, contractors, guests and invitees while any such person is in, on or about the Premises and/or the Project. Tenant shall at Tenant’s cost obtain insurance coverage to the extent Tenant desires protection against such criminal acts.

34. **Force Majeure.** Except for the payment of Rent and the TI Allowance, neither Landlord nor Tenant shall be responsible or liable for delays in the performance of its obligations hereunder when caused by, related to, or arising out of acts of God, sinkholes or subsidence, strikes, lockouts, or other labor disputes, embargoes, quarantines, weather, national, regional, or local disasters, calamities, or catastrophes, inability to obtain labor or materials (or reasonable substitutes therefor) at reasonable costs or failure of, or inability to obtain, utilities necessary for performance, governmental restrictions, orders, limitations, regulations, or controls, national emergencies, delay in issuance or revocation of permits, enemy or hostile governmental action, terrorism, insurrection, riots, civil disturbance or commotion, fire or other casualty, and other causes or events beyond their reasonable control ("**Force Majeure**").

35. **Brokers.** Landlord and Tenant each represents and warrants that it has not dealt with any broker, agent or other person (collectively, "Broker") in connection with this transaction and that no Broker brought about this transaction, other than Newmark Grubb Knight Frank and Jones Lang LaSalle. Landlord and Tenant each hereby agree to indemnify and hold the other harmless from and against any claims by any Broker, other than the broker, if any named in this **Section 35**, claiming a commission or other form of compensation by virtue of having dealt with Tenant or Landlord, as applicable, with regard to this leasing transaction.

36. **Limitation on Landlord’s Liability.** NOTWITHSTANDING ANYTHING SET FORTH HEREIN OR IN ANY OTHER AGREEMENT BETWEEN LANDLORD AND TENANT TO THE CONTRARY: (A) LANDLORD SHALL NOT BE LIABLE TO TENANT OR ANY OTHER PERSON FOR (AND TENANT AND EACH SUCH OTHER PERSON ASSUME ALL RISK OF) LOSS, DAMAGE OR INJURY, WHETHER ACTUAL OR CONSEQUENTIAL TO: TENANT’S PERSONAL PROPERTY OF EVERY KIND AND DESCRIPTION, INCLUDING, WITHOUT LIMITATION TRADE FIXTURES, EQUIPMENT, INVENTORY, SCIENTIFIC RESEARCH, SCIENTIFIC EXPERIMENTS, LABORATORY ANIMALS, PRODUCT, SPECIMENS, SAMPLES, AND/OR SCIENTIFIC, BUSINESS, ACCOUNTING AND OTHER RECORDS OF EVERY KIND AND DESCRIPTION KEPT AT THE PREMISES AND ANY AND ALL INCOME DERIVED OR DERIVABLE THEREFROM; (B) THERE SHALL BE NO PERSONAL RECOURSE TO LANDLORD FOR ANY ACT OR OCCURRENCE IN, ON OR ABOUT THE PREMISES OR ARISING IN ANY WAY UNDER THIS LEASE OR ANY OTHER AGREEMENT BETWEEN LANDLORD AND TENANT WITH RESPECT TO THE SUBJECT MATTER HEREOF AND ANY LIABILITY OF LANDLORD HEREUNDER SHALL BE STRICTLY LIMITED SOLELY TO LANDLORD’S INTEREST IN THE PROJECT OR ANY PROCEEDS FROM SALE OR CONDEMNATION THEREOF AND ANY INSURANCE PROCEEDS PAYABLE IN RESPECT OF LANDLORD’S INTEREST IN THE PROJECT OR IN CONNECTION WITH ANY SUCH LOSS; AND (C) IN NO EVENT SHALL ANY PERSONAL LIABILITY BE ASSERTED AGAINST LANDLORD IN CONNECTION WITH THIS LEASE.
NOR SHALL ANY RECOURSE BE HAD TO ANY OTHER PROPERTY OR ASSETS OF LANDLORD OR ANY OF LANDLORD’S OFFICERS, DIRECTORS, EMPLOYEES, AGENTS OR CONTRACTORS. UNDER NO CIRCUMSTANCES SHALL LANDLORD OR ANY OF LANDLORD’S OFFICERS, DIRECTORS, EMPLOYEES, AGENTS OR CONTRACTORS BE LIABLE FOR INJURY TO TENANT’S BUSINESS OR FOR ANY LOSS OF INCOME OR PROFIT THEREFROM.

37. Severability. If any clause or provision of this Lease is illegal, invalid or unenforceable under present or future laws, then and in that event, it is the intention of the parties hereto that the remainder of this Lease shall not be affected thereby. It is also the intention of the parties to this Lease that in lieu of each clause or provision of this Lease that is illegal, invalid or unenforceable, there be added, as a part of this Lease, a clause or provision as similar in effect to such illegal, invalid or unenforceable clause or provision as shall be legal, valid and enforceable.

38. Signs; Exterior Appearance. Tenant shall not, without the prior written consent of Landlord, which may be granted or withheld in Landlord’s sole discretion: (i) attach any awnings, exterior lights, decorations, balloons, flags, pennants, banners, painting or other projection to any outside wall of the Project, (ii) use any curtains, blinds, shades or screens other than Landlord’s standard window coverings, (iii) coat or otherwise sunscreen the interior or exterior of any windows, (iv) place any bottles, parcels, or other articles on the window sills, (v) place any equipment, furniture or other items of personal property on any exterior balcony, or (vi) paint, affix or exhibit on any part of the Premises or the Project any signs, notices, window or door lettering, placards, decorations, or advertising media of any type which can be viewed from the exterior of the Premises. Interior signs on the floors on which the Premises are located and the directory tablet shall be inscribed, painted or affixed for Tenant by Landlord at the sole cost and expense of Tenant, and shall be of a size, color and type acceptable to Landlord. Nothing may be placed on the exterior of corridor walls or corridor doors other than Landlord’s standard lettering. The directory tablet shall be provided exclusively for the display of the name and location of tenants.

Commencing on the date of this Lease, so long as Tenant is leasing no less than 100,000 rentable square feet of space in the Building, Tenant shall have the non-exclusive right to display, at Tenant’s cost and expense, a sign bearing Tenant’s name and/or logo (“Building Sign”) at a location on one side of the Building, which location and side of the Building shall be reasonably acceptable to Landlord and Tenant. Following the expiration or early termination of Landlord’s lease with Novartis at the Building, Tenant shall have the right to display an additional Building Sign at a location on a second side of the Building, which location and side of the Building shall be reasonably acceptable to Landlord and Tenant. Notwithstanding anything to the contrary contained herein, in no event shall Landlord grant rights to any other tenant of the Project to have signage on the Building façade on any side of the Building on which Tenant’s Building Sign(s) is/are located. For the avoidance of doubt, as used in this paragraph, “leasing” shall mean and include Tenant’s future obligation to occupy Phases of the Premises to be Delivered pursuant to Section 2 of this Lease, such that Tenant shall have the right, subject to the terms of this Lease and applicable Legal Requirements, to install the Building Sign following the mutual execution and delivery of this Lease by the parties. Tenant shall be responsible for obtaining all approvals from Governmental Authorities required in connection with the Building Sign. Notwithstanding the foregoing, Tenant acknowledges and agrees that the Building Sign including, without limitation, the size, color and type, shall be subject to Landlord’s prior written approval, which shall not be unreasonably withheld, and shall be subject to any and all other required approvals and applicable Legal Requirements. Tenant shall be responsible, at Tenant’s sole cost and expense, for the maintenance of the Building Sign, for the removal of the Building Sign at the expiration or earlier termination of this Lease and for the repair of all damage resulting from such removal. The Building Sign shall be personal to Tenant, except that such right may be assigned in connection with any Permitted Assignment.

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39. Right to Expand.

(a) Expansion in the Building. Tenant shall, during the Term, have the right, but not the obligation, to expand the Premises (the “Expansion Right”) to include the Available Space upon the terms and conditions set forth in this Section. For purposes of this Section 39(a), “Available Space” shall mean any full floor in the Building, which is not occupied by a tenant or which is occupied by a then-existing tenant whose lease is expiring within 9 months or less and such tenant does not wish to renew (whether or not such tenant has a right to renew) its occupancy of such space. If there is any Available Space, Landlord shall, at such time as Landlord shall elect so long as Tenant’s rights hereunder are preserved, deliver to Tenant written notice (the “Expansion Notice”) of such Available Space, together with the terms and conditions on which Landlord is prepared to lease Tenant such Available Space, which shall include a delivery date no sooner than 6 months after the Expansion Notice and which will provide sufficient time, as reasonably determined by Landlord, for Tenant to perform initial improvements in such Available Space prior to the date upon which Tenant is required to commence paying base rent with respect to such Available Space; provided that Base Rent for the Available Space shall be at the Market Rate (as defined in Section 40(a) below). Notwithstanding anything to the contrary contained in this Section 39(a), in no event shall Landlord be required to deliver an Expansion Notice to Tenant with respect to the lease of any premises comprised of less than a full floor. Tenant shall be entitled to exercise its right under this Section 39(a) only with respect to the entire Available Space identified in the Expansion Notice (“Identified Available Space”). Tenant shall have 10 business days following delivery of the Expansion Notice to deliver to Landlord written notification of Tenant’s exercise of the Expansion Right (“Exercise Notice”) with respect to the Identified Available Space.

Tenant shall be entitled to lease the Identified Available Space upon the terms and conditions set forth in the Expansion Notice. If Landlord and Tenant are unable to agree on the Market Rate for the Identified Available Space after negotiating in good faith within 5 days after Tenant’s delivery of an Exercise Notice, the applicable Market Rate will be determined through arbitration in accordance with Section 40(b) below. The Term of the lease with respect to the Identified Available Space shall be co-terminus with the Term of the Lease with respect to the then-existing Premises; provided, however, that if as of the commencement date of the Lease with respect to the Identified Available Space there would be less than 24 months of Term remaining with respect to the then-existing Premises, the expiration date of the Term of the Lease with respect to the entire Premises shall be extended to the date that is 60 months after the commencement date of the Lease with respect to the Identified Available Space. Notwithstanding anything to the contrary contained herein, in no event shall the Work Letter apply to the Identified Available Space. If Tenant fails to deliver an Exercise Notice to Landlord for the Identified Available Space within the required 10 business day period, Tenant shall be deemed to have waived its rights under this Section 39(a) to lease the Available Space, and Landlord shall have the right to lease the Available Space to any third party on any terms and conditions acceptable to Landlord. Notwithstanding anything to the contrary contained herein, Tenant shall have no right to exercise the Expansion Right and the provisions of this Section 39(a) shall no longer apply after the date that is 12 months prior to the expiration of the Base Term or the date that is 12 months prior to the expiration of the first Extension Term, if applicable, if Tenant has not exercised its applicable Extension Right pursuant to Section 40.

(b) Amended Lease. If: (i) Tenant fails to timely deliver an Exercise Notice, or (ii) after the expiration of a period of 10 days from the date Tenant delivers an Exercise Notice to Tenant, no lease amendment for the Identified Available Space has been executed, and Landlord tenders to Tenant an amendment to this Lease setting forth only the terms for the rental of the Identified Available Space consistent with those set forth in the Expansion Notice and otherwise consistent with the terms of this Lease and Tenant fails to execute such Lease amendment within 10 business days following such tender, Tenant shall be deemed to have waived its right to lease the Identified Available Space.

(c) Exceptions. Notwithstanding the above, the Expansion Right shall, at Landlord’s option, not be in effect and may not be exercised by Tenant:

(i) during any period of time that Tenant is in Default under any provision of the Lease; or

(ii) if Tenant has been in Default under any provision of the Lease 3 or more times, whether or not the Defaults are cured, during the 12 month period prior to the date on which Tenant seeks to exercise the Expansion Right.
(d) Termination. The Expansion Right shall, at Landlord’s option, terminate and be of no further force or effect even after Tenant’s due and timely exercise of the Expansion Right, if, after such exercise, but prior to the commencement date of the lease of the Identified Available Space, (i) Tenant fails to timely cure any default by Tenant under the Lease; or (ii) Tenant has Defaulted 3 or more times during the period from the date of the exercise of the Expansion Right to the date of the commencement of the lease of the Identified Available Space, whether or not such Defaults are cured.

(e) Rights Personal. The Expansion Right is personal to Tenant and are not assignable without Landlord’s consent, which may be granted or withheld in Landlord’s sole discretion separate and apart from any consent by Landlord to an assignment of Tenant’s interest in the Lease, except that it may be assigned in connection with any Permitted Assignment of this Lease.

(f) No Extensions. The period of time within which the Expansion Right may be exercised shall not be extended or enlarged by reason of Tenant’s inability to exercise the Expansion Right.

40. Right to Extend Term. Tenant shall have the right to extend the Term of the Lease upon the following terms and conditions:

(a) Extension Rights. Tenant shall have 2 consecutive rights (each, an “Extension Right”) to extend the term of this Lease for 5 years each (each, an “Extension Term”) on the same terms and conditions as this Lease (other than Base Rent and the Work Letter) by giving Landlord written notice of its election to exercise each Extension Right (“Election Notice”) at least 12 months prior to the expiration of the Base Term of the Lease or the expiration of the prior Extension Term, as applicable.

Upon the commencement of any Extension Term, Base Rent shall be payable at the Market Rate (as defined below). Base Rent shall thereafter be adjusted on each annual anniversary of the commencement of such Extension Term by a percentage as determined by Landlord and agreed to by Tenant at the time the Market Rate is determined. As used herein, “Market Rate” shall mean the rate that comparable landlords of comparable buildings have accepted in current transactions from non-equity (i.e., not being offered equity in the buildings) and nonaffiliated tenants of similar financial strength for space of comparable size, quality (including all Tenant Improvements, Alterations and other improvements) and floor height in Class A laboratory/office buildings in the vicinity of the Project for a comparable term, with the determination of the Market Rate to take into account all relevant factors, including tenant inducements, views, project amenities, parking costs, leasing commissions, allowances or concessions, if any.

Tenant shall exercise each Extension Right, if at all, as follows: (i) Tenant shall deliver written notice to Landlord (the “Interest Notice”) not more than 15 months nor less than 14 months prior to the expiration of the Base Term of the Lease or the expiration of the prior Extension Term, as applicable, stating that Tenant may be interested in exercising such Extension Right; (ii) Landlord shall deliver written notice (the “Option Rent Notice”) to Tenant within 30 days after Landlord’s receipt of the Interest Notice setting forth Landlord’s good faith determination of the Market Rate; and (iii) if Tenant wishes to exercise such Extension Right, Tenant shall, on or before the date (the “Exercise Date”) which is 12 months prior to the expiration of the Base Term of the Lease or the expiration of the prior Extension Term, as applicable, exercise such Extension Right by delivering an Election Notice to Landlord. Concurrently with Tenant’s delivery of the Election Notice to Landlord, Tenant may object, in writing (the “Objection Notice”), to Landlord’s determination of the Market Rate set forth in the Option Rent Notice, in which event such Market Rate shall be determined by arbitration pursuant to Section 40(b) below). If Tenant does not deliver an Objection Notice pursuant to the immediately preceding sentence, Tenant shall be deemed to have accepted Landlord’s determination of the Market Rate. Tenant acknowledges and agrees that, if Tenant has delivered an Election Notice to Landlord pursuant to this paragraph, Tenant shall have no right thereafter to rescind such Election Notice or elect not to extend the term of the Lease for the Extension Term subject to the Election Notice.
(b) Arbitration.

(i) Within 10 days of Tenant’s notice to Landlord of its election (or deemed election) to arbitrate Market Rate and escalations, each party shall deliver to the other a proposal containing the Market Rate and escalations that the submitting party believes to be correct (“Extension Proposal”). If either party fails to timely submit an Extension Proposal, the other party’s submitted proposal shall determine the Base Rent and escalations for the Extension Term. If both parties submit Extension Proposals, then Landlord and Tenant shall meet within 7 days after delivery of the last Extension Proposal and make a good faith attempt to mutually appoint a single Arbitrator (and defined below) to determine the Market Rate and escalations. If Landlord and Tenant are unable to agree upon a single Arbitrator, then each shall, by written notice delivered to the other within 10 days after the meeting, select an Arbitrator. If either party fails to timely give notice of its selection for an Arbitrator, the other party’s submitted proposal shall determine the Base Rent for the Extension Term. The 2 Arbitrators so appointed shall, within 5 business days after their appointment, appoint a third Arbitrator. If the 2 Arbitrators so selected cannot agree on the selection of the third Arbitrator within the time above specified, then either party, on behalf of both parties, may request such appointment of such third Arbitrator by application to any state court of general jurisdiction in the jurisdiction in which the Premises are located, upon 10 days prior written notice to the other party of such intent.

(ii) The decision of the Arbitrator(s) shall be made within 30 days after the appointment of a single Arbitrator or the third Arbitrator, as applicable. The decision of the single Arbitrator shall be final and binding upon the parties. The average of the two closest Arbitrators in a three Arbitrator panel shall be final and binding upon the parties. Each party shall pay the fees and expenses of the Arbitrator appointed by or on behalf of such party and the fees and expenses of the third Arbitrator shall be borne equally by both parties. If the Market Rate and escalations are not determined by the first day of the Extension Term, then Tenant shall pay Landlord Base Rent in an amount equal to the Base Rent in effect immediately prior to the Extension Term and increased by the Rent Adjustment Percentage until such determination is made. After the determination of the Market Rate and escalations, the parties shall make any necessary adjustments to such payments made by Tenant. Landlord and Tenant shall then execute an amendment recognizing the Market Rate and escalations for the Extension Term.

(iii) An “Arbitrator” shall be any person appointed by or on behalf of either party or appointed pursuant to the provisions hereof and: (i) shall be (A) a member of the American Institute of Real Estate Appraisers with not less than 10 years of experience in the appraisal of improved office and high tech industrial real estate in the greater Cambridge metropolitan area, or (B) a licensed commercial real estate broker with not less than 15 years experience representing landlords and/or tenants in the leasing of high tech or life sciences space in the greater Cambridge metropolitan area, (ii) devoting substantially all of their time to professional appraisal or brokerage work, as applicable, at the time of appointment and (iii) be in all respects impartial and disinterested.

(c) Rights Personal. The Extension Rights are personal to Tenant and are not assignable without Landlord’s consent, which may be granted or withheld in Landlord’s sole discretion separate and apart from any consent by Landlord to an assignment of Tenant’s interest in the Lease, except that they may be assigned in connection with any Permitted Assignment of this Lease.

(d) Exceptions. Notwithstanding anything set forth above to the contrary, the Extension Rights shall, at Landlord’s option, not be in effect and Tenant may not exercise any of the Extension Rights:

(i) during any period of time that Tenant is in Default under any provision of this Lease; or

(ii) if Tenant has been in Default under any provision of this Lease 3 or more times, whether or not the Defaults are cured, during the 12 month period immediately prior to the date that Tenant intends to exercise an Extension Right, whether or not the Defaults are cured; or
(iii) if Tenant and/or any entity under a Permitted Assignment is not in occupancy of at least 75% of the Premises demised hereunder both at the time of the exercise of an Extension Right and at the time of the commencement date of the applicable Extension Term.

(e) **No Extensions.** The period of time within which an Extension Right may be exercised shall not be extended or enlarged by reason of Tenant’s inability to exercise such Extension Right.

(f) **Termination.** The Extension Rights shall, at Landlord’s option, terminate and be of no further force or effect even after Tenant’s due and timely exercise of an Extension Right, if, after such exercise, but prior to the commencement date of an Extension Term, (i) Tenant fails to timely cure any default by Tenant under this Lease; or (ii) Tenant has Defaulted 3 or more times during the period from the date of the exercise of an Extension Right to the date of the commencement of the Extension Term, whether or not such Defaults are cured.

41. **Intentionally Omitted.**

42. **Miscellaneous.**

(a) **Notices.** All notices or other communications between the parties shall be in writing and shall be deemed duly given upon delivery or refusal to accept delivery by the addressee thereof if delivered in person, or upon actual receipt if delivered by reputable overnight guaranty courier, addressed and sent to the parties at their addresses set forth above. Landlord and Tenant may from time to time by written notice to the other designate another address for receipt of future notices.

(b) **Joint and Several Liability.** If and when included within the term “Tenant,” as used in this instrument, there is more than one person or entity, each shall be jointly and severally liable for the obligations of Tenant.

(c) **Financial Information.** Tenant shall furnish Landlord with true and complete copies of (i) Tenant’s most recent audited annual financial statements within 150 days of the end of each of Tenant’s fiscal years during the Term, and (ii) Tenant’s most recent unaudited quarterly financial statements within 45 days of the end of each of Tenant’s first three fiscal quarters of each of Tenant’s fiscal years during the Term. Notwithstanding the foregoing, in no event shall Tenant be required to provide any financial information to Landlord which Tenant does not otherwise prepare (or cause to be prepared) for its own purposes. So long as Tenant is a “public company” and its financial information is publicly available, then the foregoing delivery requirements of this Section 42(c) shall not apply.

(d) **Recordation.** Neither this Lease nor a memorandum of lease shall be filed by or on behalf of Tenant in any public record. Landlord may prepare and file, and upon request by Landlord Tenant will execute, a memorandum of lease.

(e) **Interpretation.** The normal rule of construction to the effect that any ambiguities are to be resolved against the drafting party shall not be employed in the interpretation of this Lease or any exhibits or amendments hereto. Words of any gender used in this Lease shall be held and construed to include any other gender, and words in the singular number shall be held to include the plural, unless the context otherwise requires. The captions inserted in this Lease are for convenience only and in no way define, limit or otherwise describe the scope or intent of this Lease, or any provision hereof, or in any way affect the interpretation of this Lease.

(f) **Not Binding Until Executed.** The submission by Landlord to Tenant of this Lease shall have no binding force or effect, shall not constitute an option for the leasing of the Premises, nor confer any right or impose any obligations upon either party until execution of this Lease by both parties.
(g) **Limitations on Interest.** It is expressly the intent of Landlord and Tenant at all times to comply with applicable law governing the maximum rate or amount of any interest payable on or in connection with this Lease. If applicable law is ever judicially interpreted so as to render usurious any interest called for under this Lease, or contracted for, charged, taken, reserved, or received with respect to this Lease, then it is Landlord’s and Tenant’s express intent that all excess amounts theretofore collected by Landlord be credited on the applicable obligation (or, if the obligation has been or would thereby be paid in full, refunded to Tenant), and the provisions of this Lease immediately shall be deemed reformed and the amounts thereafter collectible hereunder reduced, without the necessity of the execution of any new document, so as to comply with the applicable law, but so as to permit the recovery of the fullest amount otherwise called for hereunder.

(h) **Choice of Law.** Construction and interpretation of this Lease shall be governed by the internal laws of the state in which the Premises are located, excluding any principles of conflicts of laws.

(i) **Time.** Time is of the essence as to the performance of Tenant’s obligations under this Lease.

(j) **OFAC.** Tenant, and all beneficial owners of Tenant, are currently (a) in compliance with and shall at all times during the Term of this Lease remain in compliance with the regulations of the Office of Foreign Assets Control ("OFAC") of the U.S. Department of Treasury and any statute, executive order, or regulation relating thereto (collectively, the "OFAC Rules"), (b) not listed on, and shall not during the term of this Lease be listed on, the Specially Designated Nationals and Blocked Persons List maintained by OFAC and/or on any other similar list maintained by OFAC or other governmental authority pursuant to any authorizing statute, executive order, or regulation, and (c) not a person or entity with whom a U.S. person is prohibited from conducting business under the OFAC Rules.

(k) **Incorporation by Reference.** All exhibits and addenda attached hereto are hereby incorporated into this Lease and made a part hereof. If there is any conflict between such exhibits or addenda and the terms of this Lease, such exhibits or addenda shall control.

(l) **Entire Agreement.** This Lease, including the exhibits attached hereto, constitutes the entire agreement between Landlord and Tenant pertaining to the subject matter hereof and supersedes all prior and contemporaneous agreements, understandings, letters of intent, negotiations and discussions, whether oral or written, of the parties, and there are no warranties, representations or other agreements, express or implied, made to either party by the other party in connection with the subject matter hereof except as specifically set forth herein.

(m) **No Accord and Satisfaction.** No payment by Tenant or receipt by Landlord of a lesser amount than the monthly installment of Base Rent or any Additional Rent will be other than on account of the earliest stipulated Base Rent and Additional Rent, nor will any endorsement or statement on any check or letter accompanying a check for payment of any Base Rent or Additional Rent be an accord and satisfaction. Landlord may accept such check or payment without prejudice to Landlord’s right to recover the balance of such Rent or to pursue any other remedy provided in this Lease.

(n) **Hazardous Activities.** Notwithstanding any other provision of this Lease, Landlord, for itself and its employees, agents and contractors, reserves the right to refuse to perform any repairs or services in any portion of the Premises which, pursuant to Tenant’s routine safety guidelines, practices or custom or prudent industry practices, require any form of protective clothing or equipment other than safety glasses. In any such case, Tenant shall contract with parties who are acceptable to Landlord, in Landlord’s reasonable discretion, for all such repairs and services, and Landlord shall, to the extent required, equitably adjust Tenant’s Share of Operating Expenses in respect of such repairs or services to reflect that Landlord is not providing such repairs or services to Tenant.

[ Signatures on next page ]
IN WITNESS WHEREOF, Landlord and Tenant have executed this Lease as of the day and year first above written.

**TENANT:**

**MODERNA THERAPEUTICS, INC.,**
a Delaware corporation

By: /s/ Stéphane Bancel
Its: Stéphane Bancel
Chief Executive Officer

**LANDLORD:**

**ARE-TECH SQUARE, LLC,**
a Delaware limited liability company

By: ARE-MA REGION NO. 31, LLC,
a Delaware limited liability company, its manager

By: ALEXANDRIA REAL ESTATE EQUITIES, L.P.,
a Delaware limited partnership, managing member

By: ARE-QRS CORP.,
a Maryland corporation, general partner

By: /s/ Eric S. Johnson
Its: Eric S. Johnson
Senior Vice President
RE Legal Affairs
EXHIBIT A-1 TO LEASE

DESCRIPTION OF PREMISES

<table>
<thead>
<tr>
<th>Phase</th>
<th>RSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,845 rsf</td>
</tr>
<tr>
<td>2</td>
<td>52,627 rsf</td>
</tr>
<tr>
<td>3</td>
<td>18,263 rsf</td>
</tr>
<tr>
<td>4</td>
<td>17,857 rsf</td>
</tr>
<tr>
<td>5</td>
<td>16,188 rsf</td>
</tr>
<tr>
<td>6</td>
<td>17,980 rsf</td>
</tr>
</tbody>
</table>
EXHIBIT B TO LEASE

DESCRIPTION OF PROJECT

The following parcels of land in Cambridge, Middlesex County, Massachusetts:

The Registered Land shown as Lots 15,16 and 19 on Land Court Plan No. 30711E, Lot 43 on Land Court Plan No. 30711J and Lots 46 and 47 on Land Court Plan No. 30711K, and

The Unregistered Land shown as Area No. 1, Area No. 2, Area No. 3, Area No. 4, Area No. 5, Area No. 6, Area No. 7, Area No. 8 and Area No. 9 on a plan entitled “Plan of Land and Easements, Cambridge, Mass.” Prepared by Raymond C. Pressey, Inc., dated June 1970 and recorded with the Middlesex South Registry of Deeds in Book 11879, Page 393, Plan 852 (A of 2) of 1970.

Excepting therefrom that portion taken by the Cambridge Redevelopment Authority Eminent Domain Taking dated April 12, 1982 and recorded in Book 14590, Page 221 and that portion taken by the Cambridge Redevelopment Authority Eminent Domain Taking dated January 27, 1983 and recorded in Book 14891, Page 556.

Said parcels are also described as Units 100, 200, 300, 400, 500, 600 and 700 of that certain condominium known as the Technology Square Condominium, as set forth in that certain Master Deed dated November 30, 2000, executed by Technology Square LLC, and recorded with the Registry in Book 32159, at Page 490, and registered with the Land Court as Document No. 1158816, under Certificate of Title No. C404, as the same has been amended by that certain Amendment to Master Deed dated May 28, 2002, and recorded with the Registry as Instrument No. 690 on September 6, 2002, and registered with the Land Court as Document No. 1226564, and as the same has been amended by that certain Second Amendment to Master Deed dated as of November 15, 2002, and recorded with the Registry as Instrument No. 1617 on September 23, 2003, and registered with the Land Court as Document No. 1293465.

Together with the benefit of and subject to the following:

1. Terms and provisions of Reciprocal Easement Agreement dated April 18, 2000 by and between Technology Square LLC and the Charles Stark Draper Laboratory, Inc. recorded in Book 31324, Page 262 and filed as Document No. 1137080, as amended by First Amendment to Reciprocal Easement Agreement dated February 6, 2003 recorded in Book 38441, Page 415 and filed as Document No. 1261130, and as amended by Second Amendment to Reciprocal Easement Agreement dated March 26, 2004 recorded in Book 42362, Page 126 and filed as Document No. 1315537.

2. Terms and provisions of Foundation, Grade Beam and Encroachment Agreement dated March 11, 1975, filed as Document No. 531493, as amended by an Amendment to Foundation Grade Beam and Encroachment Agreement, dated September 1, 1976, filed as Document No. 547840, affecting Lots 19 and 20, as affected by Reciprocal Easement Agreement dated April 18, 2000 recorded in Book 31324, Page 262 and filed as Document No. 1137080, as amended by Amendment to Foundation, Grade Beam and Encroachment Agreement, dated September 1, 1976, filed with the Registry District as Document No. 547840, affecting Lots 19 and 20, as affected by the Reciprocal Easement Agreement.

All as affected by Voluntary Withdrawal from Registration filed January 16, 2008 as Document No. 1462980. For title see Deed in Book 42269, Page 372 and Notice of Lease in Book 42269, Page 395.
EXHIBIT C TO LEASE

WORK LETTER

THIS WORK LETTER (this “Work Letter”) is incorporated into that certain Lease Agreement (the “Lease”) dated as of , by and between ARE-TECH SQUARE, LLC, a Delaware limited liability company (“Landlord”), and MODERNA THERAPEUTICS, INC., a Delaware corporation (“Tenant”). Any initially capitalized terms used but not defined herein shall have the meanings given them in the Lease.

1. General Requirements.

(a) Tenant’s Authorized Representative. Tenant designates Steven Harbin (“Tenant’s Representative”) as the only person authorized to act for Tenant pursuant to this Work Letter. Landlord shall not be obligated to respond to or act upon any request, approval, inquiry or other communication (“Communication”) from or on behalf of Tenant in connection with this Work Letter unless such Communication is in writing from Tenant’s Representative. Tenant may change Tenant’s Representative at any time upon not less than 5 business days advance written notice to Landlord.

(b) Landlord’s Authorized Representative. Landlord designates Tim White and Dan Cordeau (either such individual acting alone, “Landlord’s Representative”) as the only persons authorized to act for Landlord pursuant to this Work Letter. Tenant shall not be obligated to respond to or act upon any request, approval, inquiry or other Communication from or on behalf of Landlord in connection with this Work Letter unless such Communication is in writing from Landlord’s Representative. Landlord may change either Landlord’s Representative at any time upon not less than 5 business days advance written notice to Tenant.

(c) Architects, Consultants and Contractors. Landlord and Tenant hereby acknowledge and agree that the architect (the “TI Architect”) for the Tenant Improvements (as defined in Section 2(a) below), the general contractor and any subcontractors for the Tenant Improvements shall be selected by Tenant, subject to Landlord’s approval, which approval shall not be unreasonably withheld, conditioned or delayed. Landlord shall be named a third party beneficiary of any contract entered into by Tenant with the TI Architect, any consultant, any contractor or any subcontractor, and of any warranty made by any contractor or any subcontractor. Tenant may retain a third party project manager reasonably acceptable to Landlord to oversee the construction of the Tenant Improvements. The reasonable costs and fees of such project manager may be paid for out of the TI Fund (as defined in Section 5(d) below).

2. Tenant Improvements.

(a) Tenant Improvements Defined. As used herein, “Tenant Improvements” shall mean all improvements to the Premises desired by Tenant of a fixed and permanent nature. Other than funding the TI Allowance (as defined below) as provided herein, Landlord shall not have any obligation whatsoever with respect to the finishing of the Premises for Tenant’s use and occupancy. Landlord and Tenant acknowledge and agree that the Tenant Improvements shall be constructed in multiple phases.

(b) Tenant’s Space Plans. Tenant shall deliver to Landlord schematic drawings and outline specifications (the “TI Design Drawings”) detailing Tenant’s requirements for the Tenant Improvements. Not more than 5 business days thereafter, Landlord shall deliver to Tenant the written objections, questions or comments of Landlord and the TI Architect with regard to the TI Design Drawings. Tenant shall cause the TI Design Drawings to be revised to address such written comments and shall resubmit said drawings to Landlord for approval. Such process shall continue until Landlord has approved the TI Design Drawings.
(c) Working Drawings. Following the approval of the TI Design Drawings by Landlord, Tenant shall cause the TI Architect to prepare and deliver to Landlord for review and comment construction plans, specifications and drawings for the Tenant Improvements ("TI Construction Drawings"), which TI Construction Drawings shall be prepared substantially in accordance with the TI Design Drawings. Tenant shall be solely responsible for ensuring that the TI Construction Drawings reflect Tenant’s requirements for the Tenant Improvements. Landlord shall deliver its written comments on the TI Construction Drawings to Tenant not later than 5 business days after Landlord’s receipt of the same; provided, however, that Landlord may not disapprove any matter that is consistent with the TI Design Drawings. Tenant and the TI Architect shall consider all such comments in good faith and shall, within 5 business days after receipt, notify Landlord how Tenant proposes to respond to such comments. Any disputes in connection with such comments shall be resolved in accordance with Section 2(d) hereof. Provided that the design reflected in the TI Construction Drawings is consistent with the TI Design Drawings, Landlord shall approve the TI Construction Drawings submitted by Tenant. Once approved by Landlord, subject to the provisions of Section 4 below, Tenant shall not materially modify the TI Construction Drawings except as may be reasonably required in connection with the issuance of the TI Permit (as defined in Section 3(a) below).

(d) Approval and Completion. If any dispute regarding the design of the Tenant Improvements is not settled within 10 business days after notice of such dispute is delivered by one party to the other, Tenant may make the final decision regarding the design of the Tenant Improvements, provided (i) Tenant acts reasonably, (ii) that all costs and expenses resulting from any such decision by Tenant shall be payable out of the TI Fund, and (iii) Tenant’s decision will not affect the base Building, structural components of the Building or any Building systems (in which case Landlord shall make the final decision). Any changes to the TI Construction Drawings following Landlord’s and Tenant’s approval of same requested by Tenant shall be processed as provided in Section 4 hereof.


(a) Commencement and Permitting of the Tenant Improvements. Tenant shall commence construction of the Tenant Improvements upon obtaining and delivering to Landlord a building permit (the “TI Permit”) authorizing the construction of the Tenant Improvements consistent with the TI Construction Drawings approved by Landlord. The cost of obtaining the TI Permit shall be payable from the TI Fund. Landlord shall assist Tenant in obtaining the TI Permit. Prior to the commencement of the Tenant Improvements, Tenant shall deliver to Landlord a copy of any contract with Tenant’s contractors (including the TI Architect), and certificates of insurance from any contractor performing any part of the Tenant Improvement evidencing industry standard commercial general liability, automotive liability, “builder’s risk”, and workers’ compensation insurance. Tenant shall cause the general contractor to provide a certificate of insurance naming Landlord, Alexandria Real Estate Equities, Inc., and Landlord’s lender (if any) as additional insureds for the general contractor’s liability coverages required above.

(b) Selection of Materials, Etc. Where more than one type of material or structure is indicated on the TI Construction Drawings approved by Tenant and Landlord, the option will be within Tenant’s reasonable discretion if the matter concerns the Tenant Improvements, and within Landlord’s sole and absolute subjective discretion if the matter concerns the structural components of the Building or any Building system.

(c) Tenant Liability. Tenant shall be responsible for correcting any deficiencies or defects in the Tenant Improvements.

(d) Substantial Completion. Tenant shall substantially complete or cause to be substantially completed the Tenant Improvements in a good and workmanlike manner, in accordance with the TI Permit subject, in each case, to Minor Variations and normal “punch list” items of a non-material nature which do not interfere with the use of the Premises, respectively (“Substantial Completion” or “Substantially Complete”). Upon Substantial Completion of the Tenant Improvements in each Phase of the Premises, Tenant shall require the TI Architect and the general contractor to execute and deliver, for
the benefit of Tenant and Landlord, a Certificate of Substantial Completion in the form of the American Institute of Architects ("AIA") document G704. For purposes of this Work Letter, "Minor Variations" shall mean any modifications reasonably required: (i) to comply with all applicable Legal Requirements and/or to obtain or to comply with any required permit (including the TI Permit); (ii) to comport with good design, engineering, and construction practices which are not material; or (iii) to make reasonable adjustments for field deviations or conditions encountered during the construction of the Tenant Improvements.

4. Changes. Any changes requested by Tenant to the Tenant Improvements after the delivery and approval by Landlord of the TI Design Drawings, shall be requested and instituted in accordance with the provisions of this Section 4 and shall be subject to the written approval of Landlord, which approval shall not be unreasonably withheld, conditioned or delayed.

(a) Tenant’s Right to Request Changes. If Tenant shall request changes ("Changes"), Tenant shall request such Changes by notifying Landlord in writing in substantially the same form as the AIA standard change order form (a "Change Request"), which Change Request shall detail the nature and extent of any such Change. Such Change Request must be signed by Tenant’s Representative. Landlord shall review and approve or disapprove such Change Request within 5 business days thereafter, provided that Landlord’s approval shall not be unreasonably withheld, conditioned or delayed.

(b) Implementation of Changes. If Landlord approves such Change and Tenant deposits with Landlord any Excess TI Costs (as defined in Section 5(d) below) required in connection with such Change, Tenant may cause the approved Change to be instituted. If any TI Permit modification or change is required as a result of such Change, Tenant shall promptly provide Landlord with a copy of such TI Permit modification or change.

5. Costs.

(a) Budget For Tenant Improvements. Before the commencement of construction of the Tenant Improvements, Tenant shall obtain a detailed breakdown, by trade, of the costs incurred or that will be incurred, in connection with the design and construction of the Tenant Improvements (the "Budget"), and deliver a copy of the Budget to Landlord. The Budget shall be based upon the TI Construction Drawings approved by Landlord.

(b) TI Allowance. Landlord shall provide to Tenant a tenant improvement allowance (collectively, the "TI Allowance") as follows:

1. a "Tenant Improvement Allowance" in the maximum amount of $10.00 per rentable square foot in the Premises, or $1,247,600 in the aggregate, which is included in the Base Rent set forth in the Lease; and

2. an "Additional Tenant Improvement Allowance" in the maximum amount of $30.00 per rentable square foot in the Premises, or $3,742,800 in the aggregate, which shall, to the extent used, result in Additional Rent as set forth in Section 4(b) of the Lease.

The TI Allowance shall be disbursed in accordance with this Work Letter. Tenant shall have no right to the use or benefit (including any reduction to Base Rent) of any portion of the TI Allowance not required for the construction of (i) the Tenant Improvements described in the TI Construction Drawings approved pursuant to Section 2(d) or (ii) any Changes pursuant to Section 4. Tenant shall have no right to any portion of the TI Allowance that is not disbursed before November 30, 2021.
(c) **Costs Includable in TI Fund.** The TI Fund shall be used solely for the payment of design (including A&E drawings), permits and construction costs in connection with the construction of the Tenant Improvements, including, without limitation, the cost of electrical power and other utilities used in connection with the construction of the Tenant Improvements, the cost of preparing the TI Design Drawings and the TI Construction Drawings, all costs set forth in the Budget, including and the cost of Changes (collectively, "TI Costs"). Notwithstanding anything to the contrary contained herein, except as provided below, the TI Fund shall not be used to purchase any furniture, personal property or other non-Building system materials or equipment, including, but not be limited to, non-ducted biological safety cabinets and other scientific equipment not incorporated into the Tenant Improvements; provided, however, that the TI Fund may be used for Tenant’s voice and data cabling, special electrical power distribution, telephone and security systems.

(d) **Excess TI Costs.** Landlord shall have no obligation to bear any portion of the cost of any of the Tenant Improvements except to the extent of the TI Allowance. If at any time and from time-to-time, the remaining TI Costs under the Budget exceed the remaining unexpended TI Allowance ("Excess TI Costs"), monthly disbursements of the TI Allowance shall be made in the proportion that the remaining TI Allowance bears to the outstanding TI Costs under the Budget, and Tenant shall fund the balance of each such monthly draw. For purposes of any litigation instituted with regard to such amounts, those amounts required to be paid by Tenant will be deemed Rent under the Lease. The TI Allowance and Excess TI Costs is herein referred to as the “TI Fund.” Notwithstanding anything to the contrary set forth in this Section 5(d), Tenant shall be fully and solely liable for TI Costs and the cost of Minor Variations in excess of the TI Allowance.

(e) **Payment for TI Costs.** During the course of design and construction of the Tenant Improvements, Landlord shall reimburse Tenant for TI Costs once a month against a draw request in Landlord’s standard form, containing evidence of payment of such TI Costs by Tenant and such certifications, lien waivers (including a conditional lien release for each progress payment and unconditional lien releases for the prior month’s progress payments), inspection reports and other matters as Landlord customarily obtains, to the extent of Landlord’s approval thereof for payment, no later than 30 days following receipt of such draw request. Upon completion of the Tenant Improvements (and prior to any final disbursement of the TI Fund), Tenant shall deliver to Landlord:

(i) sworn statements setting forth the names of all contractors and first tier subcontractors who did the work and final, unconditional lien waivers from all such contractors and first tier subcontractors;

(ii) as-built plans (one copy in print format and two copies in electronic CAD format) for such Tenant Improvements;

(iii) a certification of substantial completion in Form AIA G704, (iv) a certificate of occupancy for the Premises; and (v) copies of all operation and maintenance manuals and warranties affecting the Premises.

6. **Miscellaneous.**

(a) **Consents.** Whenever consent or approval of either party is required under this Work Letter, that party shall not unreasonably withhold, condition or delay such consent or approval, except as may be expressly set forth herein to the contrary.

(b) **Modification.** No modification, waiver or amendment of this Work Letter or of any of its conditions or provisions shall be binding upon Landlord or Tenant unless in writing signed by Landlord and Tenant.

(c) **Default.** Notwithstanding anything set forth herein or in the Lease to the contrary, Landlord shall not have any obligation to fund any portion of the TI Fund during any period Tenant is in Default under the Lease.
EXHIBIT D TO LEASE

ACKNOWLEDGMENT OF COMMENCEMENT DATE

This ACKNOWLEDGMENT OF COMMENCEMENT DATE is made as of this day of , 2023, between ARE-TECH SQUARE, LLC, a Delaware limited liability company ("Landlord"), and MODERNA THERAPEUTICS, INC., a Delaware corporation ("Tenant"), and is attached to and made a part of the Lease dated as of (the "Lease"), by and between Landlord and Tenant. Any initially capitalized terms used but not defined herein shall have the meanings given them in the Lease.

Landlord and Tenant hereby acknowledge and agree, for all purposes of the Lease, that the Phase 1 Premises Commencement Date is , 2023, the Phase 2 Non-Sublease Premises Commencement Date is , 2023, the Phase 3 Premises Commencement Date is , 2023, the Phase 4 Premises Commencement Date is , 2023, the Phase 5 Premises Commencement Date is , 2023, and the expiration date of the Base Term of the Lease shall be midnight on December 31, 2027. In case of a conflict between the terms of the Lease and the terms of this Acknowledgment of Commencement Date, this Acknowledgment of Commencement Date shall control for all purposes.

IN WITNESS WHEREOF, Landlord and Tenant have executed this ACKNOWLEDGMENT OF COMMENCEMENT DATE to be effective on the date first above written.

TENANT:
MODERNA THERAPEUTICS, INC.,
a Delaware corporation

By: ________________________________
Its: _______________________________

LANDLORD:
ARE-TECH SQUARE, LLC,
a Delaware limited liability company

By: ARE-MA REGION NO. 31, LLC,
a Delaware limited liability company, its manager

By: ALEXANDRIA REAL ESTATE EQUITIES, L.P.,
a Delaware limited partnership, managing member

By: ARE-QRS CORP.,
a Maryland corporation, general partner

By: ________________________________
Its: _______________________________
EXHIBIT E TO LEASE

Rules and Regulations

1. The sidewalk, entries, and driveways of the Project shall not be obstructed by Tenant, or any Tenant Party, or used by them for any purpose other than ingress and egress to and from the Premises.

2. Tenant shall not place any objects, including antennas, outdoor furniture, etc., in the parking areas, landscaped areas or other areas outside of its Premises, or on the roof of the Project.

3. Except for animals assisting the disabled, no animals shall be allowed in the Premises, offices, halls, or corridors in the Project.

4. Tenant shall not disturb the occupants of the Project or adjoining buildings by the use of any radio or musical instrument or by the making of loud or improper noises.

5. If Tenant desires telegraphic, telephonic or other electric connections in the Premises, Landlord or its agent will direct the electrician as to where and how the wires may be introduced; and, without such direction, no boring or cutting of wires will be permitted. Any such installation or connection shall be made at Tenant’s expense.

6. Tenant shall not install or operate any steam or gas engine or boiler, or other mechanical apparatus in the Premises, except as specifically approved in the Lease. The use of oil, gas or inflammable liquids for heating, lighting or any other purpose is expressly prohibited. Explosives or other articles deemed extra hazardous shall not be brought into the Project.

7. Parking any type of recreational vehicles is specifically prohibited on or about the Project. Except for the overnight parking of operative vehicles, no vehicle of any type shall be stored in the parking areas at any time. In the event that a vehicle is disabled, it shall be removed within 48 hours. There shall be no “For Sale” or other advertising signs on or about any parked vehicle. All vehicles shall be parked in the designated parking areas in conformity with all signs and other markings. All parking will be open parking, and no reserved parking, numbering or lettering of individual spaces will be permitted except as specified by Landlord.

8. Tenant shall maintain the Premises free from rodents, insects and other pests.

9. Landlord reserves the right to exclude or expel from the Project any person who, in the judgment of Landlord, is intoxicated or under the influence of liquor or drugs or who shall in any manner do any act in violation of the Rules and Regulations of the Project.

10. Tenant shall not cause any unnecessary labor by reason of Tenant’s carelessness or indifference in the preservation of good order and cleanliness. Landlord shall not be responsible to Tenant for any loss of property on the Premises, however occurring, or for any damage done to the effects of Tenant by the janitors or any other employee or person.

11. Tenant shall give Landlord prompt notice of any defects in the water, lawn sprinkler, sewage, gas pipes, electrical lights and fixtures, heating apparatus, or any other service equipment affecting the Premises.

12. Tenant shall not permit storage outside the Premises, including without limitation, outside storage of trucks and other vehicles, or dumping of waste or refuse or permit any harmful materials to be placed in any drainage system or sanitary system in or about the Premises.
13. All moveable trash receptacles provided by the trash disposal firm for the Premises must be kept in the trash enclosure areas, if any, provided for that purpose.

14. No auction, public or private, will be permitted on the Premises or the Project.

15. No awnings shall be placed over the windows in the Premises except with the prior written consent of Landlord.

16. The Premises shall not be used for lodging, sleeping or cooking or for any immoral or illegal purposes or for any purpose other than that specified in the Lease. No gaming devices shall be operated in the Premises.

17. Tenant shall ascertain from Landlord the maximum amount of electrical current which can safely be used in the Premises, taking into account the capacity of the electrical wiring in the Project and the Premises and the needs of other tenants, and shall not use more than such safe capacity. Landlord’s consent to the installation of electric equipment shall not relieve Tenant from the obligation not to use more electricity than such safe capacity.

18. Tenant assumes full responsibility for protecting the Premises from theft, robbery and pilferage.

19. Tenant shall not install or operate on the Premises any machinery or mechanical devices of a nature not directly related to Tenant’s ordinary use of the Premises and shall keep all such machinery free of vibration, noise and air waves which may be transmitted beyond the Premises.
EXHIBIT F TO LEASE

TENANT’S PERSONAL PROPERTY

None.
FIRST AMENDMENT TO LEASE

THIS FIRST AMENDMENT TO LEASE (this “First Amendment”) is made as of August 31, 2016, by and between ARE-TECH SQUARE, LLC, a Delaware limited liability company (“Landlord”), and MODERNA THERAPEUTICS, INC., a Delaware corporation (“Tenant”).

RECITALS

A. Landlord and Tenant are now parties to that certain Lease Agreement dated as of May 26, 2016 (as amended, the “Lease”). Pursuant to the Lease, Tenant leases certain premises consisting of approximately 124,760 rentable square feet of space (“Premises”) in a building located at 200 Technology Square, Cambridge, Massachusetts (“Building”). The Premises are more particularly described in the Lease. Capitalized terms used herein without definition shall have the meanings defined for such terms in the Lease.

B. Pursuant to Section 2(d) of the Lease, if the Capsugel Lease terminates prior to May 1, 2019, then the Early Phase 4 Premises Commencement Date shall occur on the day immediately following such early termination of the Capsugel Lease.

C. Concurrently with Landlord entering into this First Amendment with Tenant, Landlord is entering into an agreement with Capsugel pursuant to which the Capsugel Lease shall terminate on March 30, 2017.

D. Landlord and Tenant desire, subject to the terms and conditions set forth below, to amend the Lease, among other things, acknowledge the early commencement of the Lease with respect to the Phase 4 Premises as of the Early Phase 4 Premises Commencement Date.

NOW, THEREFORE, in consideration of the foregoing Recitals, which are incorporated herein by this reference, the mutual promises and conditions contained herein, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Landlord and Tenant hereby agree as follows:

1. **Phase 4 Premises Commencement Date.** Notwithstanding anything to the contrary contained in the Lease, Landlord and Tenant acknowledge and agree that the Early Phase 4 Premises Commencement Date shall occur on April 1, 2017.

2. **Base Rent.** Commencing on the Early Phase 4 Premises Commencement Date, Tenant shall pay Base Rent with respect to the Phase 4 Premises pursuant to the following table:

<table>
<thead>
<tr>
<th>Period</th>
<th>Base Rent</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/1/17 – 4/30/17</td>
<td>$55.00 per rsf of the Phase 4 Premises per year</td>
</tr>
<tr>
<td>5/1/17 – 4/30/18</td>
<td>$56.00 per rsf of the Phase 4 Premises per year</td>
</tr>
<tr>
<td>5/1/18 – 4/30/19</td>
<td>$57.00 per rsf of the Phase 4 Premises per year</td>
</tr>
</tbody>
</table>

   Commencing on May 1, 2019, Tenant shall commence paying Base Rent with respect to the Phase 4 Premises at the same rate per rentable square foot then being paid by Tenant with respect to the Phase 1 Premises, as adjusted pursuant to Section 4(a) of the Lease.

3. **Operating Expenses.** Commencing on the Early Phase 4 Premises Commencement Date, Tenant shall commence paying Tenant’s Share of Operating Expenses under the Lease with respect to the Phase 4 Premises, which is equal to 10.08%.

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4. **Brokers.** Landlord and Tenant each represents and warrants that it has not dealt with any broker, agent or other person (collectively, “Broker”) in connection with the transaction reflected in this First Amendment and that no Broker brought about this transaction. Landlord and Tenant each hereby agrees to indemnify and hold the other harmless from and against any claims by any Broker claiming a commission or other form of compensation by virtue of having dealt with Tenant or Landlord, as applicable, with regard to this First Amendment.

5. **OFAC.** Tenant and all beneficial owners of Tenant are currently (a) in compliance with and shall at all times during the Term of the Lease remain in compliance with the regulations of the Office of Foreign Assets Control (“OFAC”) of the U.S. Department of Treasury and any statute, executive order, or regulation relating thereto (collectively, the “OFAC Rules”), (b) not listed on, and shall not during the term of the Lease be listed on, the Specially Designated Nationals and Blocked Persons List, Foreign Sanctions Evaders List or the Sectoral Sanctions Identifications List, which are all maintained by OFAC and/or on any other similar list maintained by OFAC or other governmental authority pursuant to any authorizing statute, executive order, or regulation, and (c) not a person or entity with whom a U.S. person is prohibited from conducting business under the OFAC Rules.

6. **Miscellaneous.**
   a. This First Amendment is the entire agreement between the parties with respect to the subject matter hereof and supersedes all prior and contemporaneous oral and written agreements and discussions. This First Amendment may be amended only by an agreement in writing, signed by the parties hereto.
   b. This First Amendment is binding upon and shall inure to the benefit of the parties hereto, their respective successors and assigns.
   c. This First Amendment may be executed in any number of counterparts, each of which shall be deemed an original, but all of which when taken together shall constitute one and the same instrument. The signature page of any counterpart may be detached therefrom without impairing the legal effect of the signature(s) thereon provided such signature page is attached to any other counterpart identical thereto except having additional signature pages executed by other parties to this First Amendment attached thereto.
   d. Except as amended and/or modified by this First Amendment, the Lease is hereby ratified and confirmed and all other terms of the Lease shall remain in full force and effect, unaltered and unchanged by this First Amendment. In the event of any conflict between the provisions of this First Amendment and the provisions of the Lease, the provisions of this First Amendment shall prevail. Whether or not specifically amended by this First Amendment, all of the terms and provisions of the Lease are hereby amended to the extent necessary to give effect to the purpose and intent of this First Amendment.
IN WITNESS WHEREOF, the parties hereto have executed this First Amendment as of the day and year first above written.

TENANT:

MODERNA THERAPEUTICS, INC.,
a Delaware corporation

By:  /s/ Steve Harbin
Its:  SVP Manufacturing & Quality Facilities

LANDLORD:

ARE-TECH SQUARE, LLC,
a Delaware limited liability company

By:  ARE-MA REGION NO. 31, LLC,
a Delaware limited liability company,
its manager

By:  ALEXANDRIA REAL ESTATE EQUITIES, L.P.,
a Delaware limited partnership,
managing member

By:  ARE-QRS CORP.,
a Maryland corporation, general partner

By:  /s/ Eric S. Johnson
Name:  Eric S. Johnson
Title:  Senior Vice President
RE Legal Affairs-
SECOND AMENDMENT TO LEASE

THIS SECOND AMENDMENT TO LEASE (this “Second Amendment”) is made as of December 31, 2016, by and between ARE-TECH SQUARE, LLC, a Delaware limited liability company (“Landlord”), and MODERNA THERAPEUTICS, INC., a Delaware corporation (“Tenant”).

RECITALS

A. Landlord and Tenant are now parties to that certain Lease Agreement dated as of May 26, 2016, as amended by that certain First Amendment to Lease dated as of August 31, 2016 (as amended, the “Lease”). Pursuant to the Lease, Tenant leases certain premises consisting of approximately 124,760 rentable square feet of space (“Premises”) in a building located at 200 Technology Square, Cambridge, Massachusetts (“Building”). The Premises are more particularly described in the Lease. Capitalized terms used herein without definition shall have the meanings defined for such terms in the Lease.

B. Pursuant to Section 2(b) of the Lease, if the GSK Lease terminates prior to January 1, 2018, then the Early Phase 2 Premises Commencement Date shall occur on the day immediately following such early termination of the GSK Lease.

C. Concurrently with Landlord entering into this Second Amendment with Tenant, Landlord is entering into an agreement with GSK pursuant to which the GSK Lease with respect to the Phase 2 Sublease Premises shall terminate on January 31, 2017.

D. Landlord and Tenant desire, subject to the terms and conditions set forth below, to amend the Lease to, among other things, acknowledge the early commencement of the Lease with respect to the Phase 2 Sublease Premises as of the Early Phase 2 Premises Commencement Date.

NOW, THEREFORE, in consideration of the foregoing Recitals, which are incorporated herein by this reference, the mutual promises and conditions contained herein, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Landlord and Tenant hereby agree as follows:

1. Phase 2 Sublease Premises Commencement Date. Notwithstanding anything to the contrary contained in the Lease, Landlord and Tenant acknowledge and agree that the Early Phase 2 Premises Commencement Date shall occur on February 1, 2017.

2. Base Rent. Commencing on the Early Phase 2 Premises Commencement Date through December 31, 2017, Tenant shall pay Base Rent with respect to the Phase 2 Sublease Premises only in the amount of $53.00 per rentable square foot of the Phase 2 Sublease Premises per year.

Commencing on January 1, 2018, Tenant shall commence paying Base Rent with respect to the Phase 2 Sublease Premises at the same rate per rentable square foot then being paid by Tenant with respect to the Phase 1 Premises, as adjusted pursuant to Section 4(a) of the Lease.

3. Operating Expenses. Commencing on the Early Phase 2 Premises Commencement Date, Tenant shall commence paying Tenant’s Share of Operating Expenses under the Lease with respect to the Phase 2 Sublease Premises, which is equal to 35.05%.

4. Brokers. Landlord and Tenant each represents and warrants that it has not dealt with any broker, agent or other person (collectively, “Broker”) in connection with the transaction reflected in this Second Amendment and that no Broker brought about this transaction. Landlord and Tenant each hereby agrees to indemnify and hold the other harmless from and against any claims by any Broker claiming a commission or other form of compensation by virtue of having dealt with Tenant or Landlord, as applicable, with regard to this Second Amendment.

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5. **OFAC**. Tenant and all beneficial owners of Tenant are currently (a) in compliance with and shall at all times during the Term of the Lease remain in compliance with the regulations of the Office of Foreign Assets Control (“OFAC”) of the U.S. Department of Treasury and any statute, executive order, or regulation relating thereto (collectively, the “OFAC Rules”), (b) not listed on, and shall not during the term of the Lease be listed on, the Specially Designated Nationals and Blocked Persons List, Foreign Sanctions Evaders List or the Sectoral Sanctions Identifications List, which are all maintained by OFAC and/or on any other similar list maintained by OFAC or other governmental authority pursuant to any authorizing statute, executive order, or regulation, and (c) not a person or entity with whom a U.S. person is prohibited from conducting business under the OFAC Rules.

6. **Miscellaneous.**

   a. This Second Amendment is the entire agreement between the parties with respect to the subject matter hereof and supersedes all prior and contemporaneous oral and written agreements and discussions. This Second Amendment may be amended only by an agreement in writing, signed by the parties hereto.

   b. This Second Amendment is binding upon and shall inure to the benefit of the parties hereto, their respective successors and assigns.

   c. This Second Amendment may be executed in any number of counterparts, each of which shall be deemed an original, but all of which when taken together shall constitute one and the same instrument. The signature page of any counterpart may be detached therefrom without impairing the legal effect of the signature(s) thereon provided such signature page is attached to any other counterpart identical thereto except having additional signature pages executed by other parties to this Second Amendment attached thereto.

   d. Except as amended and/or modified by this Second Amendment, the Lease is hereby ratified and confirmed and all other terms of the Lease shall remain in full force and effect, unaltered and unchanged by this Second Amendment. In the event of any conflict between the provisions of this Second Amendment and the provisions of the Lease, the provisions of this Second Amendment shall prevail. Whether or not specifically amended by this Second Amendment, all of the terms and provisions of the Lease are hereby amended to the extent necessary to give effect to the purpose and intent of this Second Amendment.
IN WITNESS WHEREOF, the parties hereto have executed this Second Amendment as of the day and year first above written.

TENANT:

MODERNA THERAPEUTICS, INC.,
a Delaware corporation

By: /s/ Steve Harbin
Its: Steve Harbin
SVP Manufacturing, Quality and Facilities

LANDLORD:

ARE-TECH SQUARE, LLC,
a Delaware limited liability company

By: ARE-MA REGION NO. 31, LLC,
a Delaware limited liability company,
its manager

By: ALEXANDRIA REAL ESTATE EQUITIES, L.P.,
a Delaware limited partnership, managing member

By: ARE-QRS CORP.,
a Maryland corporation,
general partner

By: /s/ Eric S. Johnson
Name: Eric S. Johnson
Title: Senior Vice President
RE Legal Affairs

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THIRD AMENDMENT TO LEASE

THIS THIRD AMENDMENT TO LEASE (this “Third Amendment”) is made as of April 24, 2017, by and between ARE-TECH SQUARE, LLC, a Delaware limited liability company (“Landlord”), and MODERNA THERAPEUTICS, INC., a Delaware corporation (“Tenant”).

RECITALS

A. Landlord and Tenant are now parties to that certain Lease Agreement dated as of May 26, 2016, as amended by that certain First Amendment to Lease dated as of August 31, 2016, and as further amended by that certain Second Amendment to Lease dated as of December 31, 2016 (the “Second Amendment”) (as amended, the “Lease”). Pursuant to the Lease, Tenant leases certain premises consisting of approximately 124,760 rentable square feet of space (“Premises”) in a building located at 200 Technology Square, Cambridge, Massachusetts (“Building”). The Premises are more particularly described in the Lease. Capitalized terms used herein without definition shall have the meanings defined for such terms in the Lease.

B. Landlord and Tenant desire, subject to the terms and conditions set forth below, to amend the Lease to, among other things, clarify Tenant’s Share of Operating Expenses as of April 1, 2017.

NOW, THEREFORE, in consideration of the foregoing Recitals, which are incorporated herein by this reference, the mutual promises and conditions contained herein, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Landlord and Tenant hereby agree as follows:

1. Operating Expenses. Commencing on the April 1, 2017, Tenant’s Share of Operating Expenses payable under the Lease is equal to 35.82%.

2. Indemnity. Landlord and Tenant hereby agree that, in order to reflect changes in applicable Legal Requirements, retroactive to the date of the original Lease, the language of Section 16 of the original Lease which reads “unless caused solely by the willful misconduct or negligence of Landlord,” is hereby deleted in its entirety and replaced with the following: “except to the extent caused by the willful misconduct or negligence of Landlord.”

3. Energy Use Reporting. Tenant agrees to provide, within 10 business days of request by Landlord, such information and documentation as may be needed for compliance with the City of Cambridge Building Energy Use Disclosure Ordinance, Section 8.67.010 et seq. of the Municipal Code of the City of Cambridge (as the same may be amended, the “Cambridge Building Energy Use Disclosure Ordinance”), and other such energy or sustainability requirements as may be adopted from time to time by the City of Cambridge or any other governmental authority with jurisdiction over the Building, which information shall include without limitation usage at or by the Leased Premises of electricity, natural gas, steam, hot or chilled water or other energy. Landlord shall report to the applicable governmental authority such energy usage for the Building and other Building information as required by the Cambridge Building Energy Use Disclosure Ordinance.

4. Brokers. Landlord and Tenant each represents and warrants that it has not dealt with any broker, agent or other person (collectively, “Broker”) in connection with the transaction reflected in this Third Amendment and that no Broker brought about this transaction. Landlord and Tenant each hereby agrees to indemnify and hold the other harmless from and against any claims by any Broker claiming a commission or other form of compensation by virtue of having dealt with Tenant or Landlord, as applicable, with regard to this Third Amendment.
5. **OFAC.** Tenant and all beneficial owners of Tenant are currently (a) in compliance with and shall at all times during the Term of the Lease remain in compliance with the regulations of the Office of Foreign Assets Control ("OFAC") of the U.S. Department of Treasury and any statute, executive order, or regulation relating thereto (collectively, the "OFAC Rules"), (b) not listed on, and shall not during the term of the Lease be listed on, the Specially Designated Nationals and Blocked Persons List, Foreign Sanctions Evaders List or the Sectoral Sanctions Identifications List, which are all maintained by OFAC and/or on any other similar list maintained by OFAC or other governmental authority pursuant to any authorizing statute, executive order, or regulation, and (c) not a person or entity with whom a U.S. person is prohibited from conducting business under the OFAC Rules.

6. **Miscellaneous.**
   a. This Third Amendment is the entire agreement between the parties with respect to the subject matter hereof and supersedes all prior and contemporaneous oral and written agreements and discussions. This Third Amendment may be amended only by an agreement in writing, signed by the parties hereto.
   b. This Third Amendment is binding upon and shall inure to the benefit of the parties hereto, their respective successors and assigns.
   c. This Third Amendment may be executed in any number of counterparts, each of which shall be deemed an original, but all of which when taken together shall constitute one and the same instrument. The signature page of any counterpart may be detached therefrom without impairing the legal effect of the signature(s) thereon provided such signature page is attached to any other counterpart identical thereto except having additional signature pages executed by other parties to this Third Amendment attached thereto.
   d. Except as amended and/or modified by this Third Amendment, the Lease is hereby ratified and confirmed and all other terms of the Lease shall remain in full force and effect, unaltered and unchanged by this Third Amendment. In the event of any conflict between the provisions of this Third Amendment and the provisions of the Lease, the provisions of this Third Amendment shall prevail. Whether or not specifically amended by this Third Amendment, all of the terms and provisions of the Lease are hereby amended to the extent necessary to give effect to the purpose and intent of this Third Amendment.
IN WITNESS WHEREOF, the parties hereto have executed this Third Amendment as of the day and year first above written.

TENANT:

MODERNA THERAPEUTICS, INC.,
a Delaware corporation

By: /s/ Steve Harbin

Its: Steve Harbin
SVP Manufacturing, Quality and Facilities

LANDLORD:

ARE-TECH SQUARE, LLC,
a Delaware limited liability company

By: ARE-MA REGION NO. 31, LLC,
a Delaware limited liability company,
its manager

By: ALEXANDRIA REAL ESTATE EQUITIES, L.P.,
a Delaware limited partnership, managing member

By: ARE-QRS CORP.,
a Maryland corporation,
general partner

By: /s/ Eric S. Johnson

Name: Eric S. Johnson
Title: Senior Vice President
RE Legal Affairs

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FOURTH AMENDMENT TO LEASE

THIS FOURTH AMENDMENT TO LEASE (this “Fourth Amendment”) is made as of April 13th, 2018, by and between ARE-TECH SQUARE, LLC, a Delaware limited liability company (“Landlord”), and MODERNA THERAPEUTICS, INC., a Delaware corporation (“Tenant”).

RECITALS

A. Landlord and Tenant are now parties to that certain Lease Agreement dated as of May 26, 2016 (the “Original Lease”), as amended by that certain First Amendment to Lease dated as of August 31, 2016, as further amended by that certain Second Amendment to Lease dated as of December 31, 2016, as further amended by that certain Third Amendment to Lease dated April 24, 2017 (as amended, the “Lease”). Pursuant to the Lease, Tenant leases certain premises consisting of approximately 124,760 rentable square feet of space (“Premises”) in a building located at 200 Technology Square, Cambridge, Massachusetts (“Building”). The Premises are more particularly described in the Lease. Capitalized terms used herein without definition shall have the meanings defined for such terms in the Lease.

B. Concurrently with Landlord entering into this Fourth Amendment with Tenant, Landlord is entering into an agreement with the tenant currently occupying the Phase 3 Premises to terminate such existing tenant’s lease as to the Phase 3 Premises as of May 3, 2018.

C. Landlord and Tenant desire, subject to the terms and conditions set forth below, to amend the Lease to, among other things, acknowledge the early commencement of the Lease with respect to the Phase 3 Premises as of May 4, 2018.

NOW, THEREFORE, in consideration of the foregoing Recitals, which are incorporated herein by this reference, the mutual promises and conditions contained herein, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Landlord and Tenant hereby agree as follows:

1. Phase 3 Premises Commencement Date. Notwithstanding anything to the contrary contained in Section 2(c) of the Original Lease, Landlord and Tenant acknowledge and agree that the Phase 3 Premises Commencement Date shall occur on May 4, 2018. As consideration for accelerating the Phase 3 Premises Commencement Date, Tenant hereby agrees to assume all liabilities and obligations of Proteostasis Therapeutics, Inc. (“PTI”) to surrender the Premises in the condition required under PTI’s lease with Landlord, including, without limitation, remediating and removing any Hazardous Materials from the Premises and Project to ensure that the Premises are free from any and all residual impact from PTI’s hazardous materials operations.

2. Base Rent. Tenant shall commence paying Base Rent with respect to the Phase 3 Premises as of the amended Phase 3 Premises Commencement Date in an amount equal to $72.00 per rentable square foot of the Phase 3 Premises, subject to adjustment pursuant to Section 4 of the Original Lease.

3. Operating Expenses. Commencing on the Phase 3 Premises Commencement Date, Tenant shall commence paying Tenant’s Share of Operating Expenses under the Lease with respect to the Phase 3 Premises. As of the Phase 3 Premises Commencement Date, the Tenant’s Share of Operating Expenses as of such date shall be deemed to be 51.15%.

4. Brokers. Landlord and Tenant each represents and warrants that it has not dealt with any broker, agent or other person (collectively, “Broker”) in connection with the transaction reflected in this Fourth Amendment and that no Broker brought about this transaction. Landlord and Tenant each hereby agrees to indemnify and hold the other harmless from and against any claims by any Broker claiming a commission or other form of compensation by virtue of having dealt with Tenant or Landlord, as applicable, with regard to this Fourth Amendment.
5. **OFAC.** Tenant and all beneficial owners of Tenant are currently (a) in compliance with and shall at all times during the Term of the Lease remain in compliance with the regulations of the Office of Foreign Assets Control (“OFAC”) of the U.S. Department of Treasury and any statute, executive order, or regulation relating thereto (collectively, the “**OFAC Rules**”), (b) not listed on, and shall not during the term of the Lease be listed on, the Specially Designated Nationals and Blocked Persons List, Foreign Sanctions Evaders List or the Sectoral Sanctions Identifications List, which are all maintained by OFAC and/or on any other similar list maintained by OFAC or other governmental authority pursuant to any authorizing statute, executive order, or regulation, and (c) not a person or entity with whom a U.S. person is prohibited from conducting business under the OFAC Rules.

6. **Miscellaneous.**
   
a. This Fourth Amendment is the entire agreement between the parties with respect to the subject matter hereof and supersedes all prior and contemporaneous oral and written agreements and discussions. This Fourth Amendment may be amended only by an agreement in writing, signed by the parties hereto.

b. This Fourth Amendment is binding upon and shall inure to the benefit of the parties hereto, their respective successors and assigns.

c. This Fourth Amendment may be executed in any number of counterparts, each of which shall be deemed an original, but all of which when taken together shall constitute one and the same instrument. The signature page of any counterpart may be detached therefrom without impairing the legal effect of the signature(s) thereon provided such signature page is attached to any other counterpart identical thereto except having additional signature pages executed by other parties to this Fourth Amendment attached thereto.

d. Except as amended and/or modified by this Fourth Amendment, the Lease is hereby ratified and confirmed and all other terms of the Lease shall remain in full force and effect, unaltered and unchanged by this Fourth Amendment. In the event of any conflict between the provisions of this Fourth Amendment and the provisions of the Lease, the provisions of this fourth Amendment shall prevail. Whether or not specifically amended by this Fourth Amendment, all of the terms and provisions of the Lease are hereby amended to the extent necessary to give effect to the purpose and intent of this Fourth Amendment.

[remainder of page intentionally left blank]
IN WITNESS WHEREOF, the parties hereto have executed this Fourth Amendment as of the day and year first above written.

TENANT:
MODERNA THERAPEUTICS, INC.,
a Delaware corporation
By: /s/ Steve Harbin
Its: Steve Harbin
SVP Manufacturing, Quality and Facilities

LANDLORD:
ARE-TECH SQUARE, LLC,
a Delaware limited liability company
By: ARE-MA REGION NO. 31, LLC,
a Delaware limited liability company, its manager
By: ALEXANDRIA REAL ESTATE EQUITIES, L.P., a Delaware limited partnership, managing member
By: ARE-QRS CORP.,
a Maryland corporation, general partner
By: /s/ Eric S. Johnson
Name: Eric S. Johnson
Title: Senior Vice President
RE Legal Affairs

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Net Lease
by and between
Campanelli-TriGate Norwood Upland, LLC, a Delaware limited liability company, as Landlord,

And

Moderna Therapeutics, Inc., a Delaware corporation, as Tenant,

August 29, 2016
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Exhibit H
1.1 Subjects Referred To.

Each reference in this Lease to any of the following subjects shall be construed to incorporate the data stated for that subject in this Section 1.1.

Date of this Lease: August 29, 2016
Lot: The lot known as 100 Tech Drive, Norwood, Massachusetts (“Lot”), as more particularly described in Exhibit A.
Premises: The Lot, together with the approximately 200,431 rentable square feet of space in the building (“Building”) located on the Lot (specifically the portions of the Building Shown as Area 1 (“Area 1”), Area 2A (“Area 2A”) and Area 2B (“Area 2B”) on Exhibit A-1), including all parking lots, travel lanes, loading docks, landscaping and walkways and sidewalks on the Lot, together with all right, title and interest of Landlord in and to all rights, privileges, rights of way and easements appurtenant to the Lot, including, without limitation, any easements, rights of way or other interests in, on, or under any land, highway, alley, street or right of way abutting or adjoining the Lot.
Landlord: Campanelli-TriGate Norwood Upland, LLC, a Delaware limited liability company
Address of Landlord: One Campanelli Drive
  Braintree, MA 02184
  Attention: Mr. Daniel R. DeMarco
Tenant: Moderna Therapeutics, Inc., a Delaware corporation
Address of Tenant: 200 Technology Square
  Cambridge, MA 02139
  Attention: Mr. Steve Harbin
With a copy to:
  320 Bent Street
  Cambridge, MA 02141
  Attention: General Counsel
<table>
<thead>
<tr>
<th>Term:</th>
<th>Commencing on the Commencement Date, and, unless sooner terminated pursuant to the provisions hereof, ending at 11:59 p.m. on the last day of the 15th Lease Year, subject to extension pursuant to Article X.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commencement Date:</td>
<td>The date of Substantial Completion, as defined in Section 3.1(d), which Landlord estimates will occur on or about October 1, 2016 (the “Estimated Substantial Completion Date”).</td>
</tr>
<tr>
<td>Rent Commencement Date:</td>
<td>The date twelve (12) months after the Commencement Date.</td>
</tr>
<tr>
<td>Annual Fixed Rent:</td>
<td>As set forth in Schedule 1</td>
</tr>
<tr>
<td>Lease Year:</td>
<td>The first “Lease Year” shall commence on the Rent Commencement Date, or, if the Rent Commencement Date does not fall on the first day of a calendar month, the first Lease Year shall consist of the partial calendar month starting on the Rent Commencement Date and the succeeding twelve full calendar months. Each successive Lease Year shall be comprised of succeeding periods of twelve (12) calendar months.</td>
</tr>
<tr>
<td>Permitted Uses:</td>
<td>Light manufacturing, laboratory, research, development, office use and ancillary uses supporting the foregoing, all in accordance with the Norwood Zoning By-Laws and in compliance with applicable laws, rules and regulations and the Park Covenants. In no event shall any portion of the Premises be used for operations classified as so-called “Biohazard Level 3” or “Biohazard Level 4”.</td>
</tr>
<tr>
<td>Park Covenants:</td>
<td>That certain Declaration of Covenants, Easements and Restrictions recorded in the Norfolk Registry of Deeds in Book 22094, Page 439, to which this Lease is subject. For the purposes of this Lease, “Park” shall mean the Upland Woods Business Park, as more particularly described in the Park Covenants.</td>
</tr>
<tr>
<td>Commercial General Liability Insurance Limits:</td>
<td>$10,000,000 combined single limit per occurrence; $10,000,000 annual aggregate.</td>
</tr>
<tr>
<td>Security Deposit</td>
<td>$8,869,071.75, subject to adjustment as set forth in Section 9.8 hereof.</td>
</tr>
</tbody>
</table>
ARTICLE II
Premises and Term

2.1 Premises. Landlord hereby leases and demises to Tenant and Tenant hereby leases from Landlord, subject to and with the benefit of the terms, covenants, conditions and provisions of this Lease, the Premises. Landlord shall deliver to Tenant possession of the Premises in accordance with Article III below. Except for Landlord’s Work, Landlord shall not have the right to make any installation, improvement, alteration, addition or improvement to the Premises without Tenant’s prior written consent, which consent shall be in Tenant’s sole and absolute discretion.

2.2 Term. TO HAVE AND TO HOLD for a term beginning on the Commencement Date and continuing for the Term, unless sooner terminated as hereinafter provided.

ARTICLE III
Initial Construction Work

3.1 Preparation of Premises. Landlord shall deliver the Premises to Tenant in accordance with this Section 3.1 upon Substantial Completion of the work described in Sections 3.1(b), 3.1(c) and 3.1(d) (collectively, “Landlord’s Work”). “Substantial Completion” of Landlord’s Work shall be deemed to have occurred as of the date on which Landlord’s Work has been completed with the exception of minor items of which Landlord informs Tenant which can be fully completed without material interference with the Initial Tenant Work (“punchlist items”). For purposes of determining the Commencement Date, such Substantial Completion shall be evidenced by the issuance of a Certificate of Substantial Completion by Landlord’s architect. Except for portions of the Lot to be modified by Landlord’s Work, Landlord shall leave the Lot in the condition which exists as of the date of this Lease.

   (a) Area 1. Area 1 shall be delivered to Tenant in its “as-is” condition, with all existing systems and infrastructure in good condition and working order.

   (b) Area 2A. Area 2A shall be delivered by Landlord to Tenant in “Shell Condition” as described in Exhibit B-1, the cost of which shall be solely borne by Landlord. Tenant shall perform all Initial Tenant Work in Area 2A in accordance with Section 5.1.6 and Section 5.2.3 below, the cost of which shall be funded in accordance with clause (f) below.

   (c) Area 2B. Area 2B shall be delivered by Landlord to Tenant in “Shell Condition” as described in Exhibit B-2, the cost of which shall be solely borne by Landlord. Tenant shall perform all Initial Tenant Work in Area 2B in accordance with Section 5.1.6 and Section 5.2.3 below, the cost of which shall be funded in accordance with clause (f) below.

   (d) Additional Landlord Work. Landlord shall perform the demolition of the “N2X Facility” in accordance with Exhibit B-3, the cost of which shall be solely borne by Landlord.
(e) **Tenant Delay.** In the event that Landlord is delayed completing Landlord’s Work by the dates set forth in this Section 3.1 due to a Tenant Delay (as defined below), Landlord’s Work shall be deemed to be completed for purposes of this Lease on that date on which Landlord’s Work would have occurred, but for the applicable Tenant Delay, as reasonably determined by Landlord’s architect. If the portion of Landlord’s Work to be performed within the Building (excluding elements of such work that will be affected by work on the exterior walls of the Building) (the ”Interior Work”) is not Substantially Complete on or before October 16, 2016, then, to the extent such failure to complete such work is not due to force majeure or Tenant Delay, Tenant shall be entitled to a credit equal to one day of Fixed Rent first due under the Lease for each day that the Interior Work is not Substantially Complete thereafter. If the Interior Work is Substantially Complete but the portion of Landlord’s Work not constituting Interior Work (“Exterior Work”) is not Substantially Complete on or before December 16, 2016, then, to the extent such failure to complete such work is not due to force majeure or Tenant Delay, Tenant shall be entitled to a credit equal to one day of Fixed Rent first due under the Lease for each day that the Exterior Work is not Substantially Complete thereafter.

Notwithstanding anything to the contrary herein, if actual Substantial Completion has not occurred on or before November 1, 2016, Tenant shall have access to the Premises commencing on November 1, 2016 to commence the Initial Tenant Work. Such access and the conduct of Initial Tenant Work prior to the Commencement Date shall be subject to and upon all of the terms and conditions of this Lease, other than the obligation to pay Fixed Rent or Additional Rent on account of Taxes and Assessments and the obligation to obtain (or pay for) insurance (but Tenant shall be required to pay utilities from and after the commencement of any significant activity by Tenant in the Premises). Tenant shall coordinate any such access with Landlord in such a manner so as not to delay the remaining portions of Landlord’s Work.

(f) **Initial Tenant Work Allowance; Budget; Funding of Cost of Initial Tenant Work.** Except with respect to the Landlord’s Work, Tenant shall be responsible for any demolition of existing improvements within the Premises any landscaping and sitework (including, without limitation, fencing, gates, repair/resurface of parking areas, curbing, sidewalks, etc.), within the Premises (“Sitework”), any desired construction within the Premises and installation of all tenant improvements within the Premises (such demolition, Sitework and tenant improvements, collectively, “Initial Tenant Work”). Tenant shall perform the Initial Tenant Work in accordance with Section 5.1.6 and Section 5.2.3, below. Landlord shall provide to Tenant an Initial Tenant Work Allowance, of up to $24,152,582.00 as hereinafter set forth, to be used for the Initial Tenant Work Allowance (“Initial Tenant Work Allowance”); provided, however, that no more than $100,862.00 (the “Sitework Amount”) of the Initial Tenant Work Allowance may be used for Sitework and Landlord shall remit the Sitework Amount (or, if less, the total cost incurred by Tenant for the Sitework) within thirty (30) days of Tenant providing Evidence of Completion (as hereinafter defined) with respect to the Sitework. Prior to commencing any Initial Tenant Work, Tenant shall prepare and deliver to Landlord a detailed line item budget for the Initial Tenant Work (the “Tenant Work Budget”). The Tenant Work Budget shall be comprehensive, including all soft and hard costs. Tenant shall be responsible for all costs associated with the Initial Tenant Work in excess of the Initial Tenant Work Allowance and all costs of the Sitework in excess of the Sitework Amount. During Tenant’s construction of the Initial Tenant Work, the cost of the Initial Tenant Work (other than with respect to Sitework) shall be paid for as follows: (a) the first $36,077,580.00 of the cost of the Initial Tenant Work (other than with respect to Sitework) shall be paid for in regular installments (no more frequently than monthly) 50% by Landlord (i.e., $ 18,038,790) and 50% by Tenant, with Landlord obligated to make such installment payments within thirty (30) days of requisition therefor by Tenant to Landlord, provided that each such requisition includes evidence of Tenant’s payment of an
amount matching the amount so requested, the contractor’s application for payment for the relevant work together with lien waivers and the supervising architect’s approval thereof and (b) thereafter, the cost of the Initial Tenant Work (other than with respect to Sitework) shall be timely paid for by Tenant (with the provision to Landlord on a monthly basis of copies of requisitions, lien waivers and evidence of payment by Tenant, and, upon completion, the following (the “Evidence of Completion”): final lien waivers, certificates of substantial completion, and the certificate of occupancy obtained by Tenant from the Town of Norwood). Within thirty (30) days of receipt therefor made by Tenant delivered to Landlord after the delivery of the Evidence of Completion, Landlord shall, from the Initial Tenant Work Allowance, remit to Tenant an amount equal to the lesser of (x) the sum expended (and documented) by Tenant pursuant to clause (b) of the preceding sentence and (y) $6,012,930. In no event shall the Tenant Improvement Work Allowance be available for any work completed (or reimbursement requested) after the date that is twenty-four (24) months after the Commencement Date. It is expressly agreed that the Initial Tenant Work Allowance shall be used only for demolition and the cost of constructing the Initial Tenant Work, and shall not be used for furniture, equipment or moving expenses. If Tenant has obtained a final non-appealable judgment from a court of competent jurisdiction with respect thereto, then, any portion of the Initial Tenant Work Allowance that has not been funded by Landlord within thirty (30) days following a complete requisition by Tenant may be offset by Tenant against any amounts of Fixed Rent and Additional Rent payable to Landlord under this Lease, together with interest on such unpaid amounts from the date originally due at the rate set forth in Section 4.3.

3.2 Representatives. Each party authorizes the other to rely in connection with their respective rights and obligations under this Article III upon approval and other actions on the party’s behalf by Landlord’s Representative in the case of Landlord or Tenant’s Representative in the case of Tenant or by any person designated in substitution or addition by notice to the party relying. “Landlord’s Representative” shall mean Stephen Murphy. “Tenant’s Representative” shall mean Steve Harbin.

3.3 Tenant Delays. For purposes of this Lease, any act, omission or delay by Tenant, or its contractors, employees, agents or representatives which actually delays Landlord’s Work, including any early access pursuant to Section 3.1(f), shall be deemed to be a “Tenant Delay.” Landlord shall provide Tenant with notice within five (5) business days of becoming aware of any Tenant Delay. Tenant shall pay to Landlord any and all actual (but not consequential) additional costs incurred by Landlord as a result of a Tenant Delay, as substantiated by Landlord by invoices or other reasonable written documentation.

3.4 Landlord’s Warranty. Landlord hereby agrees to correct all defects in Landlord’s Work at Landlord’s sole cost and expense as to which Landlord has been given written notice by Tenant prior to the date that is one (1) year after the Commencement Date. In addition, Landlord shall assign to Tenant all third party guarantees and warranties of fixtures or equipment installed in the Premises as part of Landlord’s construction of Landlord’s Work, from and after the date that is one (1) year after the Commencement Date, unless such third-party guarantee or warranty relates to items for which Tenant is responsible to maintain pursuant to the terms and conditions of this Lease, in which case, Landlord will assign such guarantees or warranties to Tenant upon request therefor. In addition, with respect to any existing third party warranties or guaranties with respect to the Building, to the extent the same are assignable and relate to items which
Tenant is responsible to maintain pursuant to the terms of this Lease, Landlord will assign the same to Tenant upon request therefor. In the event that any such warranties or guaranties cannot be assigned by Landlord, then, to the extent the same relate to items which Tenant is responsible to maintain pursuant to the terms of this Lease, Landlord, upon request by Tenant, agrees to enforce such warranties or guaranties for Tenant’s benefit, and Tenant shall reimburse Landlord for Landlord’s out of pocket cost and expense with respect to such enforcement.

3.5 **Condition of Premises.** Except for Landlord’s Work described in this Article III and subject to Landlord’s obligations under Section 5.2.2 below with respect to Hazardous Materials, the Premises are leased to Tenant in their “as-is, where-is” condition; provided, however, that Landlord shall deliver the Building envelope and structure, including roof, in good condition and working order and Landlord shall deliver the Premises to the Tenant on the Commencement Date with no knowledge (after due inquiry) of the presence of any Hazardous Materials in the Building or on the Lot except to the extent in compliance with applicable law.

**ARTICLE IV**

**Rent**

4.1 **The Fixed Rent.** From and after the Rent Commencement Date, Tenant covenants and agrees to pay rent to Landlord at the Original Address of Landlord or at such other place or to such other person or entity as Landlord may by written notice to Tenant from time to time direct, Annual Fixed Rent, in equal installments of 1/12th of the Annual Fixed Rent in advance on the first day of each calendar month included in the Term from and after the Rent Commencement Date. In the event that the Rent Commencement Date occurs on a day other than the first (1st) day of a month, Tenant shall pay to Landlord Annual Fixed Rent for such partial month on a per diem basis, which payment shall be made by Tenant to Landlord within ten (10) days of the Rent Commencement Date.

4.2 **Additional Rent.** As and to the extent set forth herein, this Lease is a NET LEASE, and Landlord shall not be obligated to pay any charge or bear any expense whatsoever against or with respect to the Premises except as expressly set forth herein, nor shall the rent payable hereunder be subject to any reduction or offset whatsoever on account of any such charge or otherwise except as expressly set forth herein. Tenant covenants and agrees to pay, as Additional Rent, from and after the Commencement Date, Taxes and Assessments, insurance costs, utility charges and management fees with respect to the Premises as provided in this Section 4.2 as follows (and CAM Costs as described in Section 9.13):

4.2.1 **Real Estate Taxes.** Tenant shall be responsible for the payment of (and shall pay the appropriate authority timely and directly) all of the following accruing during, and allocable to, the Term: (i) all taxes, assessments, levies, fees, water and sewer rents and charges, and all other government levies and charges, general and special, ordinary and extraordinary, foreseen and unforeseen, which are, at any time during the Term hereof, payable, imposed or levied upon or assessed against the Building and the Lot, and all taxes assessed against (A) any Annual Fixed Rent, Additional Rent or other sum payable hereunder, or (B) this Lease, or the leasehold estate hereby created, or which arise in respect of the operation, possession or use of the Premises; (ii) all gross receipts or similar taxes imposed or levied upon, assessed against or measured by any Fixed Rent, Additional Rent or other sum payable hereunder; (iii) all sales,
value added, use and similar taxes at any time levied, assessed or payable on account of the leasing or use of the Premises; and (iv) all charges for utilities furnished to the Premises which may become a lien on the Premises (collectively “Taxes and Assessments” or if singular “Tax or Assessment”). Landlord and Tenant acknowledge that (A) the Lot has not, as of the Date of this Lease, been created as a separate legal lot, (B) promptly after the execution of this Lease, Landlord will, in good faith, diligently take all steps necessary to cause the Lot to constitute a separate legal lot and (3) that there may be a period of time during the Term where the Lot (and the improvements thereon) is taxed as part of a larger tax lot (the “Existing Tax Parcel”). Until such time as the Lot is separately assessed for tax purposes, Tenant shall pay to the taxing authority, within thirty (30) days after delivery to Tenant by Landlord of the tax assessor’s invoice for the Existing Tax Parcel the entire amount payable for the Existing Tax Parcel, less a sum equal to the product of (I) the Landlord’s Tax Percentage (as hereinafter defined) multiplied by (II) the amount payable for the land portion under the tax assessor’s invoice on the Existing Tax Parcel (to reflect the fact that the assessed improvements will be the same under the existing and new tax parcels but the amount of land will be reduced by the Landlord’s Tax Percentage). Landlord shall timely pay to the taxing authority a percentage of the land allocation equal to the Landlord’s Tax Percentage. As used herein, the “Landlord’s Tax Percentage” shall be the quotient, expressed as a percentage, equal to the number of acres of land in the Existing Tax Parcel not part of the Lot divided by the total number of acres of land in the Existing Tax Parcel, as reasonably certified by Landlord.

Nothing contained in this Lease shall, however, require Tenant to pay any franchise, corporate, estate, inheritance, succession capital levy or transfer tax of Landlord, or any income, profits or revenue tax or charge upon the rent payable by Tenant under this Lease unless (a) such Tax is imposed, levied or assessed in substitution for any other Tax or Assessment which Tenant is required to pay pursuant to this Section 4.2.1, or (b) if at any time during the Term of this Lease, the method of taxation shall be such that there shall be levied, assessed or imposed on Landlord a capital levy or other tax directly on the rents received from the Premises and/or any Tax or Assessment measured by or based, in whole or in part, upon such rents or measured in whole or in part by income from the Premises (if in computing such rents or income there is not allowable as a deduction for the taxable year substantially all of the depreciation or interest deductions allowed for federal income tax purposes for the taxable year), or upon the value of the Premises or any present or future improvement or improvements on the Premises, in which case all such Taxes and Assessments or the part thereof so measured or based (“Substitute Taxes”), shall be payable by Tenant, provided however, Tenant’s obligation with respect to the aforesaid Substitute Taxes shall be limited to the amount thereof as computed at the rates that would be payable if the Premises were the only property of Landlord.

4.2.2 Tax Contests. Notwithstanding the foregoing, Tenant shall not be required to pay any Taxes and Assessments so long as Tenant shall contest, in good faith and at its expense, the existence, the amount or the validity thereof by appropriate proceedings which shall operate during the pendency thereof to prevent the collection of, or other realization upon, the imposition of any lien and the sale, forfeiture or loss of the Premises. Landlord shall reasonably cooperate with Tenant in connection therewith, at no out-of-pocket cost to Landlord, it being agreed that Tenant shall indemnify, defend and hold Landlord harmless from any and all loss, cost or damage arising out of any such contest.
4.2.3 Insurance. Tenant shall provide and maintain insurance throughout the Term protecting Landlord (as an Additional Named Insured as respects the real property and loss of rents at the Lot with respect to Sections 4.2.3.1, 4.2.3.2 and 4.2.3.5) and Landlord’s Mortgagee (as set forth in Sections 4.2.3.3 and 4.2.3.7).

4.2.3.1 “All-risk” or “special form” insurance (or an equivalent form reasonably approved by Landlord) covering the Building and improvements now existing or hereafter erected upon the Premises installed in or used in connection with the Premises (including without limitation, the Initial Tenant Work, and any replacements thereof), that includes building replacement cost coverage with such additional endorsements as may be necessary to include coverage for “building laws” (including coverages for “demolition,” “increased costs of construction” and “value of undamaged portions of the building” in an aggregate amount of not less than $2,000,000), terrorism (in compliance with the Terrorist Risk Insurance Program Reauthorization and Extension Act of 2007, including all amendments thereto), vandalism and malicious conduct, flood, water damage, earthquake and debris removal. Such policy shall include an agreed amount clause, equal to the replacement cost of the Building. Replacement cost shall be determined by agreement or by appraisal by an accredited insurance appraiser reasonably approved by Landlord. Either party may require a re-appraisal whenever three (3) years have elapsed since the last such agreement or appraisal, or when alterations or additions increasing cost have been made.

4.2.3.2 Rental value or similar business interruption insurance against loss of rent in an amount equal to at least all the Fixed Rent and Additional Rent payable for twelve (12) months under this Article IV.

4.2.3.3 Commercial general liability insurance indemnifying Tenant, and Landlord and Landlord’s Mortgagee as Additional Insured against liability for bodily injury, property damage or personal injury occurrences which may be claimed to have occurred on or about the Premises or on the sidewalks or ways adjoining the Premises, with combined single limit and annual aggregate coverage at least equal to the amounts set forth in Section 1.1.

4.2.3.4 Workmen’s compensation insurance with statutory limits covering all of Tenant’s employees working on the Premises to the extent required by law.

4.2.3.5 Insurance against loss or damage from sprinklers and from leakage or explosion or cracking of boilers, pipes carrying steam or water, or both, pressure vessels or similar apparatus, in the so-called “broad form” in an amount not less than $1,000,000.00.

4.2.3.6 Builder’s risk insurance on all work being performed on the Premises by Tenant, in such amounts as may reasonably afford one hundred percent (100%) coverage against loss to the Building or Improvements.

4.2.3.7 Proceeds from policies of insurance required under the provisions of Sections 4.2.3.1, 4.2.3.2, 4.2.3.5, and 4.2.3.6 shall be first payable to Landlord’s Mortgagee under a standard non-contributing mortgagee’s clause (or to Landlord, if there is no Mortgagee), to be held and disbursed as provided in Section 6.3 or 6.4, as applicable.
4.2.3.8 All such insurance required under this Section 4.2.3 shall be written by insurance companies licensed to do business in the state in which the Premises are located and approved by that state’s insurance department and reasonably acceptable to Landlord. Insurance companies with a current A. M. Best’s rating of “A-” and a Financial Category Class IX or better shall be deemed to be reasonably acceptable to Landlord. Tenant agrees to furnish Landlord with binding certificates evidencing the maintenance by Tenant of all such insurance prior to the beginning of the Term hereof and of each renewal policy 30 days prior to its expiration. Each certificate shall provide that the policies evidenced thereby shall be non-cancellable with respect to the interest of Landlord and the holders of any mortgages on the Premises without at least 30 days’ prior written notice thereto. Tenant shall deliver complete copies of all insurance policies carried hereunder within ten (10) days of request therefor by Landlord.

If, in the reasonable opinion of the independent insurance advisor or insurance broker retained by Landlord, the amount of liability and property damage insurance coverage, or the types of coverage required hereunder, at any time during the Term are not adequate, Tenant shall increase the insurance coverage, or obtain such new insurance coverages, as reasonably required by Landlord’s insurance broker.

4.2.3.9 All insurance which is carried by either party with respect to the Premises or to furniture, furnishings, fixtures or equipment therein or alterations or improvements thereto, whether or not required, shall include a waiver of subrogation against the other party. Tenant’s policies shall also state that its insurance shall be primary and non-contributing with respect to the Landlord’s insurance. Each party shall be entitled to have certificates of any policies evidencing satisfaction of the requirements of Section 4.2.3. Each party hereby waives all rights of recovery against the other for loss or injury against which the waiving party is protected by insurance containing said non-subrogation provisions, reserving, however, any rights with respect to any excess of loss or injury over the amount recovered by such insurance.

4.2.4 Utilities. Tenant shall pay directly to the proper authorities charged with the collection thereof all charges for water, sewer, gas, electricity, telephone and other utilities or services used or consumed on the Premises, whether called charge, tax, assessment, fee or otherwise, including, without limitation, water and sewer use charges and taxes, if any, all such charges to be paid as the same from time to time become due. Tenant shall make its own arrangement for such utilities and Landlord shall be under no obligation to furnish any utilities to the Premises and shall not be liable for any interruption or failure in the supply of any such utilities to the Premises.

4.2.5 Management. Tenant shall pay to Landlord, as Additional Rent, within thirty (30) days of Landlord’s invoice therefor, the charges actually incurred by Landlord for commercially reasonable management fees, not to exceed 1.5% of Annual Fixed Rent accruing over the applicable time period.
4.3 **Late Payment of Rent.** If any installment of Fixed Rent or payment of Additional Rent is paid more than five (5) days after the date the same was due more than once in any twelve (12) month period (a) such amount shall bear interest from the due date at the prime commercial rate published by The Wall Street Journal, as it may be adjusted from time to time, plus four percent (4%) per annum, but in no event more than the maximum rate of interest allowed by law, the payment of which shall be Additional Rent, and (b) Tenant shall pay, to Landlord on demand, as Additional Rent, a late fee of four percent (4%) of the amount not paid when due.

4.4 **Independent Covenants.** The foregoing covenants of Tenant are independent covenants and, except as otherwise set forth in this Lease, Tenant shall have no right to withhold or abate any payment of Fixed Rent, Additional Rent or other payment, or to set off any amount against the Fixed Rent, Additional Rent or other payment then due and payable, or to terminate this Lease, because of any breach or alleged breach by Landlord of this Lease; Tenant hereby acknowledges and agrees that it has been represented by counsel of its choice and has participated fully in the negotiation of this Lease, that Tenant understands that the remedies available to Tenant in the event of a default by Landlord may be more limited than those that would otherwise be available to Tenant under the common law in the absence of certain provisions of this Lease, and that the so-called “dependent covenants” rule as developed under the common law (including, without limitation, the statement of such rule as set forth in the Restatement (Second) of Property, Section 7.1) shall not apply to this Lease or to the relationship of landlord and tenant created hereunder.

ARTICLE V
Tenant’s Additional Covenants

5.1 **Affirmative Covenants.** Tenant covenants at its sole expense at all times during the Term and for such prior or subsequent time as Tenant occupies the Premises or any part thereof:

5.1.1 **Perform Obligations.** To perform promptly all of the obligations of Tenant set forth in this Lease; and to pay when due the Fixed Rent and Additional Rent and all charges, rates and other sums which by the terms of this Lease are to be paid by Tenant.

5.1.2 **Use.** To use the Premises only for the Permitted Uses, and from time to time to procure all licenses and permits necessary therefor at Tenant’s sole expense, including without limitation, the building permit and certificate of occupancy for the Initial Tenant Work.

5.1.3 **Repair and Maintenance.** To keep the Premises including, without limitation, all improvements therein and all heating, plumbing, hot water, ventilating, electrical, air-conditioning, security, alarm, mechanical and other fixtures and equipment now or hereafter on the Premises in good order, condition and repair and in at least as good order, condition and repair as they are in upon completion of the same by Tenant as required under Article III above; and to make all repairs and all capital replacements and to do all other work necessary for the foregoing purposes whether the same may be ordinary or extraordinary, foreseen or unforeseen. Tenant shall secure, pay for and keep in force contracts with appropriate and reputable service companies providing for the regular and proper maintenance of the security, alarm, elevator, heating, ventilating, and air-conditioning systems and copies of such contracts shall be furnished to Landlord upon request. It is expressly understood and agreed that, except for Landlord’s Work under Article III, Landlord shall not be obligated during the Term of this Lease to make
any repairs, alterations, or replacements, whether structural or otherwise, of any kind whatsoever to the Premises. Notwithstanding the foregoing, except to the extent of any repair, maintenance or replacement occasioned by the act or wrongful omission of Tenant or by any casualty (which shall be subject to Article VI), Landlord shall be responsible for the repair and maintenance of the structural elements of the Building (including the structural elements of the roof system) at its sole cost and expense, and Tenant shall provide reasonable access to Landlord in connection therewith.

5.1.4 Exterior Maintenance. From and after the Commencement Date, throughout the Term, except as set forth in the next succeeding sentence, to keep all exterior elements of the Premises in good order, condition and repair and in at least as good order, condition and repair as they are in upon completion of the same by Tenant as required under Article III, including, without limitation, (a) snow and ice removal (including sweeping) from surfaced roadways, walks, roofs and parking and loading areas, (b) mowing and maintenance of all lawns and planted areas on the Lot, and (c) maintenance, repair, and replacement, as necessary, of all surface roadways, walks and parking and loading areas on the Lot. Landlord and Tenant acknowledge that some such services, such as snowplowing and landscaping, may be provided to the entire Park, in which event the cost thereof shall be allocated to the Premises on an equitable basis as more particularly described in the Park Covenants.

5.1.5 Compliance with Law. To make all repairs, alterations, additions or replacements to the Premises required by any law or ordinance or any order or regulation of any public authority (collectively, “Laws”); to keep the Premises equipped with all safety equipment so required; to comply with the orders, regulations, variances, licenses and permits of or granted by governmental authorities with respect to zoning, building, fire, health and other codes, regulations, ordinances or laws applicable to the Premises, and the condition, use or occupancy thereof, except that Tenant may defer compliance so long as the validity of any such order, regulation, code, ordinance or law shall be contested by Tenant in good faith and by appropriate legal proceedings, and provided such contest shall not subject Landlord to criminal penalties or civil sanctions, loss of property, material civil liability or mortgage default. Tenant shall also comply with the reasonable requirements of insurance underwriters with respect to Tenant’s business activities in the Premises.

5.1.6 Tenant’s Work. To procure at Tenant’s sole expense all necessary permits and licenses before undertaking any alteration work on the Premises; to do all such work in compliance with the applicable provisions of Section 5.2.3 hereof, to do all such work in a good and workmanlike manner employing materials of good quality and so as to conform with all applicable zoning, building, fire, health and other codes, regulations, ordinances and laws; and to pay promptly when due the entire cost of any work on the Premises undertaken by Tenant so that the Premises shall be free of liens for labor and materials; to employ for such work one or more responsible contractors (whose labor will work without interference with other labor working in the Premises if such work is proceeding while Landlord performs Landlord’s Work); to require such contractors employed by Tenant to carry workmen’s compensation insurance in accordance with statutory requirements and commercial general liability insurance covering such contractors on or about the Premises in an amount not less than $2,000,000 and to submit certificates evidencing such coverage to Landlord prior to the commencement of such work; and to save Landlord harmless and indemnified from all injury, loss, claims or damage to any person or property occasioned by or growing out of such work.
5.1.7 **Indemnity.** Except if caused by the negligence or willful misconduct of Landlord or its agents, employees or contractors, Tenant shall defend, with counsel chosen by Tenant’s insurer or otherwise reasonably acceptable to Landlord, all actions against Landlord, any member, partner, trustee, stockholder, officer, director, employee or beneficiary of Landlord, holders of mortgages on the Premises, any other party having an interest in the Premises and any property or asset manager employed by Landlord (individually an “Indemnified Party” and collectively the “Indemnified Parties”) with respect to, and shall pay, protect, indemnify and save harmless, to the extent permitted by law, all Indemnified Parties from and against, any and all liabilities, losses, damages, costs, expenses (including reasonable attorneys’ fees and expenses), causes of action, suits, claims, demands or judgments of any nature arising from (a) injury to or death of any person, or damage to or loss of property, on the Premises or connected with the use, condition or occupancy of the Premises, (b) to the extent related to the Premises or this Lease, any act, fault, omission or other misconduct of Tenant or its agents, contractors, licensees, sublessees or invitees, or (c) the existence, use, generation, storage or disposal of Hazardous Materials (as defined in Section 5.2.2 hereof) on, in or about the Premises, the Building or the Lot or any surrounding area by or for Tenant or any agent, employee, contractor, licensee, sublessee or invitee of Tenant, including, without limitation, any and all liabilities, losses, damages, costs, expenses (including reasonable attorneys’ fees and expenses), causes of action, suits, claims, demands or judgments of any nature arising from or related to removal of or other remediation respecting any and all such Hazardous Materials.

Except if Tenant is required to indemnify Landlord as provided above, Landlord shall defend, with counsel chosen by Landlord’s insurer or otherwise reasonably acceptable to Tenant, all actions against Tenant with respect to, and shall pay, protect, indemnify and save harmless, to the extent permitted by law, Tenant from and against, any and all liabilities, losses, damages, costs, expenses (including reasonable attorneys’ fees and expenses), causes of action, suits, claims, demands or judgments of any nature arising from the gross negligence or willful misconduct of Landlord or its agents, or contractors.

5.1.8 **Landlord’s Right to Enter.** To permit Landlord and its agents to enter the Premises, at reasonable times and upon reasonable prior notice, subject to Tenant’s reasonable security and confidentiality requirements: (i) to examine the Premises and perform its obligations under Section 5.1.3; (ii) to show the Premises to prospective purchasers, investors and lenders throughout the Term, (iii) in case of emergency threatening persons or property; and (iv) during the last eighteen (18) months of the Term, to have access to the Premises for the purpose of showing the Premises to prospective tenants and to keep affixed in suitable places notices of availability of the Premises.

5.1.9 **Personal Property at Tenant’s Risk.** All of the furnishings, fixtures, equipment, effects and property of every kind, nature and description of Tenant, including consequential loss sustained by Tenant including loss of income or extra expenses in continuing to operate, and of all persons claiming by, through or under Tenant which, during the continuance of this Lease or any occupancy of the Premises by Tenant or anyone claiming under Tenant, may be on the Premises, shall be at the sole risk and hazard of Tenant and if the whole or any part thereof shall be destroyed or damaged by fire, water or otherwise, or by the leakage or bursting of water pipes, steam pipes, or other pipes, by theft or from any other cause, no part of said loss or damage is to be charged to or to be borne by Landlord.
5.1.10 Yield Up. Subject to the provisions of Section 5.2.3 (which the parties acknowledge limit what alterations Tenant must remove) and the provisions of Article VI, at the expiration of the Term or earlier termination of this Lease: to surrender all keys to the Premises, to remove (a) all furnishings, fixtures, equipment and other personal property now or hereafter located in the Premises, which are not affixed to the Building or Lot nor tied into the Building’s systems, excluding fixtures and equipment which Landlord agreed in writing may remain at the time it approved the same (b) all alterations Landlord otherwise requires to be removed at the expiration of the Term to the extent permitted under Section 5.2.3, and (c) all Tenant’s signs wherever located, to repair all damage caused by such removal and to yield up the Premises (including all installations and improvements made by Tenant, except for fixtures and equipment and such of said installations or improvements as are not to be removed as set forth above), broom-clean and in the same good order and repair in which Tenant is obliged to keep and maintain the Premises by the provisions of this Lease, free of Hazardous Materials brought upon, kept, used, stored, handled, treated, generated in, or released or disposed of from, the Premises by Tenant or any party claiming by, through or under Tenant (a “Tenant Party”) (collectively, “Tenant HazMat Operations”) and released of all licenses, clearances or other authorizations of any kind required by any governmental authority having jurisdiction over the use, storage, handling, treatment, generation, release, disposal, removal or remediation of Hazardous Materials (collectively “Hazardous Materials Clearances”). For purposes of clarification, in no event shall Tenant’s obligations under this Section 5.1.10 require Tenant to remove, remediate or encapsulate any Hazardous Materials from the Premises which existed in, on or under the Premises, prior to the Commencement Date. Any property not so removed shall be deemed abandoned and may be retained by Landlord or may be removed and disposed of by Landlord in such manner as Landlord shall determine and Tenant shall pay Landlord the entire cost and expense incurred by Landlord in effecting such removal and disposition and in making any repairs and replacements to the Premises necessitated by the removal of such property. For each day after the expiration of the Term, or the earlier termination of this Lease, and prior to Tenant’s performance of its obligation to yield up the Premises under this Section 5.1.10, Tenant shall pay to Landlord, for use and occupancy, an amount equal to 150% of the Fixed Rent in effect at the termination of the Lease computed on a daily basis, plus a sum equal to all Additional Rent which would have been payable with respect to each such day if this Lease were still in effect.

At least six (6) months prior to the surrender of the Premises, Tenant shall deliver to Landlord a narrative description of the actions proposed (or required by any governmental authority) to be taken by Tenant in order to surrender the Premises (including any alterations permitted by Landlord to remain in the Premises) at the expiration or earlier termination of the Term, free from any residual impact from the Tenant HazMat Operations and otherwise released for unrestricted use and occupancy (the “Surrender Plan”). Such Surrender Plan shall be accompanied by a current listing of (i) all Hazardous Materials licenses and permits held by or on behalf of any Tenant Party with respect to the Premises, and (ii) all Hazardous Materials used, stored, handled, treated, generated, released or disposed of from the Premises, and shall be subject to the review and approval of Landlord’s environmental consultant. In connection with
the review and approval of the Surrender Plan, upon the request of Landlord, Tenant shall deliver to Landlord or its consultant such additional non-proprietary information concerning Tenant HazMat Operations as Landlord shall request. On or before such surrender, Tenant shall deliver to Landlord evidence that the approved Surrender Plan shall have been satisfactorily completed and Landlord shall have the right, subject to reimbursement at Tenant’s expense as set forth below, to cause Landlord’s environmental consultant to inspect the Premises and perform such additional procedures as may be deemed reasonably necessary to confirm that the Premises are, as of the effective date of such surrender or early termination of the Lease, free from any residual impact from Tenant HazMat Operations. Tenant shall reimburse Landlord, as Additional Rent, for the actual out of pocket expense incurred by Landlord for Landlord’s environmental consultant to review and approve the Surrender Plan and to visit the Premises and verify satisfactory completion of the same, which cost shall not exceed $5,000. Landlord shall have the unrestricted right to deliver such Surrender Plan and any report by Landlord’s environmental consultant with respect to the surrender of the Premises to third parties.

If Tenant shall fail to prepare or submit a Surrender Plan approved by Landlord, or if Tenant shall fail to complete the approved Surrender Plan, or if such Surrender Plan, whether or not approved by Landlord, shall fail to adequately address any residual effect of Tenant HazMat Operations in, on or about the Premises, Landlord shall have the right to take such actions as Landlord may deem reasonable or appropriate to assure that the Premises and the Project are surrendered free from any residual impact from Tenant HazMat Operations, the cost of which actions shall be reimbursed by Tenant as Additional Rent, without regard to the limitation set forth in the second paragraph of this section.

5.1.11 Estoppel Certificate. Upon not less than ten (10) days’ prior notice by Landlord, to execute, acknowledge and deliver to Landlord a statement in writing, addressed to such party as Landlord shall designate in its notice to Tenant, certifying that this Lease is unmodified and in full force and effect and that Tenant has no defenses, offsets or counterclaims against its obligations to pay the Fixed Rent and Additional Rent and any other charges and to perform its other covenants under this Lease (or, if there have been any modifications that the same is in full force and effect as modified and stating the modifications and, if there are any defenses, offsets or counterclaims, setting them forth in reasonable detail), the dates to which the Fixed Rent and Additional Rent and other charges have been paid, a statement that Landlord is not in default hereunder (or if in default, the nature of such default, in reasonable detail), and such other information as Landlord may reasonably request. Any such statement delivered pursuant to this Section 5.1.11 may be relied upon by any prospective purchaser or mortgagee of the Premises, or any prospective assignee of any such mortgagee.

5.1.12 Landlord’s Expenses Re Consents. To reimburse Landlord promptly on demand for all reasonable third-party expenses incurred by Landlord in connection with all requests by Tenant for consent or approval hereunder.

5.1.13 Financial Statements. To furnish to Landlord within forty-five (45) days after written request by Landlord (which request may not be given more than once in any twelve (12) month period), Tenant’s most recent audited financial statements (including any notes to them) or, if no such audited statements have been prepared, such other financial statements (and notes to them) as may have been most recently prepared by an independent certified public
accountant or, if no such statements have been prepared, current internally prepared financial statements in form reasonably acceptable to Landlord, certified by Tenant’s Chief Financial Officer. Tenant agrees that if Tenant’s entity structure is altered through merger, acquisition or other transaction, such that Tenant becomes a subsidiary of another entity, the financial statements delivered pursuant to this Section 5.1.13 shall contain financial information pertaining only to Tenant’s operations and not to any parent thereof (unless the parent is liable for the obligations of Tenant under this Lease). In addition, within fifteen (15) days after delivery to Tenant of Landlord’s request to do so, Tenant shall furnish Tenant’s most recent quarterly financial statements certified by Tenant’s Chief Financial Officer. Tenant will discuss its financial statements with Landlord upon request in order to enable Landlord to verify the financial statements. The foregoing shall not be deemed to constitute Landlord’s consent to any assignment of the Lease or subletting of the Premises or in any way derogate from the provisions of Section 5.2.1. Tenant represents and warrants that the initial financial statements provided by it to Landlord prior to execution of this Lease were true, correct and complete in all material respects when provided, and that no material adverse change has occurred since that date which would render them inaccurate or misleading in any material respect, and each future delivery of financial statements hereunder to Landlord shall be deemed a representation and warranty that such statements are true, correct and complete in all material respects as of the date of delivery to Landlord. So long as Tenant is a “public company” and its financial information is publicly available, then the foregoing delivery requirements shall not apply. Upon Tenant’s request, Landlord shall execute a commercially reasonable form of non-disclosure agreement with respect to and prior to Tenant’s delivery of such financial statements.

5.2 Negative Covenants. Tenant covenants at all times during the Term and for such further time as Tenant occupies the Premises or any part thereof:

5.2.1 Assignment and Subletting. Not to assign, transfer, mortgage or pledge this Lease or to grant a security interest in Tenant’s rights hereunder, or to sublease (which term shall be deemed to include the granting of concessions and licenses and the like) or permit anyone other than Tenant to occupy all or any part of the Premises or suffer or permit this Lease or the leasehold interest hereby created or any other rights arising under this Lease to be assigned, transferred or encumbered, in whole or in part, whether voluntarily, involuntarily or by operation of law without the prior written consent of Landlord, subject to the terms and provisions of this Section 5.2.1, such consent from Landlord not to be unreasonably withheld, conditioned or delayed.

5.2.1.1 For the purposes of this Section 5.2.1, the transfer in the aggregate in any one transaction or series of related transactions of a majority of the direct or indirect interest in Tenant (whether stock, partnership interest or other form of ownership or control) by any person or persons having an interest in ownership or control of Tenant (except for transfers of publicly traded securities and transfers to or among family members, existing owners, or persons or entities controlling, controlled by, or under common control with Tenant or existing owners) shall be deemed an assignment of this Lease (a “Corporate Transfer”). Landlord shall not unreasonably withhold, condition or delay its consent to any assignment or subletting of the Premises by Tenant, provided that the proposed assignee or sublessee is determined by Landlord in its reasonable judgment to be creditworthy (taking into consideration Tenant’s ongoing liability for all of the obligations of this Lease), is qualified to do business in the state in which
the Premises are located, shall use the Premises only for the Permitted Uses hereunder, and shall not involve the use of hazardous substances not otherwise permitted by the terms and provisions of this Lease therein. Notwithstanding anything to the contrary, Tenant shall have the right, without Landlord’s consent, to assign this Lease to, or sublease all or any part of the Premises to, or permit all or part of the premises to be used or occupied by (a) any entity controlling, controlled by, or under common control with Tenant, or (b) a successor to Tenant by consolidation, merger, or sale of the entire company or all or any substantial portion of its assets (or Tenant after a Corporate Transfer), provided that in the event of a transaction subject to this clause (b) the successor entity (or Tenant after a Corporate Transfer) has a tangible net worth (as determined in accordance with generally accepted accounting principles) after such transaction at least equal to the greater of (x) the tangible net worth of Tenant as of the date hereof or (y) the tangible net worth of Tenant prior to such transaction. In addition to the foregoing, Tenant shall be permitted to sublease or license space to, or otherwise permit occupancy of portions of the Premises by, entities with which Tenant does business whose presence in the Premises is a necessary or convenient component of its working relationship with Tenant, without requiring any consent from Landlord, but upon prior written notice to Landlord, provided that such entity shall comply with the terms of this Lease, including without limitation, the Permitted Uses hereunder.

5.2.1.2 Any attempted assignment, transfer, mortgage, pledge, grant of security interest, sublease or other encumbrance, except as permitted by this Section 5.2.1, shall be void. No assignment, transfer, mortgage, grant of security interest, sublease or other encumbrance, whether or not approved, and no inducement granted by Landlord to any assignee, sublessee or occupant shall in any way impair Tenant’s continuing primary liability (which after an assignment or subletting shall be joint and several with the assignee or sublessee) of Tenant hereunder, and no approval in a particular instance shall be deemed to be a waiver of the obligation to obtain Landlord’s approval in any other case.

5.2.1.3 If for any assignment or sublease or occupancy by another permitted by Landlord hereunder, Tenant receives rent or other consideration, either initially or over the term of the assignment, sublease or occupancy, in excess of the rent called for hereunder, or in case of sublease of part of the Premises, in excess of the rent fairly allocable to the part so subleased, Tenant shall pay to Landlord, as Additional Rent, fifty percent (50%) of the excess of each such payment of rent or other consideration received by Tenant promptly after its receipt, after the deduction therefrom of reasonable legal, brokerage and tenant improvement expenses, amortized over the remaining term of the Lease, in the case of an assignment, and over the term of the sublease, in the case of a sublease.

5.2.2 Occupancy and Use. To use the Premises only for the Permitted Uses; not to injure, overload, deface or otherwise harm the Building, the Lot or any common facilities appurtenant thereto; not to make, allow or suffer any waste; to comply in all respects with the Park Covenants; and not to permit in the Building any use thereof which is contrary to law or ordinances, or to create a nuisance or to invalidate any insurance on the Building or its contents; not to dump, flush, or in any way introduce any Hazardous Materials into the septic, sewage or other waste disposal system serving the Premises or to introduce, generate, store, use or dispose of Hazardous Materials in, on or about the Premises, the Lot or any common facilities appurtenant thereto except in compliance with the requirements of applicable law in connection

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with Tenant’s business activities in the Premises for the Permitted Uses; not to dispose of Hazardous Materials from the Premises to any other location except as permitted by applicable law; to notify Landlord of any violation of applicable federal, state, or local law on the Premises, the Lot or any common facilities appurtenant thereto which requires the filing by Tenant of a notice; to comply with all laws, regulations and orders of governmental authorities, including without limitation those relating to zoning, building, fire, health and safety, applicable to the Premises, the Lot or any common facilities appurtenant thereto, including the Americans with Disabilities Act, as amended. As used herein, “Hazardous Materials” shall mean and include, but shall not be limited to, any petroleum product and all hazardous or toxic wastes or substances, any substances which because of their quantitative concentration, chemical, radioactive, flammable, explosive, infectious or other characteristics, constitute or may reasonably be expected to constitute or contribute to a danger or hazard to public health, safety or welfare or to the environment, including, without limitation, any asbestos (whether or not friable) and any asbestos-containing materials, waste oils, solvents and chlorinated oils, polychlorinated biphenyls (PCBs), toxic metals, etchants, pickling and plating wastes, explosives, reactive metals and compounds, pesticides, herbicides, radon gas, urea formaldehyde foam insulation and chemical, biological and radioactive wastes, or any other similar materials or any hazardous or toxic wastes or substances which are included under or regulated by any federal, state or local law, rule or regulation (whether now existing or hereafter enacted or promulgated, as they may be amended from time to time) pertaining to environmental regulations, contamination, clean-up or disclosures, and any judicial or administrative interpretation thereof, including any judicial or administrative orders or judgments including, without limitation, the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. Section 9601 et seq. ("CERCLA"); the Federal Resource Conservation and Recovery Act, 42 U.S.C. Section 6901 et seq. ("RCRA"); Superfund Amendments and Reauthorization Act of 1986, Public Law No. 99-499 (signed into law October 17, 1986) ("SARA"); Toxic Substances Control Act, 15 U.S.C. Section 2601 et seq. ("TSCA"); Massachusetts Oil and Hazardous Material Release Prevention and Response Act, M.G.L. c. 21E; Massachusetts Hazardous Waste Management Act, M.G.L. c. 21C; the Hazardous Materials Transportation Act, 49 U.S.C. Section 1801 et seq.; or any other state superlien or environmental clean-up or disclosure statutes (all such laws, rules and regulations being referred to collectively as the “Environmental Laws”). Tenant shall, upon request of Landlord, deliver to Landlord a certification as to all Hazardous Materials used by Tenant in the Premises, together with copies of all permits, manifests, and other non-proprietary documentation requested by Landlord to confirm Tenant’s compliance with the requirements of this Lease. Without limitation of the foregoing, Landlord reserves the right to conduct environmental assessments of Tenant’s activities in the Premises from time to time (but in no event more than once in any twelve month period except if Landlord has a reasonable basis to do so), the cost of which shall be borne by Tenant in the event that any such assessment discloses any violation by Tenant of this Section 5.2.2. The foregoing is not intended to and does not create any liability of Tenant arising from the mere presence of Hazardous Materials on the Premises prior to the commencement of the Term. Landlord represents and warrants to Tenant that it has no knowledge of any Hazardous Materials on the Premises in violation of law as of the date hereof except to the extent set forth in the environmental site assessments listed on Exhibit D, copies of which Landlord has delivered to Tenant. If any Hazardous Materials are identified at the Premises as having been in existence at the Premises prior to the date hereof and as to which remediation is required by law (and such Hazardous Materials cannot be appropriately encapsulated), Landlord shall promptly after notice from Tenant, and at Landlord’s sole cost and expense, remove and/or remediate such Hazardous Materials in compliance with all Environmental Laws.
5.2.3 Installation, Alterations or Additions. Except as otherwise set forth in this Section 5.2.3, not to make any installations, alterations or additions in, to or on the Building or Lot (including, without limitation, buildings, lawns, planted areas, walks, roadways, parking and loading areas, or excavation of any area), nor permit the painting or placing of any exterior signs (except as hereinafter provided), placards or other advertising media, awnings, aerials, antennas, or flagpoles, or the like on the exterior of the Building or visible from outside of the Premises, without on each occasion obtaining the prior written consent of Landlord, which consent shall not be unreasonably withheld, conditioned or delayed. Landlord hereby approves the initial plans and specifications for the Initial Tenant Work previously submitted by Tenant to Landlord and attached to this Lease as Exhibit H. Landlord shall not charge any overhead, coordination or supervisory or other fees in connection with the review of Tenant’s plans or monitoring of Tenant’s work, but Tenant shall pay Landlord, as Additional Rent, the reasonable out-of-pocket cost of Landlord’s third party consultants who review such plans. Prior to commencing any work in the Premises, Tenant shall submit the plans therefor to Landlord for approval in accordance with the notice requirements of Section 9.1. If Landlord fails to approve or disapprove the plans, or to approve the same with reasonable conditions, within ten (10) business days after receipt thereof, Tenant may send a second notice with respect to such submission that includes in at least 14 point-type and all capitals (with the rest of the notice in standard font and type-size) the phrase “FAILURE TO IMMEDIATELY RESPOND COULD RESULT IN THE FORFEITURE OF RIGHTS” (a “Second Plans Notice”), and if Landlord fails to approve or disapprove the plans or to approve the same with reasonable conditions within five (5) business days of receipt of the Second Plans Notice, such plans shall be deemed approved by Landlord. Subject to the provisions of this Section 5.2.3, Landlord shall notify Tenant at the time of approval as to any alterations Tenant shall be required to remove prior to yielding up the Premises upon the expiration or earlier termination of the Term. Tenant shall provide Landlord with a payment, performance and lien bond naming Landlord as co-obligee with respect to any alterations having a cost in excess of $5,000,000, it being agreed, however that no such bond shall be required for the Initial Tenant Work if Tenant’s general contractor is any of the following: The Richmond Group or Wise Construction Corp. In the event of any alteration, Tenant shall perform the same in accordance with the requirements of this Lease, including without limitation the provisions of Section 5.1.6 above, and shall provide Landlord with as-built plans thereof upon the completion of the same. Subject to this Section 5.2.3 and Section 5.1.10, all such alterations of the Building and the Lot shall become part of the Premises and the property of Landlord. The Initial Tenant Work shall be subject to the provisions of this Section 5.2.3. Notwithstanding the foregoing, alterations that are (a) entirely inside of the Building, (b) non-structural, (c) do not adversely affect the Building’s systems, and (d) are substantially consistent with the Building’s intended use for non-good manufacturing process pre-clinical discovery, good laboratory practice toxicology, current good manufacturing process clinical development supply, and comparable activities consistent with the primary business of Moderna Therapeutics Inc., and (e) are generally consistent with the Initial Tenant Work (such Alterations being referred to herein as “No Consent Alterations”) may be undertaken without Landlord’s prior consent but otherwise in accordance with this Section 5.2.3. Notwithstanding anything in this Lease to the contrary, Tenant shall not be required to remove from the Premises pursuant to Section 5.1.10 any of the Initial Tenant Work nor any No Consent Alterations.
5.2.4 **Signage.** Tenant shall have the right, subject to Landlord’s prior written approval in accordance with Sections 5.2.3 and 5.1.6, and in compliance with applicable legal requirements, including, without limitation, all local permits and approvals and the Park Covenants (including without limitation any conditions and/or restrictions imposed by the Norwood Planning Board) (the “Sign Compliance Obligations”), to install signage on the Building façade, and on the Premises’ monument signage at the entrance to the Lot, in locations and of size and design approved by Landlord in its good faith discretion. Subject to compliance with the Sign Compliance Obligations, Landlord agrees that Tenant shall have the right to use the portion of the Park monument sign so indicated on Exhibit E and the Premises’ monument sign, the locations of which are shown on Exhibit F. The cost of fabrication and installation of all signs shall be Tenant’s responsibility. All work shall be performed at Tenant’s expense by a sign installer approved by Landlord in compliance with all applicable laws, codes and regulations and the provisions of Section 5.1.6.

**ARTICLE VI**

**Casualty or Taking**

6.1 **Damage or Destruction of Premises.**

6.1.1 If the Premises or any part thereof are damaged by fire or other casualty, Tenant shall promptly notify Landlord thereof.

6.1.2 If the entire Building is destroyed or is so damaged by fire or other casualty that no portion of it can be occupied by Tenant for the normal conduct of its business operations, then Tenant may terminate this Lease by giving written notice to Landlord within forty-five (45) days after the date of such damage, in which event this Lease shall terminate thirty (30) days after such notice is so given, with the same effect as if such date was the last day of the Term.

6.1.3 If less than the entire Building is destroyed or damaged by fire or other casualty, or if Tenant does not elect to terminate this Lease as provided in Section 6.1.2, and if a reputable contractor or architect engaged by Tenant and reasonably approved by Landlord estimates (the “Casualty Restoration Estimate”) that either (a) the time required (from the date of such casualty) to restore the Building to substantially the condition in which the same existed immediately prior to the casualty (subject to then-applicable Laws) (“Restoration”) exceeds eighteen (18) months or (b) the time required for Restoration from the commencement to substantial completion of the Restoration exceeds twelve (12) months, then Tenant may terminate this Lease by giving written notice to Landlord within forty-five (45) days after the date of such damage, in which event this Lease shall terminate thirty (30) days after such notice is so given, with the same effect as if such date was the last day of the Term.

6.1.4 Notwithstanding the preceding provisions of this Section 6.1, if any casualty occurs to the Building during the last Lease Year of the Term such that Tenant is unable to continue normal business operations in a material portion of the Building, and the Casualty
Restoration Estimate provided by Tenant to Landlord sets forth a Restoration period of more than sixty (60) days from the date such damage occurred, then Tenant shall have the right to terminate this Lease by giving written notice to Landlord within thirty (30) days after the date of such damage, in which event this Lease shall terminate ten (10) days after such notice is so given, with the same effect as if such date was the last day of the Term.

6.1.5 If Tenant does not terminate this Lease as provided in this Section 6.1, then Tenant shall perform the Restoration in accordance with the provisions of Section 6.2 below.

6.2 Restoration. If this Lease is not terminated in accordance with Section 6.1, this Lease shall continue in full force and effect and Tenant shall promptly and diligently perform the Restoration of the Building at Tenant’s sole cost and expense, but including use of the Net Proceeds (defined below). Tenant shall continue to pay all Fixed Rent and Additional Rent due under this Lease during any period of Restoration, subject to a credit for any rent loss insurance proceeds actually received by Landlord from the insurance to be carried pursuant to Section 4.2.3.2. Tenant shall adjust, collect and compromise any and all claims for damage to the Building and the improvements therein. Exclusive of proceeds allocated to Tenant’s personal property and moveable trade fixtures, the holder under a first mortgage on the Premises (the “Mortgagee”), if any, and Landlord, shall have the right to join with Tenant therein and approve such settlement, such approval not to be unreasonably withheld, conditioned or delayed. Such proceeds of insurance (exclusive of proceeds allocated to Tenant’s personal property and moveable trade fixtures), less any actual and reasonable expenses incurred by Tenant in collecting such proceeds (the “Net Proceeds”), shall be paid to Mortgagee (or to Landlord, if there is no Mortgagee) and disbursed to Tenant for Restoration, in accordance with the provisions of Section 6.3.

6.3 Net Proceeds for Restoration. The Net Proceeds shall be held and disbursed by Mortgagee, or if there is no Mortgagee at such time, by Landlord in accordance with the following conditions:

6.3.1 Prior to commencement of the Restoration, the architects, general contractor(s), and plans and specifications for the Restoration shall be approved by Landlord, as and to the extent required by the provisions of Sections 5.1.6 and 5.2.3, and the general contractor shall have provided to Mortgagee and Landlord an estimate of the cost of Restoration.

6.3.2 At the time of any disbursement, no Event of Default shall exist and no mechanics’ or materialmen’s liens shall have been filed and remain undischarged or unbonded.

6.3.3 If the estimated Restoration cost is less than $250,000, the Net Proceeds shall be disbursed to Tenant within thirty (30) days after Mortgagee’s (or Landlord’s, as applicable) receipt thereof. Disbursements with respect to Restorations estimated to exceed $250,000 will be governed by Sections 6.3.4 through 6.3.8.
6.3.4 To the extent the estimated cost of Restoration exceeds the Net Proceeds, Tenant shall itself fund such excess first, prior to disbursement of any portion of the Net Proceeds, so that at all times the Net Proceeds remaining to be disbursed will be sufficient to allow for completion of the Restoration.

6.3.5 Disbursements shall be made from time to time in an amount not exceeding the hard and soft costs of the work and costs incurred since the last disbursement upon receipt of (a) satisfactory evidence, including architects’ certificates of the stage of completion, of the estimated cost of completion and of performance of the work to date in a good and workmanlike manner in accordance with the contracts and plans and specifications, (b) partial releases of liens, and (c) other reasonable evidence of cost and payment so that Mortgagee (or Landlord, as applicable) can verify that the amounts disbursed from time to time are represented by work that is completed, in place or delivered to the site and free and clear of mechanics’ lien claims.

6.3.6 Each request for disbursement shall be sent by Tenant to Landlord and Mortgagee (if any), accompanied by a certificate of Tenant describing the work, materials or other costs or expenses, for which payment is requested, stating: (a) the cost incurred in connection therewith; (b) that no Event of Default exists; (c) that no mechanics’ or materialmen’s liens shall have been filed and remain undischarged or unbonded; (d) that Tenant has not previously received payment for such work or expense; and (e) that the remainder of the Restoration can be completed with the remaining undisbursed Net Proceeds (failing which Tenant shall itself fund any gap until the Restoration project is again in balance); and the certificate to be delivered by Tenant upon completion of the work shall, in addition, state that the work has been substantially completed and complies with the applicable requirements of this Lease.

6.3.7 Ten percent (10%) of the Net Proceeds, or such lower amount as may be permitted by the Massachusetts Retainage Act (M.G.L. ch. 149, Section 29F), shall be retained by Mortgagee (or Landlord, as applicable) until the Restoration is at least fifty percent (50%) complete, and thereafter five percent (5%) until the Restoration is substantially complete.

6.3.8 At all times the undisbursed balance of the Net Proceeds, plus any funds contributed toward Restoration by Tenant, shall be not less than the cost of completing the Restoration (as reasonably estimated by Tenant, provided that Tenant shall provide to Landlord the basis for such estimate, in reasonable detail, promptly after Landlord’s request therefor, and as confirmed in writing to Landlord), free and clear of all liens. In addition, prior to commencement of Restoration and at any time during Restoration, if the estimated cost of Restoration, as reasonably determined by Landlord, exceeds the amount of the Net Proceeds, Tenant shall fund at its own expense the costs of such Restoration until the remaining Net Proceeds is sufficient for the completion of the Restoration. Any sum in the Net Proceeds which remains in the Net Proceeds upon the completion of Restoration shall be paid to Tenant.

6.4 Net Proceeds Upon Termination. If this Lease is terminated in accordance with Section 6.1 or Section 7.1, the entire Net Proceeds of insurance received in accordance with Section 6.2 shall paid to Landlord, and Landlord, not Tenant, shall have the power to adjust, compromise and settle all claims with the insurer.

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6.5 **Eminent Domain.** In the event that all or any substantial part of the Building (meaning more than 30% of the rentable floor area), or a material portion of the Lot (meaning such portion of the Lot that would prevent or materially adversely affect Tenant’s ability to use the Premises for its then current operations) is taken (other than for temporary use, as hereafter described) by public authority under power of eminent domain (or by conveyance in lieu thereof), then by notice given within three (3) months following the recording of such taking (or conveyance) in the appropriate registry of deeds, this Lease may be terminated at Landlord’s or Tenant’s election effective upon the date on which physical possession of the Premises (or the portion thereof so taken) is taken by the condemning authority, and Rent shall be apportioned as of the effective date of such termination. If this Lease is not terminated as aforesaid, the Premises (or what remain thereof) shall be restored consistent with the procedures set forth in Section 6.2 above, but only to the extent of the net proceeds of damages award for such taking, so as to re-constitute the remaining portion of the Building as a complete and functional unit for use by Tenant for the Permitted Uses. In the event that some portion of the floor area of the Building is taken (other than for temporary use) and this Lease is not terminated, Rent shall be proportionally abated for the remainder of the Term. In the event of any taking of the Premises or any part thereof for temporary use, (i) this Lease shall be and remain unaffected thereby and rent shall not abate, and (ii) Tenant shall be entitled to receive for itself any award made for such use with respect to the period of the taking which is within the Term.Irrespective of the form in which recovery may be had by law, all rights to damages or compensation for the Premises, the Building and the Lot, including the improvements thereon, shall belong to Landlord. Tenant hereby grants to Landlord all of Tenant’s rights to such damages and covenants to deliver such further assignments thereof as Landlord may from time to time request. Tenant may separately pursue an award for the unamortized value of improvements installed by Tenant at its expense, its personal property, fixtures, equipment, and moving expenses.

ARTICLE VII

Defaults

7.1 **Events of Default.** (a) If Tenant shall default in the performance of any of its obligations to pay the Fixed Rent or Additional Rent hereunder and if such default shall continue for five (5) business days after written notice, or (b) if Tenant fails to provide an estoppel certificate to Landlord within the time period provided and otherwise in accordance with Section 5.1.11 hereof which continues for more than 5 business days after further written notice from Landlord, or (c) if Tenant fails to timely procure and maintain any insurance as required by any provision of this Lease, and such failure continues for a period of 5 business days after written notice thereof, or (d) if Tenant assigns this Lease or subleases any portion of the Premises in violation of Section 5.2.1, or (e) if, within thirty (30) days after written notice from Landlord specifying any other default or defaults, Tenant has not cured the same (or if the same is curable but not within such 30-day period Tenant has either not commenced such cure within such 30 days and thereafter diligently prosecuted the same to completion, or not completed such cure within 90 days of such notice), or (f) if Tenant or any guarantor of all or any portion of Tenant’s obligations under this Lease becomes insolvent or fails to pay its debts as they fall due, or (g) if a trust mortgage or assignment is made by Tenant or by any guarantor for the benefit of creditors, or (h) if the leasehold estate under this Lease or any substantial part of the property of Tenant or of any guarantor is taken on execution, or by other process of law, or is attached or subjected to any other involuntary encumbrance and the same is not dismissed, stayed or vacated within 60
days, or (i) if a receiver, trustee, custodian, guardian, liquidator or similar agent is appointed with respect to Tenant or any guarantor, or if any such person or a mortgagee, secured party or other creditor takes possession of the Premises or of any substantial part of the property of Tenant or of any guarantor, and, in either case, if such appointment or taking of possession is not terminated within 60 days after it first occurs, or (j) if a petition is filed by or with the consent of Tenant or of any guarantor under any federal or state law concerning bankruptcy, insolvency, reorganization, arrangement, or relief from creditors, or (k) if a petition is filed against Tenant or against any guarantor under any federal or state law concerning bankruptcy, insolvency, reorganization, arrangement, or relief from creditors, and such petition is not dismissed, stayed or vacated within 60 days, or (l) if Tenant or any guarantor which is a corporation dissolves or is dissolved or liquidates (each of (a)-(l) being agreed to constitute substantial defaults hereunder and being referred to herein as an “Event of Default”), then, and in any of such cases, Landlord and the agents and servants of Landlord lawfully may, in addition to and not in derogation of any remedies for any preceding breach of covenant, immediately or at any time thereafter while such Event of Default continues, in accordance with applicable laws, terminate this Lease by notice to Tenant, and repossess the same as of Landlord’s former estate and expel Tenant and those claiming through or under Tenant and remove its and their effects without being deemed guilty of any manner of trespass and without prejudice to any remedies which might otherwise be used for arrears of rent or prior breach of covenant, and upon such entry or mailing as aforesaid this Lease shall terminate, Tenant hereby waiving all rights of redemption, if any, to the extent such rights may be lawfully waived, and Landlord, upon such termination, without notice to Tenant, may store Tenant’s effects, and those of any person claiming through or under Tenant at the expense and risk of Tenant, and, if Landlord so elects, may sell such effects at public auction or private sale and apply the net proceeds to the payment of all sums due to Landlord from Tenant, if any, and pay over the balance, if any, to the party legally entitled thereto.

7.2 Remedies. In the event that this Lease is terminated under any of the provisions contained in Section 7.1 or shall otherwise be terminated for breach of any obligation of Tenant, if Landlord so elects in writing (a “Landlord Section 7.2 Demand”), Tenant covenants to pay forthwith to Landlord, as full and final compensation and in lieu of any further amounts from Tenant accruing under this Lease after a Landlord Section 7.2 Demand, the sum of the excess, discounted to present value at a rate equal to the prime rate of interest as of the Landlord Section 7.2 Demand as reported by The Wall Street Journal minus 1.5% per annum, of (a) the total rent reserved for the residue of the Term over (b) the rental value of the Premises for said residue of the Term, taking into account Landlord’s reasonable projections with respect to (i) costs of reletting (including brokerage costs, tenant improvement costs, legal fees and the like) and (ii) the period of time that the Premises are likely to remain fully or partially untenanted. In calculating the rent reserved there shall be included, in addition to the Fixed Rent and Additional Rent, the value of all other considerations agreed to be paid or performed by Tenant for said residue. Tenant further covenants with respect to any period prior to a Landlord Section 7.2 Demand, as additional and cumulative obligations after any such termination to pay punctually to Landlord all the sums and to perform all the obligations which Tenant covenants in this Lease to pay and to perform in the same manner and to the same extent and at the same time as if this Lease had not been terminated. In calculating the amounts to be paid by Tenant pursuant to the next preceding sentence Tenant shall be credited with the net proceeds of any rent obtained by Landlord by reletting the Premises, after deducting all Landlord’s expenses in connection with such reletting, including, without limitation, all repossession costs, brokerage commissions, fees
for legal services and expenses of preparing the Premises for such reletting, it being agreed by Tenant that Landlord may, but shall not be obligated to, 
(i) relet the Premises or any part or parts thereof, for a term or terms which may at Landlord’s option be equal to or less than or exceed the period which would 
otherwise have constituted the balance of the Term and may grant such concessions and free rent as Landlord in its reasonable judgment considers advisable 
or necessary to relet the same, (ii) make such alterations, repairs and decorations in the Premises as Landlord in its reasonable judgment considers advisable or 
necessary to relet the same, and (iii) keep the Premises vacant unless and until Landlord is able to rent the Premises to a Tenant which is at least as desirable 
and financially responsible as Tenant is on the date of this Lease, on terms not less favorable to Landlord than those of this Lease. No action of Landlord in 
accordance with the foregoing or failure to relet or to collect rent under reletting shall operate or be construed to release or reduce Tenant’s liability as 
aforesaid. Notwithstanding the foregoing, Landlord hereby agrees to use commercially reasonable efforts to mitigate any damages resulting from an Event of 
Default by Tenant leading to the termination of this Lease; provided that the engagement of a broker to market the Premises shall be deemed to be the use of 
commercially reasonable efforts.

In lieu of any other damages or indemnity and in lieu of full recovery by Landlord of all sums payable under all the foregoing provisions of this 
Section 7.2, Landlord may by notice to Tenant, at any time after this Lease is terminated under any of the provisions contained in Section 7.1 or is otherwise 
terminated for breach of any obligation of Tenant and before such full recovery, elect to recover, and Tenant shall thereupon pay, as liquidated damages, an 
amount equal to the aggregate of the Fixed Rent and Additional Rent accrued in the 12 months ended next prior to such termination (or, if such termination 
occurrred prior to the first anniversary of the Rent Commencement Date, an annualized amount of the Fixed Rent and Additional Rent due or which would 
have been due in the 12 month period commencing on the Rent Commencement Date), plus the amount of rent of any kind accrued and unpaid at the time of 
termination and less the amount of any recovery by Landlord under the foregoing provisions of this Section 7.2 up to the time of payment of such liquidated 
damages.

Nothing contained in this Lease shall, however, limit or prejudice the right of Landlord to prove for and obtain in proceedings under any federal 
or state law relating to bankruptcy or insolvency or reorganization or arrangement, an amount equal to the maximum allowed by any statute or rule of law in 
effect at the time when, and governing the proceedings in which, the damages are to be proved, whether or not the amount be greater than the amount of the 
loss or damages referred to above.

7.3 Remedies Cumulative. Any and all rights and remedies which Landlord may have under this Lease, and at law and equity, shall be cumulative and 
shall not be deemed inconsistent with each other, and any two or more of all such rights and remedies may be exercised at the same time insofar as permitted 
by law.

7.4 Landlord’s Right to Cure Defaults. Landlord may, but shall not be obligated to, cure, at any time, following ten (10) days’ prior notice to Tenant 
(except in cases of emergency when no notice shall be required and except if Tenant is diligently prosecuting such cure and no Event of Default exists), any 
default by Tenant under this Lease; and whenever Landlord so elects, all reasonable costs and expenses incurred by Landlord, including reasonable 
attorneys’ fees, in curing a default shall be paid by Tenant to Landlord as Additional Rent on demand, together with interest thereon at the rate provided in 
Section 4.3 from the date of payment by Landlord to the date of payment by Tenant.
7.5 Effect of Waivers of Default. Any consent or permission by Landlord to any act or omission which otherwise would be a breach of any covenant or condition herein, or any waiver by Landlord of the breach of any covenant or condition herein, shall not in any way be held or construed (unless expressly so declared) to operate so as to impair the continuing obligation of any covenant or condition herein, or otherwise, except as to the specific instance, operate to permit similar acts or omissions. The failure of Landlord to seek redress for violation of, or to insist upon the strict performance of, any covenant or condition of this Lease shall not be deemed a waiver of such violation nor prevent a subsequent act, which would have originally constituted a violation, from having all the force and effect of an original violation. The receipt by Landlord of Fixed Rent, Additional Rent or other charges due, with knowledge of the breach of any covenant of this Lease shall not be deemed to have been a waiver of such breach by Landlord, or by Tenant, unless such waiver be in writing signed by the party to be charged. No consent or waiver, express or implied, by Landlord to or of any breach of any agreement or duty shall be construed as a waiver or consent to or of any other breach of the same or any other agreement or duty.

Any consent or permission by Tenant to any act or omission which otherwise would be a breach of any covenant or condition herein, or any waiver by Tenant of the breach of any covenant or condition herein, shall not in any way be held or construed (unless expressly so declared) to operate so as to impair the continuing obligation of any covenant or condition herein, or otherwise, except as to the specific instance, operate to permit similar acts or omissions. The failure of Tenant to seek redress for violation of, or to insist upon the strict performance of, any covenant or condition of this Lease shall not be deemed a waiver of such violation nor prevent a subsequent act, which would have originally constituted a violation, from having all the force and effect of an original violation. No consent or waiver, express or implied, by Tenant to or of any breach of any agreement or duty shall be construed as a waiver or consent to or of any other breach of the same or any other agreement or duty.

7.6 No Accord and Satisfaction. No acceptance by Landlord of a lesser sum than the Fixed Rent, Additional Rent or any other charge then due shall be deemed to be other than on account of the earliest installment of such rent or charge due, unless Landlord elects by notice to Tenant to credit such sum against the most recent installment due, nor shall any endorsement or statement on any check or any letter accompanying any check or payment as rent or other charge be deemed a waiver, an agreement or an accord and satisfaction, and Landlord may accept such check or payment without prejudice to Landlord’s right to recover the balance of such installment or pursue any other remedy in this Lease provided.

ARTICLE VIII

Mortgages

8.1 Rights of Mortgage Holders. The word “mortgage” as used herein includes mortgages, deeds of trust or other similar instruments evidencing other voluntary liens or encumbrances, and modifications, consolidations, extensions, renewals, replacements and
substitutes thereof. The word “holder” shall mean a mortgagee, and any subsequent holder or holders of a mortgage. Until the holder of a mortgage shall enter and take possession of the Premises for the purpose of foreclosure, such holder shall have only such rights of Landlord as are necessary to preserve the integrity of this Lease as security. Upon entry and taking possession of the Premises for the purpose of foreclosure, such holder shall have all the rights of Landlord. Notwithstanding any other provision of this Lease to the contrary, including without limitation Section 9.4, no such holder of a mortgage shall be liable either as mortgagee or as assignee, to perform, or be liable in damages for failure to perform, any of the obligations of Landlord unless and until such holder shall enter and take possession of the Premises for the purpose of foreclosure or deed in lieu thereof. Upon entry for the purpose of foreclosure, such holder shall have all the rights of Landlord. Notwithstanding any other provision of this Lease to the contrary, including without limitation Section 9.4, provided that a discontinuance of any foreclosure proceeding shall be deemed a conveyance under said provisions to the owner of the Premises. No Fixed Rent, Additional Rent or any other charge shall be paid more than 30 days prior to the due dates thereof and payments made in violation of this provision shall (except to the extent that such payments are actually received by a mortgagee in possession or in the process of foreclosing its mortgage) be a nullity as against such mortgagee and Tenant shall be liable for the amount of such payments to such mortgagee.

The covenants and agreements contained in this Lease with respect to the rights, powers and benefits of a holder of a mortgage (including, without limitation, the covenants and agreements contained in this Section 8.1) constitute a continuing offer to any person, corporation or other entity, which by accepting a mortgage subject to this Lease, assumes the obligations herein set forth with respect to such holder; such holder is hereby constituted a party of this Lease as an obligee hereunder to the same extent as though its name were written hereon as such; and such holder shall be entitled to enforce such provisions in its own name. Tenant agrees on request of Landlord to execute and deliver from time to time any reasonable form agreement which may be necessary to implement the provisions of this Section 8.1.

8.2 Lease Subordinate to Mortgages. This Lease shall be subject and subordinate to any mortgage which may now or hereafter affect the Premises, and to all renewals, replacements or extensions thereof, provided and on condition that, with respect to any future mortgage, the mortgagee shall provide to Tenant a subordination non-disturbance agreement (an “SNDA”) in either substantially the form attached hereto as Exhibit G or otherwise in a commercially reasonable form and, in any event, providing that so long as no Event of Default by Tenant under this Lease shall have occurred and be continuing: (a) Tenant shall not be joined as a party defendant in any foreclosure action or proceeding which may be instituted or taken by said mortgagee, its successors and assigns unless such joinder is necessary to institute such foreclosure action or proceeding; (b) Tenant shall not be evicted from the Premises; and (c) Tenant’s leasehold interest hereunder shall not be terminated or disturbed and such successor shall recognize Tenant’s rights under this Lease.

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ARTICLE IX
Miscellaneous Provisions

9.1 Notices from One Party to the Other. All notices required or permitted hereunder shall be in writing and addressed, if to Tenant, at the Address of Tenant set forth in Section 1.1 above, with a copy to Dain, Torpy, Le Ray, Wiest & Garner, P.C., 745 Atlantic Avenue, Boston, MA 02111, Attention: Eric Labbe, Esq., or such other address as Tenant shall have last designated by notice in writing to Landlord and, if to Landlord, at the Address of Landlord set forth in Section 1.1 above or such other address as Landlord shall have last designated by notice in writing to Tenant, with a copy to WilmerHale, 60 State Street, Boston, MA 02109, Attention: Keith R. Barnett, Esq. Any notice shall be deemed duly given three (3) business days after depositing in the U.S. Mail, mailed to such address postage prepaid, registered or certified mail, return receipt requested, or the next day after depositing with a recognized overnight courier service, or at the time of delivery when delivered to such address by hand with receipt acknowledged.

9.2 Quiet Enjoyment. Landlord agrees that so long as no Event of Default exists hereunder that remains uncured, Tenant shall and may peaceably and quietly have, hold and enjoy the Premises during the Term without any manner of hindrance or molestation from Landlord or anyone claiming under Landlord, subject, however, to the terms of this Lease.

9.3 Lease not to be Recorded. Tenant agrees that it will not record this Lease. Both parties shall, upon the request of either, execute and deliver a notice or short form of this Lease in such form, if any, as may be permitted by applicable statute. If this Lease is terminated before the Term expires the parties shall execute, deliver and record an instrument acknowledging such fact and the actual date of termination of this Lease, and Tenant hereby appoints Landlord its attorney-in-fact, coupled with an interest, with full power of substitution to execute such a notice of termination in Tenant’s name and on its behalf.

9.4 Bind and Inure; Limitation of Landlord’s Liability. The obligations of this Lease shall run with the land, and this Lease shall be binding upon and inure to the benefit of the parties hereto and their respective successors and assigns. No owner of the Premises shall be liable under this Lease except for breaches of Landlord’s obligations occurring while owner of the Premises. The obligations of Landlord shall be binding upon the assets of Landlord which comprise the Premises but not upon other assets of Landlord. No individual member, partner, trustee, stockholder, officer, director, employee or direct or indirect beneficial owner of Landlord or of any member of Landlord shall be personally liable under this Lease and Tenant hereby appoints Landlord its attorney-in-fact, coupled with an interest, with full power of substitution to execute such a notice of termination in Tenant’s name and on its behalf.

9.5 Landlord’s Default. Landlord shall not be deemed to be in default in the performance of any of its obligations hereunder unless it shall fail to perform such obligations and such failure shall continue for a period of 30 days following receipt of notice from Tenant or such additional time as is reasonably required to correct any such default after notice has been given by Tenant to Landlord specifying the nature of Landlord’s alleged default, provided that Landlord has commenced to cure such default within such 30 day period and thereafter diligently pursues such cure to completion. Landlord shall not be liable in any event for incidental or consequential damages to Tenant by reason of any default by Landlord hereunder, whether or not Landlord is notified that such damages may occur. Tenant shall have no right to terminate this Lease for any default by Landlord hereunder and, except as set forth herein, no right, for any such default, to offset or counterclaim against any rent due hereunder.
9.6 **Brokerage.** Each of Landlord and Tenant warrants and represents that it has had no dealings with any broker or agent in connection with this Lease other than Newmark Grubb Knight Frank and Jones Lang LaSalle, who shall be paid by Landlord pursuant to separate written agreement, and covenants to defend with counsel reasonably approved by the other, hold harmless and indemnify the other from and against any and all cost, expense or liability for any compensation, commissions and charges claimed by any other broker or agent with respect to the indemnifying party’s dealings in connection with this Lease or the negotiation thereof.

9.7 **Applicable Law and Construction.**

9.7.1 **Applicable Law.** This Lease shall be governed by and construed in accordance with the laws of the Commonwealth of Massachusetts. If any term, covenant, condition or provision of this Lease or the application thereof to any person or circumstances shall be declared invalid, or unenforceable by the final ruling of a court of competent jurisdiction having final review, the remaining terms, covenants, conditions and provisions of this Lease and their application to persons or circumstances shall not be affected thereby and shall continue to be enforced and recognized as valid agreements of the parties, and in the place of such invalid or unenforceable provision, there shall be substituted a like, but valid and enforceable provision which comports to the findings of the aforesaid court and most nearly accomplishes the original intention of the parties.

9.7.2 **No Other Agreement.** There are no oral or written agreements between Landlord and Tenant affecting this Lease. This Lease may be amended, and the provisions hereof may be waived or modified, only by instruments in writing executed by Landlord and Tenant.

9.7.3 **No Representations by Landlord.** Neither Landlord nor any agent of Landlord has made any representations or promises with respect to the Premises or the Building except as herein expressly set forth, and no rights, privileges, easements or licenses are granted to Tenant except as herein expressly set forth.

9.7.4 **Titles.** The titles of the Articles and Sections contained herein are for convenience only and shall not be considered in construing this Lease.

9.7.5 “**Landlord**” and “**Tenant**”. Unless repugnant to the context, the words “Landlord” and “Tenant” appearing in this Lease shall be construed to mean those named above and their respective heirs, executors, administrators, successors and assigns, and those claiming through or under them respectively. If there be more than one tenant the obligations imposed by this Lease upon Tenant shall be joint and several.

9.7.6 **Business Days.** For purposes hereof, a “business day” shall mean a weekday which is not a public holiday in Suffolk County, Massachusetts.

9.7.7 **Additional Rent.** Any sum, charge or expense payable by Tenant hereunder shall constitute Additional Rent.
9.7.8 No Surrender. The delivery of keys to any employee of Landlord or to any manager or any employee or agent thereof shall not operate as a termination of this Lease or a surrender of the Premises. No act by Landlord or any employee or agent thereof shall be deemed an acceptance of a surrender of the Premises.

9.7.9 Cumulative Remedies. The specific remedies to which Landlord may resort under the terms of this Lease are cumulative and are not intended to be exclusive of any other remedies or means of redress to which it may be lawfully entitled in case of any breach or threatened breach by Tenant of any provisions of this Lease. In addition to the other remedies provided in this Lease, Landlord shall be entitled to the restraint by injunction of the violation or attempted or threatened violation of any of the covenants, conditions or provisions of this Lease or to a decree compelling specific performance of any such covenants, conditions or provisions.

9.8 Security Deposit.

9.8.1 Delivery of Security Deposit. On the Date of this Lease, Tenant shall deposit with Landlord an irrevocable, clean sight, standby letter of credit (the “Letter of Credit”) in the amount set forth in Section 1.1 above, to be held by Landlord as security for the faithful performance of every provision of this Lease, including but not limited to the provisions relating to the payment of Fixed Rent, Additional Rent and all other amounts for which Tenant is obligated hereunder (the Letter of Credit and all proceeds thereof being the “Security Deposit”), it being expressly understood that the Security Deposit is not an advance payment of rent or any other amount and is not a measure of Landlord’s damages in case of default by Tenant. Landlord shall not be required to keep the Security Deposit separate from its general funds, and Tenant has no, and expressly waives any, right or interest in the Security Deposit other than as set forth in the immediately following paragraph. The Letter of Credit shall be in form and substance, and from an issuer bank, acceptable to Landlord (Landlord hereby agreeing that Silicon Valley Bank is an acceptable bank), in its sole but reasonable discretion, provided that if at any time the financial condition of the issuer bank changes in any materially adverse way, as determined in the sole but reasonable discretion of the Landlord or its mortgagee, then Tenant shall within thirty (30) days of written notice from Landlord deliver to Landlord a replacement Letter of Credit, and Tenant’s failure to do so shall permit Landlord to draw such Letter of Credit; provided, however, that if Tenant is diligently working toward obtaining the replacement Letter of Credit, and Tenant notifies Landlord thereof within the initial thirty (30) day period, which notification shall contain reasonable documentation evidencing Tenant’s efforts, Tenant shall have an additional period of time, not to exceed an additional fifteen (15) days, in which to obtain such replacement Letter of Credit. The Letter of Credit shall have a term no less than one (1) year, and shall be renewable for successive periods of one (1) year for the entire Term, unless the issuer bank gives Landlord at least sixty (60) days’ notice of cancellation. If the Letter of Credit is not renewed or replaced within twenty (20) days prior to its scheduled expiration, the same shall constitute an Event of Default under this Lease for which there shall be no notice or grace or cure periods applicable thereto and Landlord shall be allowed to draw on the Letter of Credit and hold the cash proceeds as the Security Deposit. In addition, Landlord shall be entitled to draw on the Letter of Credit at any time during the Term (and during any period following the Term when any obligation of Tenant hereunder is continuing) if, pursuant to the terms of this Lease, an Event of Default has occurred that remains uncured. Landlord may (but shall not be required to) use, apply, or retain (without any liability for interest) all or any part of the Security Deposit.
Deposit drawn by Landlord in accordance with this Section 9.8.1. for the payment of Fixed Rent, Additional Rent or any other amount in default or that, at the time of any default, is owing by Tenant or is an accrued obligation of Tenant, or for the payment of any amount which Landlord may spend or become obligated to spend hereunder by reason of Tenant’s default, or to compensate Landlord for other loss or damage authorized hereunder which Landlord may suffer hereunder by reason of Tenant’s default. The covenants in this Section 9.8.1 are personal covenants between Landlord and Tenant and not covenants running with the land, and in no event shall Landlord’s mortgagee(s) or any purchaser at a foreclosure sale or a sale in lieu of foreclosure be liable to Tenant for the return of the Security Deposit except as expressly set forth in the immediately following paragraph. If any portion of the Security Deposit is to be so used or applied, Tenant shall, within ten (10) business days after written demand therefor, provide a new Letter of Credit that satisfies the requirements hereof and that is in the full amount set forth in Section 1.1, and Tenant’s failure to do so shall be deemed an Event of Default under this Lease.

Provided Tenant shall comply and be in compliance with all of the terms of this Lease, Landlord shall surrender the Letter of Credit and any remaining cash portion of the Security Deposit that has not been used or applied within sixty (60) days after the later of (a) the expiration of the Term and surrender of possession of the Premises to Landlord, or (b) such time as any amount due or accrued or that may become due or may accrue from Tenant in accordance with this Lease has been determined and paid in full. In the event of a sale of the Lot or assignment of this Lease by Landlord to any person other than a mortgagee, Landlord shall transfer the Security Deposit (whether Letter of Credit or cash) to its transferee or assignee, subject to Tenant’s aforesaid rights, and, upon such transfer, Landlord shall be released from any liability with respect to the return of such Security Deposit to Tenant and such transferee or assignee shall be solely responsible to Tenant therefor. Any transfer of a Letter of Credit by Landlord shall be at Tenant’s sole expense and the form of Letter of Credit shall so state.

Tenant shall not assign or encumber any interest in the Security Deposit, and neither Landlord nor its successors and assigns shall be bound by any attempted assignment or encumbrance.

9.8.2 Increase and Decreases in Security Deposit. In the event that there has been no Event of Default in the prior 18 months and there is no Event of Default then outstanding hereunder, the Security Deposit shall be reduced at the request of Tenant as follows: (a) On or after the fourth anniversary of the Rent Commencement Date, to $5,912,714.50; (b) On or after the fifth anniversary of the Rent Commencement Date, to $4,434,535,87; and (c) On or after the fifth anniversary of the Rent Commencement Date, if Tenant has in its possession (and has had in its possession at all times for at least the trailing 12 months), $500,000,000 in cash, to $2,956,357.25. Any such reduction in the Security Deposit shall be effective upon Tenant’s election pursuant to the preceding sentence together with delivery to Landlord of a replacement Letter of Credit satisfying the requirements of Section 9.8.1.

9.9 Submission Not an Offer. The submission of a draft of this Lease or a summary of some or all of its provisions does not constitute an offer to lease or demise the Premises, it being understood and agreed that neither Landlord nor Tenant shall be legally bound with respect to the leasing of the Premises unless and until this Lease has been executed by both Landlord and Tenant and a fully executed copy delivered.
9.10 Authority. Each party represents to the other party (which representations and warranties shall survive the delivery of this Lease) that:
(a) such party (i) is duly organized, validly existing and in good standing under the laws of its state of incorporation or creation, (ii) has the corporate or other power and authority to carry on businesses now being conducted and is qualified to do business in the Commonwealth of Massachusetts, and (iii) has the corporate or other power to execute and deliver and perform its obligations under this Lease, and (b) the execution, delivery and performance by such party of its obligations under this Lease have been duly authorized by all requisite corporate or other action and will not violate any provision of law, any order of any court or other agency of government, the corporate charter or by-laws or other governing documents of such party or any indenture, agreement or other instrument to which it is a party or by which it is bound.

9.11 Force Majeure. In any case where either party is required to do any act, delays caused by or resulting from Acts of God, war, civil commotion, fire, flood or other casualty, labor difficulties, shortages of labor, materials or equipment, government regulations, unusually severe weather, or other causes beyond such party’s reasonable control shall not be counted in determining the time during which work shall be completed, whether such time be designated by a fixed date, a fixed time or a “reasonable time”, and such time shall be deemed to be extended by the period of such delay; provided, however, in no event shall this Section 9.11 be deemed to apply to financial incapacity of a party.

9.12 Landlord’s Estoppel Certificate. Upon not less than fifteen (15) days’ prior notice by Tenant, Landlord shall execute, acknowledge and deliver to Tenant a statement in writing, addressed to such party as Tenant shall designate in its notice to Landlord, certifying that this Lease is unmodified and in full force and effect (or, if there have been any modifications that the same is in full force and effect as modified and stating the modifications), the dates to which the Fixed Rent and Additional Rent and other charges have been paid, and a statement that to the best of Landlord’s knowledge, Tenant is not in default hereunder (or if in default, the nature of such default, in reasonable detail) and such other information as Tenant may reasonably request.

9.13 Park Covenants. This Lease is subordinate to that certain that certain Declaration of Covenants, Easements and Restrictions recorded with the Norfolk Registry of Deeds in Book 22094, Page 439 (“Park Covenants”). From and after the Commencement Date, Tenant shall be solely responsible for compliance with the Park Covenants with respect to the Premises (other than violations which exist prior to the Commencement Date – it being agreed that Landlord shall be responsible for promptly correcting the same at Landlord’s cost) and for all CAM Costs payable with respect to the Premises pursuant to the Park Covenants related to the Term. Tenant shall have the benefit of all rights of Landlord under the Park Covenants relating to the use and occupancy of the Premises and the access thereto, and Landlord agrees, upon written notice from Tenant, to use reasonable efforts to enforce its rights thereunder for the benefit of Tenant. In no event shall Landlord or any affiliate of Landlord modify or amend the Park Covenants that would increase materially increase Tenant’s obligations under this Lease or adversely affect Tenant’s ability to use and occupy the Premise for the normal conduct of its business. Concurrent with the execution of this Lease, Landlord shall deliver an estoppel certificate from the Manager under the Park Covenants which confirms that there are no outstanding amounts due from Landlord or related to the Premises under the Park Covenants and that there are no defaults by Landlord or related to the Premises under the Park Covenants.
9.14 No Consequential Damages. In no event shall Landlord or Tenant be liable to the other party for any consequential, indirect or punitive damages suffered by such party from whatever cause.

ARTICLE X
Determination of Fair Market Rent and Tenant Option to Extend

10.1 Fair Market Rent. Whenever any provision of this Lease provides that the “Fair Market Rent” shall be calculated, it shall mean that the fair rent for the Premises as of the commencement of the period in question under market conditions then existing shall be determined, as well as such annual increases in rent for the period in question as are consistent with market conditions, taking into consideration the Permitted Uses and Additional Rent payments required under this Lease, the quality, size, design and location of the Premises and the rent for comparable buildings located in south suburban Boston, Massachusetts area. Fair Market Rent shall be determined by agreement between Landlord and Tenant, but if Landlord and Tenant are unable to agree upon the Fair Market Rent at least six (6) months prior to the date upon which the Fair Market Rent is to take effect, then each party will promptly hire and appoint a licensed broker, each of whom shall have at least ten (10) years of experience in the south suburban Boston, Massachusetts rental market for comparable properties and each of whom is hereinafter referred to as “appraiser”. Following appointment of the second appraiser, the appraisers will each submit their estimated Fair Market Rent (a “Fair Market Determination”) to the other. If they are unable to agree within thirty (30) days of the exchange of Fair Market Rent estimates, the appraisers will elect a third appraiser meeting the qualifications stated above and each such appraiser will present the third appraiser with his Fair Market Rent Determination. The third appraiser shall then make a determination as to Fair Market Rent which shall be (and may only be) the Fair Market Rent Determinations previously submitted by the initial two appraisers which the third appraiser believes is closest to the Fair Market Rent.

The third appraiser must be a person who has not previously acted in any capacity for either Landlord or Tenant, or their affiliates. The cost and expenses of the third appraiser shall be shared equally by Tenant and Landlord. Landlord and Tenant shall appoint their respective appraisers at least five (5) months prior to commencement of the period for which Fair Market Rent is to be determined and shall designate the appraisers so appointed by notice to the other party. The Fair Market Rent of the Premises determined in accordance with the provisions of this Section shall be binding and conclusive on Tenant and Landlord.

Notwithstanding the foregoing, if either party shall fail to appoint its appraiser within the period specified above (such party referred to hereinafter as the “failing party”), the other party may serve notice on the failing party requiring the failing party to appoint its appraiser within ten (10) days of the giving of such notice and if the failing party shall not respond by appointment of its appraiser within said ten (10) day period, then the appraiser appointed by the other party shall be the sole appraiser whose determination of the Fair Market Rent shall be binding and conclusive upon Tenant and Landlord.
10.2 **Options to Extend.** Tenant shall have the right and option to extend the Term for two (2) additional periods (each, an “Extension Term”), in the case of the first Extension Term, commencing the day after the expiration of the original Term referred to in Section 1.1 (the “Original Term”), and ending on the tenth (10th) anniversary of the expiration of the Original Term, and in the case of the second Extension Term, commencing on the day after the expiration of the first Extension Term, and ending on the tenth (10th) anniversary of the expiration of the first Extension Term, provided that Tenant shall give Landlord notice of Tenant’s exercise of such option no sooner than twenty-four (24) months and no later than eighteen (18) months prior to the expiration of the then current Term, and provided further that Tenant shall not be in default at the time of giving such notice under this Lease beyond applicable notice and cure periods. Prior to the exercise by Tenant of such option, the expression “Term” shall mean the Original Term, and after the exercise by Tenant of such option, the expression “Term” shall mean the Term as it has been then extended. It is a condition precedent to the exercise of the second Extension Term that Tenant shall have validly exercised the prior Extension Term. All of the terms, covenants, conditions, provisions and agreements in this Lease contained shall be applicable to the additional period to which the Term shall be extended as aforesaid. If Tenant shall give notice of its exercise of this option to extend in the manner and within the time period provided aforesaid, the Term shall be extended upon the giving of such notice without the requirement of any further action on the part of either Landlord or Tenant. If Tenant shall fail to give timely notice of the exercise of any such option as aforesaid, Tenant shall have no right to extend the Term of this Lease, time being of the essence of the foregoing provisions. The Annual Fixed Rent payable during each Extension Term shall be 92% of the Fair Market Rent for the Premises for the Extension Term. The Fair Market Rent shall be determined in accordance with the provisions of Section 10.1 above.

**ARTICLE XI**

**Opportunity to Purchase**

11.1 **Right of First Opportunity to Purchase.** Provided that no Event of Default has occurred during the previous twenty-four (24) months before Landlord executes a binding agreement to sell the Premises, subject to the terms of clause (e) below, Landlord shall not during the Term sell the Premises to a third party without first complying with the following:

(a) Landlord shall not sell the Premises to a third party unless it first gives Tenant written notice of its intention to sell or attempt to sell the Premises and setting forth the terms and conditions upon which it would be willing to sell (a “Sale Offer”) the Premises to Tenant.

(b) Tenant shall have thirty (30) days after receipt of a Sale Offer (the “Offer Period”) within which to accept any such Sale Offer. Failure of Tenant to accept any such Sale Offer in accordance with its terms within such Offer Period shall constitute and be deemed a rejection of such Sale Offer. If Tenant accepts such Sale Offer within such Offer Period, the parties shall consummate the sale upon the terms set forth in such Sale Offer. If Tenant shall fail to accept the Sale Offer within the Offer Period, or shall fail to consummate the sale within the time period set forth in the Sale Offer, the right granted to Tenant under this Section 11.1 shall thereupon terminate (subject to Section 11.1(c) below), provided that Landlord executes a binding agreement to sell or commercially customary non-binding Letter of Intent to sell the
Premises within eighteen (18) months thereafter and subsequently sells the Premises pursuant thereto. If Landlord shall fail to execute such agreement or Letter of Intent within such eighteen (18) month period, or shall fail to subsequently close on such sale thereafter, Landlord shall again give a Sale Offer to Tenant pursuant to this Section 11.1 before Landlord executes a binding agreement to sell the Premises.

(c) If Tenant does not accept such Sale Offer within the Offer Period, then Landlord shall thereafter be free to sell the Premises for a price which is not less than ninety percent (90%) of the purchase price offered to Tenant (the “Offered Price”) in the Sale Offer. Upon completion of any sale of the Premises in accordance with this Section 11.1, Tenant’s rights under this Section 11.1 shall terminate and have no further force or effect.

(d) In the event Landlord receives an offer acceptable to Landlord in which the offer price (the “Reduced Offer”) is less than 90% of the Offered Price, Landlord shall notify Tenant, by written notice, of the Reduced Offer, whereupon Tenant shall have fifteen (15) days to accept the Reduced Offer. If Tenant shall fail within such fifteen (15) day period to accept the Reduced Offer or if Tenant shall accept the Reduced Offer but shall fail to consummate the sale within thirty (30) days of acceptance of the Reduced Offer, Tenant’s rights under this Section 11.1 shall terminate provided that Landlord executes a binding agreement to sell or commercially customary non-binding Letter of Intent to sell the Premises within eighteen (18) months thereafter and subsequently sells the Premises pursuant thereto. If Landlord shall fail to execute such agreement or Letter of Intent within such eighteen (18) month period, or shall fail to subsequently close on such sale thereafter, Landlord shall again give a Sale Offer to Tenant pursuant to this Section 11.1 before Landlord executes a binding agreement to sell the Premises.

(e) Notwithstanding any provision hereof to the contrary, in no event shall Tenant’s rights under this Section 11.1 apply to any transfer of the Premises by Landlord to any party directly or indirectly controlling, controlled by, or under common control with Landlord, to any portfolio transaction involving the sale of multiple properties including the Premises by any party having a direct or indirect interest in Landlord, to any financing transaction involving the sale and leaseback of the Premises to a party directly or indirectly controlling, controlled by, or under common control with Landlord, or to any mortgage, foreclosure or deed in lieu of foreclosure.

11.2 Option to Purchase. Provided that there has been no Event of Default, at any time between the Commencement Date and the date thirty (30) months after the Commencement Date, Tenant may, by notice (a “Purchase Notice”), irrevocably elect to purchase the Premises from Landlord. If Tenant validly and timely delivers a Purchase Notice, Landlord shall, by quitclaim deed, convey fee simple title to the Premises to Tenant (in their then as-is, where-is condition, free and clear of any voluntary liens created by Landlord and free and clear of mechanic’s liens for work performed by or on behalf of Landlord and not by or on behalf of Tenant, but otherwise subject to all matters of record as of the date of the Purchase Notice except for such matters created by Landlord after the date hereof without Tenant’s consent) on a date (the “Sale Closing Date”) forty-five (45) business days after delivery of the Purchase Notice and, Tenant shall, in consideration of such conveyance pay to Landlord a purchase price for the Premises equal to the quotient of (a) the Fixed Rent scheduled to accrue during the next succeeding Lease Year starting after delivery of the Purchase Notice (without taking into account any abatement of Fixed Rent pursuant to Article VI) divided by (b) 0.07. Tenant shall remain responsible to Landlord for all obligations under this Lease accruing through the Sale Closing Date.

[Signature Page Follows]

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WITNESS the execution hereof under seal as of the day and year set forth in Section 1.1.

**Landlord:** Campanelli-TriGate Norwood Upland, LLC, a Delaware limited liability company

By: /s/ Stephen J.T. Murphy
   Stephen J.T. Murphy, President
   Hereunto duly authorized

**Tenant:** Moderna Therapeutics, Inc., a Delaware corporation

By: /s/ Stephen W. Harbin
   Name: Stephen W. Harbin
   Hereunto duly authorized
## SCHEDULE I

### Fixed Rent

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EXHIBIT A

Legal Description of the Lot

Lot 2A as shown on a plan dated 8/31/16 prepared by Kelly Engineering Group, Inc. entitled “Campanelli – Trigate Norwood Upland, LLC 100 Tech Drive, Norwood, Massachusetts Approved Not Required Plan”.
EXHIBIT B-l
Description of Landlord’s Work (Area 2A)

• Area 2A will be delivered in shell condition as follows:
  • Existing office finishes, walls, lighting, ductwork, vertical and overhead plumbing (except roof drains) and former process piping and power systems in this area will be removed.
  • Remaining interior walls will be limited to those shown on Exhibit B.
  • Underfloor plumbing will remain in place.
  • Existing unistrut hangers and cable trays will remain in place.
  • Existing HVAC supply and return trunk ducts from a 50-ton packaged rooftop unit will remain.
  • The electric service will be removed entirely.
  • No new electric panels or lighting will be installed.
Area 2B will be delivered in shell condition as follows:

- Existing office and storage area finishes, walls, lighting, ductwork, vertical and overhead plumbing (except roof drains) and former process piping and power systems will be demolished.
- The existing mezzanines (two) in this area will be removed.
- Five (5) existing gas-fired unit heaters at the warehouse ceiling will remain in place.
- The electric service in this area will be removed entirely.
- A temporary 400A/480V/3Ph panel and stepdown dry transformer to power a 120/277V subpanel will be installed.
- Existing high-bay HID lights in the warehouse will be re-fed from the temporary subpanel and shall be operational.
- Underfloor plumbing will remain in place.
- Existing uni-strut hangers and cable trays will remain in place.
- The existing steam/chilled water utility entrance pit at the north side of Area 2B will be filled and floored over with a new 4” concrete slab.
• The three-story addition shown on Exhibit C (N2X) will be demolished.
  • The basement foundation wall will be removed to an elevation 2’ below finish grade. The foundation will be filled with granular compacted fill to grade.
  • The site will be loamed and seeded to match surrounding surface grades.
  • Following the demolition of N2X, the existing 180’ long x 24’ high 8” CMU wall which separates Building 100 from N2X will be repaired as necessary to provide a weather-tight building façade and painted to match existing concrete exterior. Any repairs made by Landlord to make the existing CMU wall weathertight shall conform to exterior wall construction building codes for wind loading capability and insulation value.
Plan Showing N2X
(Follows this Page)
EXHIBIT D

Environmental Site Assessments

Phase II Environmental Site Assessment, 1 Upland Road, Norwood, Massachusetts, prepared by GZA GeoEnvironmental, Inc. (“GZA”), dated August 2003.


Remedial Completion Report, Former Polaroid Facility, Building 100, One Upland Road, Norwood, Massachusetts, prepared by GZA, dated September 2009.

Underground Storage Tank Closure Report, Former Polaroid Facility, 1 Upland Road, Norwood, Massachusetts, prepared by Coneco Engineers & Scientists, Incorporated, dated September 20, 2011.

Draft ASTM Phase I Environmental Site Assessment, 1 Upland Road, Lot 3, Norwood, Massachusetts, prepared by Haley & Aldrich, Inc., dated 18 November 2015.
EXHIBIT E

Tenant’s Portion of Park Monument Sign
(Follows this Page)
Exhibit E
Tenant’s Portion of Park Monument Sign

Two (2) Panels Reserved for Moderna’s Use
Each Panel is 16 3/4 inches high by 75 inches wide

Universal Technical Institute
Premises’ and Park Monument Sign Locations
(Follows this Page)
EXHIBIT G

Form of SNDA
(Follows this Page)
This Subordination, Non-Disturbance and Attornment Agreement (this “Agreement”) made on , 2016, by and among Landlord, Tenant and Lender, all as hereinafter defined;

W I T N E S S E T H:

IN CONSIDERATION OF TEN AND NO/100 ($10.00) DOLLARS and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the undersigned Landlord, Tenant and Lender hereby covenant and agree as follows:

1. For purposes of this Agreement the following terms shall be defined as set forth below:

   A. Assignment of Leases: That certain Collateral Assignment of Lessor’s Interest in Leases, Rents, and Profits executed by Landlord in favor of Lender, dated June 16, 2016 and recorded in the Norfolk Registry of Deeds (the “Registry”) at Book 34181, Page 219 (included in that term are all amendments, additions and substitutions thereto).

   B. Mortgage: That certain Mortgage and Security Agreement and Financing Statement dated June 16, 2016 executed by Landlord in favor of Lender recorded in the Registry at Book 34181, Page 205 (included in the term are all amendments, additions and substitutions thereof).

   C. Landlord: CAMPANELLI-TRIGATE NORWOOD UPLAND, LLC

   D. Lease: That certain Net Lease by and between Landlord and Tenant dated , 2016, affecting the Property.

   E. Property: All that tract or parcel of land lying and being in Norfolk County, Massachusetts, as more particularly described on Exhibit “A” attached hereto and made a part hereof.

   F. Tenant: MODERNA THERAPEUTICS, INC.

   G. Lender: CAMBRIDGE SAVINGS BANK

2. Subject to and conditioned up on the terms and provisions of this Agreement, Tenant does hereby subordinate all of its rights in and to the Property and in and to the Lease (including any options to purchase) to the lien of the Mortgage and Assignment of Leases and all renewals, substitutions, extensions, modifications, replacements or amendments of the Mortgage and Assignment of Leases. Notwithstanding anything to the contrary contained herein or in the Lease, Tenant agrees that its right of first offer to purchase the Property set forth in Section 11.1 of the Lease shall not be binding upon (i) Lender or an affiliate of Lender at a foreclosure sale of the Property, (ii) upon a transfer of the Property to Lender or an affiliate of Lender by deed in lieu of foreclosure, and (iii) upon the first transfer of the Property by Lender or an affiliate of Lender to an unrelated third-party after (i) or (ii) above occurs.
3. Tenant shall give written notice to Lender of any default of Landlord under the Lease (at the time it gives said notice to Landlord) and agrees that Lender shall have the time periods set forth in the Lease for cure to cure said Landlord default.

4. So long as Tenant is not in default under the Lease in the payment of rent or additional rent or in the performance of any of the terms, or conditions of the Lease, in any case, beyond applicable notice and cure periods under the Lease, Lender covenants and agrees that possession of the demised premises under the Lease and the rights and privileges of Tenant under the Lease shall not be diminished or interfered with by the Lender in the exercise of any of its rights under the Mortgage.

5. If Lender, its successors or assigns shall succeed to the interest of Landlord under the Lease in any manner, or if any other person or entity shall acquire Landlord’s interest in the Property upon any foreclosure of the Mortgage (Lender, its successors or assigns, or such other person or entity, as the case may be, being hereinafter referred to as “Successor Landlord”), Tenant shall attorn to Successor Landlord upon such succession or foreclosure sale and shall recognize Successor Landlord as the landlord under the Lease, and the Lease shall remain in full force and effect and shall inure to the benefit of Successor Landlord as landlord thereunder. Such attornment shall be effective and self-operative without the execution of any further instrument. Tenant agrees, however, to execute and deliver at any time and from time to time, upon the request of Successor Landlord, any reasonable instrument or certificate that may be necessary or appropriate to evidence such attornment. From and after any such attornment, Successor Landlord shall be bound to Tenant under all the terms, covenants and conditions of the Lease, except that Successor Landlord shall not (a) be liable for any act or omission of any prior landlord (including Landlord), except to the extent that any such act or omission remains continuing and uncured after such attornment but only if Lender has received notice and an opportunity to cure as set forth in Section 3 above; or (b) be subject to any offset or defenses which Tenant might have against any prior landlord (including Landlord); or (c) be bound by any rent or additional rent which Tenant might have paid for more than sixty (60) days in advance to any prior landlord (including Landlord) unless the same shall have been actually received by or credited to Successor Landlord; or (d) be bound by any amendment or modification of the Lease made without the consent of Lender, excluding any amendments memorializing the exercise of a right or option under the Lease, including, without limitation, extension rights and purchase rights.

6. Notwithstanding anything to the contrary contained in the Mortgage and Assignment of Leases or other agreements between Lender and Landlord, Lender hereby agrees that so long as the Lease is in full force and effect, and no Event of Default exists under the Lease, the disposition of insurance proceeds in the event of fire or other casualty at the Premises shall be handled and disbursed for purposes of restoration in accordance with the terms and conditions of the Lease.

7. The agreements herein contained shall bind and inure to the benefit of successors in interest of the parties hereto.

8. Any notice which by any provision of this Agreement is required or provided to be given shall be deemed to have been sufficiently given or served for all purposes by being sent certified mail, postage and registration charges prepaid, or by recognized overnight carrier to the following addresses or such other address as the parties my designate in by written notice to the other parties:
If to Landlord at:
Campanelli-TriGate Norwood Upland, LLC
One Campanelli Drive
Braintree, MA 02184
Attn: Daniel R. DeMarco

With a copy to:
Wilmer Cutler Pickering Hale and Dorr, LLP
60 State Street
Boston, MA 02109
Attn: Katharine E. Bachman, Esq.

If to Tenant:
Moderna Pharmaceuticals, Inc.
200 Technology Square
Cambridge, MA 02139
Attention: Mr. Steve Harbin

With a copy to:
Moderna Pharmaceuticals, Inc.
320 Bent Street
Cambridge, MA 02141
Attention: General Counsel

If to Lender at:
Cambridge Savings Bank
1374 Massachusetts Avenue
Cambridge, MA 02138
Attn: Commercial Real Estate

With a copy to:
Robinson & Cole LLP
One Boston Place, 25th Floor
Boston, MA 02108
Attn: Amanda S. Eckhoff, Esq.
9. This instrument shall be governed by the laws of the Commonwealth of Massachusetts.

[signature page follows]

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IN WITNESS WHEREOF, the undersigned Tenant, Landlord, and Lender have hereunto caused this instrument to be executed by its duly authorized corporate officials and its corporate seal to be affixed hereto as of the day and year first above written.

TENANT: MODERNA THERAPEUTICS, INC.

By: ________________________________

______________________________

By: ________________________________

COMMONWEALTH OF MASSACHUSETTS

______________________________, s.s.

On this ______ day of __________, 2016, before me, the undersigned notary public, personally appeared ________________, proved to me through satisfactory evidence of identification, which was ________________________, to be the person whose name is signed on the preceding or attached document, and acknowledged to me that he signed it voluntarily for its stated purposes as said ____________________________, Notary Public

My commission expires: _____________________________

(SNDA)

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STATE OF/COMMONWEALTH OF 

On this , 2016, before me, the undersigned notary public, personally appeared proved to me through satisfactory evidence of identification, which was , to be the person whose name is signed on the preceding or attached document, and acknowledged to me that he signed it voluntarily for its stated purposes as said of the .

, Notary Public

My commission expires: (SND)
LENDER:
CAMBRIDGE SAVINGS BANK
By: ________________________________
    David A. Ault
    Its: First Vice President

STATE OF/COMMONWEALTH OF ____________________________

____________________, ss.

On this __________ day of _______ , 2016, before me, the undersigned notary public, personally appeared ____________________ proved to me through satisfactory evidence of identification, which was ____________________, to be the person whose name is signed on the preceding or attached document, and acknowledged to me that he signed it voluntarily for its stated purposes as said ____________________ of the ____________________.

____________________, Notary Public
My commission expires:

(SNDA)
Exhibit A

LEGAL DESCRIPTION OF THE LOT

Lot 2A shown on a plan entitled “Campanelli-Trigate Norwood Upland, LLC, 100 Tech Drive, Norwood, Massachusetts, Approval Not Required Plan”, dated 8/31/16, prepared by Kelly Engineering Group, Inc.
EXHIBIT H

Initial Approved Plans and Specifications for Initial Tenant Work
(Follows this Page)
The following is a list of proposed Green Initiatives that will be considered for implementation in the design of the 100 Tech Drive facility for the Moderna Clinical / Manufacturing Expansion project.

**Lighting**
1. Auto controlled interior lights
2. LED lights to be used
3. “Sundoliers” on roof

**Mechanical Systems**
1. Energy recovery unit (roof top unit to recover heat from air systems)
2. Use of natural gas for heating
3. High efficient motors with VFDs
4. High efficiency boilers and chillers
5. Boiler feed-water energy recovery
6. HVAC equipment and refrigerant specifications to limit emissions of ozone depleting compounds

**Grey Water**
1. AHU condensate to grey water tank, grey water tank to feed cooling towers
2. RO reject to grey water tank, grey water tank to feed cooling towers
3. Rain water collection system

**Building Material**
1. Reuse of an existing building (reuse of wall, floor, and roof elements)
2. Specify low emitting paints and coatings
3. High recycled material content in casework, carpets, office furniture
4. Insulation wherever possible
5. Low water use rest rooms and services

**Green Power**
1. Solar panels, of limited value for internals, but possible for facility peripherals (gates, charging stns) and exterior lighting power

**Roofing**
1. White roof membrane

**Alternative Transportation**
1. Bike storage facility for 5% of employees
2. Shower facilities for 0.5% employees
3. car/van pool parking for min of total provided parking
4. Public transport subsidy
5. Electrical car charging stations (solar fed)

**General**
1. Recycling initiatives
2. Waste food management

Clinical / Manufacturing Expansion Project
Green/Environmental – Example Facility Initiatives
FIRST AMENDMENT TO LEASE

THIS FIRST AMENDMENT TO LEASE ("First Amendment") is made and entered into as of the 10th day of April, 2017 (the “Effective Date”), by and between CAMPANELLI-TRIGATE NORWOOD UPLAND, LLC, a Delaware limited liability company (“Landlord”) and MODERNA THERAPEUTICS, INC., a Delaware corporation (“Tenant”).

RECITALS:

A. Tenant and Landlord entered into that certain Net Lease dated August 29, 2016 (the “Lease”).

B. Tenant and Landlord have agreed to amend and modify the Lease as set forth herein.

AGREEMENT:

NOW, THEREFORE, in consideration of the recitals set forth above, the covenants and agreements contained herein, and other good and valuable consideration, the receipt, adequacy and sufficiency of which are hereby acknowledged, Tenant and Landlord hereby agree as follows:

1. Incorporation of Defined Terms. Capitalized terms used but not otherwise defined herein shall have the same meanings as are ascribed to such terms in the Lease.

2. Amendment to Definition of “Lot”. As of the Effective Date, the definition of “Lot” in Section 1.1 of the Lease is hereby deleted in its entirety and replaced with the following:

   “The lot known as 100 Tech Drive, Norwood, Massachusetts, together with Lot 3A, adjacent thereto (collectively, “Lot”), as more particularly described in Exhibit A.”

   As of the Effective Date, the Legal Description of the Lot set forth on Exhibit A to the Lease, is hereby deleted in its entirety and replaced with the following:

   “Lot 2A ("Lot 2A") and Lot 3A ("Lot 3A") as shown on a plan dated 8/31/16 prepared by Kelly Engineering Group, Inc., entitled “Campanelli – Trigate Norwood Upland, LLC 100 Tech Drive, Norwood, Massachusetts Approved Not Required Plan”.”

3. Lot 3A Work; Lot 3A Allowance. In addition to the Initial Tenant Work to be performed by Tenant as provided in Section 3.1(f) of the Lease, Tenant is responsible for any desired construction and installation of any improvements desired by Tenant to Lot 3A and/or improvement to Lot 2A necessary to facilitate access to Lot 3A (the “Lot 3A Work”). The Lot 3A Work shall be performed by Tenant subject to and in accordance with Section 5.1.6 and 5.2.3 of the Lease. In addition to the Tenant Improvement Work Allowance (also referred to in the Lease as the Initial Tenant Work Allowance), Landlord shall make available to Tenant up to $300,000 (the “Lot 3A Allowance”) to be applied to the costs and expenses incurred by Tenant.
for the Lot 3A Work. Landlord shall, within thirty (30) days of Tenant providing Evidence of Completion (as defined in Section 3.1(f) of the Lease) with respect to the Lot 3A Work, remit to Tenant from the Lot 3A Allowance, the lesser of the Lot 3A Allowance or the total cost incurred by Tenant and reasonably documented to Landlord for the Lot 3A Work. In no event shall the Lot 3A Allowance be available for any work completed (or reimbursement requested) after the date that is thirty (30) months after the Commencement Date. No portion of the Initial Tenant Work Allowance shall be available for the Lot 3A Work. It is expressly agreed that the Lot 3A Allowance shall be used only for demolition and the cost of constructing the Lot 3A Work, and shall not be used for furniture, equipment or moving expenses. If Tenant has obtained a final non-appealable judgment from a court of competent jurisdiction with respect thereto, then, any portion of the Lot 3A Allowance that has not been funded by Landlord within thirty (30) days following a complete requisition by Tenant may be offset by Tenant against any amounts of Fixed Rent and Additional Rent payable to Landlord under this Lease, together with interest on such unpaid amounts from the date originally due at the rate set forth in Section 4.3 of the Lease.

4. Amendment of Annual Fixed Rent. As of the Effective Date, Schedule I of the Lease is hereby deleted in its entirety and replaced with Schedule I attached hereto and incorporated herein.

5. Brokerage. Each of Landlord and Tenant warrants and represents that it has had no dealings with any broker or agent in connection with this First Amendment and covenants to defend with counsel reasonably approved by the other, hold harmless and indemnify the other from and against any and all cost, expense or liability for any compensation, commissions and charges claimed by any broker or agent with respect to the indemnifying party’s dealings in connection with this First Amendment or the negotiation thereof.

6. Ratifications. Except as expressly provided in this First Amendment, in all other respects the Lease is unmodified and remains in full force and effect and is hereby ratified by the parties, and the provisions of this First Amendment shall govern and control over any contrary or inconsistent provisions of the Lease.

7. Governing Law. This First Amendment shall be governed by and interpreted under the laws of the Commonwealth of Massachusetts without giving effect to conflict of laws principles thereof.

8. Authority. Tenant and Landlord each represents and warrants that it has full authority to execute and deliver this First Amendment.

9. Counterparts Deemed Original. This First Amendment may be executed in one or more counterparts (including by PDF), all parties need not be signators to the same documents, and all counterpart-signed documents shall be deemed to be an original and one (1) instrument.
IN WITNESS WHEREOF, the parties have executed this First Amendment to Lease under seal as of the date first above written.

TENANT:
MODERNA THERAPEUTICS, INC.
By: /s/ Stephen W. Harbin
    Stephen W. Harbin
    Hereunto duly authorized

LANDLORD:
CAMPANELLI-TRIGATE NORWOOD
UPLAND, LLC
By: /s/ Stephen J.T. Murphy
    Stephen J.T. Murphy, President
    Hereunto duly authorized

Reference is made to that certain Subordination, Non-Disturbance and Attornment Agreement dated August 29, 2016 (the “SNDA”) among Tenant, Landlord and Cambridge Savings Bank (“Lender”). Lender joins in this instrument for the sole purpose of confirming its consent thereto and acknowledging and agreeing that, as used in the SNDA, the term “Lease” shall refer to the Lease as hereby amended.

LENDER:
CAMBRIDGE SAVINGS BANK
By: /s/ David A. Ault
    David A. Ault
    First Vice President
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SECOND AMENDMENT TO LEASE

THIS SECOND AMENDMENT TO LEASE (this “Second Amendment”) is made as of March 16, 2018, by and between ARE-MA REGION NO. 64, LLC, a Delaware limited liability company (“ARE”), and MODERNA THERAPEUTICS, INC., a Delaware corporation (“Tenant”).

RECITALS

A. Tenant and Campanelli-TriGate Norwood Upland, LLC, a Delaware limited liability company, (“Seller”) are now parties to that certain Net Lease dated as of August 29, 2016, as amended by that certain First Amendment to Lease dated as of April 10, 2017 (as amended, the “Lease”). Pursuant to the Lease, Tenant leases certain premises known as 100 Tech Drive, Norwood, Massachusetts (the “Premises”). The Premises are more particularly described in the Lease. Capitalized terms used herein without definition shall have the meanings defined for such terms in the Lease.

B. ARE and Seller have entered into an Agreement of Purchase and Sale Agreement dated as of February 14, 2018 (the “Purchase Agreement”), which contemplates the acquisition of the Premises by ARE (the “Acquisition”).

C. If the closing of the Acquisition occurs, as of the date of such closing (the “Effective Date”), subject to the terms and conditions set forth below, the Lease shall be amended as provided in this Second Amendment.

NOW, THEREFORE, in consideration of the foregoing Recitals, which are incorporated herein by this reference, the mutual promises and conditions contained herein, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Landlord and Tenant hereby agree as follows:

1. **Abatement of Rent.** Annual Fixed Rent payable under the Lease shall be abated for the period commencing on the Effective Date through the date that is 120 days after the Effective Date (the “Abatement Period”). Tenant shall resume paying full Annual Fixed Rent as required under the Lease commencing on the day immediately following the expiration of the Abatement Period.

2. **Option to Purchase.** Section 11.2 of the original Lease is hereby deleted in its entirety and is null and void and of no further force or effect.

3. **Right of First Opportunity to Purchase.** Tenant acknowledges that, pursuant to that certain side letter agreement between Seller and Tenant dated January 30, 2018, Tenant has waived its rights under Section 11.1 of the original Lease in connection with the Acquisition including, without limitation, its right to receive a Sale Offer in connection with the Acquisition.

4. **Condition Precedent.** Notwithstanding anything to the contrary contained in this Second Amendment, Tenant and ARE acknowledge and agree that the effectiveness of this Second Amendment shall be subject to the following condition precedent (“Condition Precedent”) having been satisfied: the closing under the Purchase Agreement shall have occurred on or before May 15, 2018. In the event that the Condition Precedent is not satisfied, this Second Amendment shall automatically terminate and shall be null and void and of no further force or effect. ARE shall have no liability whatsoever to Tenant relating to or arising from ARE’s inability or failure to cause the Condition Precedent to be satisfied.

5. **Brokers.** Landlord and Tenant each represents and warrants that it has not dealt with any broker, agent or other person (collectively, “Broker”) in connection with the transaction reflected in this Second Amendment and that no Broker brought about this transaction. Landlord shall only

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pay commissions to Broker pursuant to a separate written agreement between Landlord and Broker. Landlord and Tenant each hereby agree to
indemnify and hold the other harmless from and against any claims by any Broker, claiming a commission or other form of compensation by virtue of
having dealt with Tenant or Landlord, as applicable, with regard to this Second Amendment.

6. **OFAC**. Tenant and all beneficial owners of Tenant are currently (a) in compliance with and shall at all times during the Term of the Lease remain in
compliance with the regulations of the Office of Foreign Assets Control (“OFAC”) of the U.S. Department of Treasury and any statute, executive order,
or regulation relating thereto (collectively, the “OFAC Rules”), (b) not listed on, and shall not during the term of the Lease be listed on, the Specially
Designated Nationals and Blocked Persons List, Foreign Sanctions Evaders List or the Sectoral Sanctions Identifications List, which are all maintained
by OFAC and/or on any other similar list maintained by OFAC or other governmental authority pursuant to any authorizing statute, executive order, or
regulation, and (c) not a person or entity with whom a U.S. person is prohibited from conducting business under the OFAC Rules.

7. **Miscellaneous.**

   a. This Second Amendment is the entire agreement between the parties with respect to the subject matter hereof and supersedes all prior and
      contemporaneous oral and written agreements and discussions. This Second Amendment may be amended only by an agreement in writing,
      signed by the parties hereto.

   b. This Second Amendment is binding upon and shall inure to the benefit of the parties hereto, and their respective successors and assigns.

   c. This Second Amendment may be executed in any number of counterparts, each of which shall be deemed an original, but all of which when
      taken together shall constitute one and the same instrument. The signature page of any counterpart may be detached therefrom without impairing
      the legal effect of the signature(s) thereon provided such signature page is attached to any other counterpart identical thereto except having
      additional signature pages executed by other parties to this Second Amendment attached thereto.

   d. Except as amended and/or modified by this Second Amendment, the Lease is hereby ratified and confirmed and all other terms of the Lease shall
      remain in full force and effect, unaltered and unchanged by this Second Amendment. In the event of any conflict between the provisions of this
      Second Amendment and the provisions of the Lease, the provisions of this Second Amendment shall prevail. Whether or not specifically
      amended by this Second Amendment, all of the terms and provisions of the Lease are hereby amended to the extent necessary to give effect to
      the purpose and intent of this Second Amendment.

   [Signatures are on the next page.]
IN WITNESS WHEREOF, the parties hereto have executed this Second Amendment as of the day and year first above written.

ARE:

ARE-MA REGION NO. 64, LLC,
a Delaware limited liability company

By: ALEXANDRIA REAL ESTATE EQUITIES, L.P.,
a Delaware limited partnership,
managing member

By: ARE-QRS CORP.,
a Maryland corporation, general partner

By: /s/ Eric S. Johnson
Its: Eric S. Johnson
Senior Vice President
RE Legal Affairs

TENANT:

MODERN THERAPEUTICS, INC.,
a Delaware corporation

By: /s/ Steve Harbin
Its: Chief of Staff & Norwood Ops

Copyright © 2005. Alexandria Real Estate Equities, Inc. ALL RIGHTS RESERVED. Confidential and Proprietary - Do Not Copy or Distribute. Alexandria and the Alexandria Logo are registered trademarks of Alexandria Real Estate Equities, Inc.
1. **Purpose.** Moderna, Inc. (the “Company”) considers it essential to the best interests of the Company to foster the continuous employment of key management personnel. The Board of Directors of the Company (the “Board”) recognizes, however, that, as is the case with many corporations, the possibility of an involuntary termination of employment, either before or after a Change in Control (as defined in Section 2 hereof), exists and that such possibility, and the uncertainty and questions that it may raise among management, may result in the departure or distraction of management personnel to the detriment of the Company. Therefore, the Board has determined that the Moderna, Inc. Amended and Restated Executive Severance Plan (the “Plan”) should be adopted to reinforce and encourage the continued attention and dedication of the Company’s Covered Executives (as defined in Section 2 hereof) to their assigned duties without distraction. Nothing in this Plan shall be construed as creating an express or implied contract of employment and nothing shall alter the “at will” nature of the Covered Executives’ employment with the Company.

2. **Definitions.** The following terms shall be defined as set forth below:
   (a) “Accounting Firm” shall mean a nationally recognized accounting firm selected by the Company.
   (b) “Administrator” means the Board or the Compensation Committee of the Board.
   (c) “Cause” shall mean, and shall be limited to, the occurrence of any one or more of the following events:
      (i) the Covered Executive’s unauthorized use or disclosure of the Company’s confidential information or trade secrets;
      (ii) the Covered Executive’s material breach of any agreement between the Covered Executive and the Company;
      (iii) the Covered Executive’s material failure to comply with the Company’s written policies or rules;
      (iv) the Covered Executive’s gross negligence or willful misconduct in connection with the Executive’s performance of his/her duties to the Company;
      (v) the Covered Executive’s continuing failure to perform assigned duties after receiving written notification of the failure from the Company and, if curable, a period of thirty (30) days to cure such failure; or
      (vi) the Covered Executive’s failure to cooperate in good faith with a governmental or internal investigation of the Company or its directors, officers or employees, if the Company has requested the Covered Executive’s cooperation.
(d) “Change in Control” shall mean:

(i) the sale of all or substantially all of the assets of the Company on a consolidated basis to an unrelated person or entity;

(ii) a merger, reorganization or consolidation pursuant to which the holders of the Company’s outstanding voting power and outstanding stock immediately prior to such transaction do not own a majority of the outstanding voting power and outstanding stock or other equity interests of the resulting or successor entity (or its ultimate parent, if applicable) immediately upon completion of such transaction;

(iii) the sale of all of the outstanding stock of the Company to an unrelated person, entity or group thereof acting in concert; or

(iv) any other transaction in which the owners of the Company’s outstanding voting power immediately prior to such transaction do not own at least a majority of the outstanding voting power of the Company or any successor entity immediately upon completion of the transaction other than as a result of the acquisition of securities directly from the Company.

(e) “Change in Control Period” shall mean the period beginning on the date of a Change in Control and ending on the one-year anniversary of the Change in Control.

(f) “Code” shall mean the Internal Revenue Code of 1986, as amended.

(g) “Covered Executives” shall mean the individuals designated as such by the Administrator and who are listed in Exhibit A, attached hereto, as such exhibit is amended by the Administrator from time to time.

(h) “Date of Termination” shall mean the date that a Covered Executive’s employment with the Company (or any successor) ends, which date shall be specified in the Notice of Termination. Notwithstanding the foregoing, a Covered Executive’s employment shall not be deemed to have been terminated solely as a result of the Covered Executive becoming an employee of any direct or indirect successor to the business or assets of the Company.

(i) “Disability” shall mean the following: if through any illness, injury, accident or condition of either a physical or psychological nature, the Covered Executive becomes unable to perform substantially all of his duties and responsibilities for a continuous period of sixteen (16) consecutive weeks or for any twenty-six (26) weeks within a fifty-two (52) week period. Determinations as to whether Covered Executive is Disabled shall be made by a physician selected by the Board or its insurers and acceptable to the Covered Executive or the Covered Executive’s legal representative, such agreement as to acceptability not to be unreasonably withheld or delayed.

(j) “Good Reason” shall mean that the Covered Executive has complied with the “Good Reason Process” following the occurrence of any of the following events:
(i) a material diminution in the Covered Executive’s annual base salary other than across the board decreases in annual base salary similarly affecting all executives of the Company;

(ii) the Company requiring the Covered Executive to relocate (other than for travel incident to the Covered Executive’s performance of his or her duties on behalf of the Company) a distance of more than fifty (50) miles from the Covered Executive’s current principal place of business; or

(iii) any material diminution in the Covered Executive’s position, responsibilities, authority or duties.

For purposes of Section 2(j)(iii), a change in the reporting relationship, or a change in a title will not, by itself, be sufficient to constitute a material diminution of responsibilities, authority or duty.

(k) “Good Reason Process” shall mean:

(i) the Covered Executive reasonably determines in good faith that a “Good Reason” condition has occurred;

(ii) the Covered Executive notifies the Company in writing of the first occurrence of the Good Reason condition within sixty (60) days of the first occurrence of such condition;

(iii) the Covered Executive cooperates in good faith with the Company’s efforts, for a period of not less than thirty (30) days following such notice (the “Cure Period”), to remedy the condition;

(iv) notwithstanding such efforts, the Good Reason condition continues to exist following the Cure Period; and

(v) the Covered Executive terminates his or her employment and provides the Company with a Notice of Termination with respect to such termination, each within sixty (60) days after the end of the Cure Period.

If the Company cures the Good Reason condition during the Cure Period, Good Reason shall be deemed not to have occurred.

(l) “Notice of Termination” shall mean a written notice which shall indicate the specific termination provision in this Plan relied upon for the termination of a Covered Executive’s employment and the Date of Termination.

(m) “Participation Agreement” shall mean an agreement between a Covered Executive and the Company that acknowledges the Covered Executive’s participation in the Plan.
3. Administration of the Plan.
   (a) Administrator. The Plan shall be administered by the Administrator.
   (b) Powers of Administrator. The Administrator shall have all powers necessary to enable it properly to carry out its duties with respect to the complete control of the administration of the Plan. Not in limitation, but in amplification of the foregoing, the Administrator shall have the power and authority in its discretion to:
      (i) construe the Plan to determine all questions that shall arise as to interpretations of the Plan’s provisions;
      (ii) determine which individuals are and are not Covered Executives, determine the benefits to which any Covered Executives may be entitled, the eligibility requirements for participation in the Plan and all other matters pertaining to the Plan;
      (iii) adopt amendments to the Plan which are deemed necessary or desirable to comply with all applicable laws and regulations, including but not limited to Code Section 409A and the guidance thereunder;
      (iv) make all determinations it deems advisable for the administration of the Plan, including the authority and ability to delegate administrative functions to a third party;
      (v) decide all disputes arising in connection with the Plan; and
      (vi) otherwise supervise the administration of the Plan.
   (c) All decisions and interpretations of the Administrator shall be binding on all persons, including the Company and Covered Executives.

4. Eligibility. All Covered Executives who have executed and submitted to the Company a Participation Agreement, and satisfied such other requirements as may be determined by the Administrator, are eligible to participate in the Plan.

5. Termination Benefits Generally. In the event a Covered Executive’s employment with the Company is terminated for any reason, the Company shall pay or provide to the Covered Executive any earned but unpaid salary, unpaid expense reimbursements in accordance with Company policy, accrued but unused vacation, if any and any vested benefits the Covered Executive may have under any employee benefit plan of the Company in accordance with the terms and conditions of such employee benefit plan (collectively, the “Accrued Benefits”), within the time required by law but in no event more than sixty (60) days after the Date of Termination.

(n) “Qualified Termination Event” shall mean (i) a termination of the Covered Executive’s employment by the Company other than for Cause, death or Disability or (ii) the Covered Executive’s resignation from the Company for Good Reason.

(o) “Restrictive Covenants Agreement” shall mean the Employee Confidentiality, Non-Competition, Non-Solicitation and Inventions Assignment Agreement or similar agreement entered into between the Covered Executive and the Company.
6. Termination Not in Connection with a Change in Control. In the event a Qualified Termination occurs at any time other than during the Change in Control Period, with respect to such Covered Executive, in addition to the Accrued Benefits, subject to his or her execution of a separation agreement in a form and manner satisfactory to the Company containing, among other provisions, a general release of claims in favor of the Company and related persons and entities, confidentiality, return of property, non-disparagement and reaffirmation of the Restrictive Covenants Agreement (the “Separation Agreement and Release”) and the Separation Agreement and Release becoming irrevocable, all within the time period set forth in the Separation Agreement and Release but in no event more than sixty (60) days after the Date of Termination, and subject to the Covered Executive complying with the Separation Agreement and Release, the Company shall:

(a) pay the Covered Executive an amount equal to the sum of (i) twelve (12) months of the Covered Executive’s annual base salary in effect immediately prior to the Qualified Termination Event plus (ii) an amount equal to the Covered Executive’s annual target bonus in effect immediately prior to the Qualified Termination Event multiplied by a fraction with a numerator equal to the number of full weeks elapsed in the then current fiscal year prior to the Date of Termination and with a denominator equal to fifty-two (52); and

(b) if the Covered Executive was participating in the Company’s group health plan immediately prior to the Date of Termination and elects COBRA health continuation, then the Company shall pay to the Covered Executive a monthly cash payment for twelve (12) months or the Covered Executive’s COBRA health continuation period, whichever ends earlier, in an amount equal to the monthly employer contribution that the Company would have made to provide health insurance to the Covered Executive if the Covered Executive had remained employed by the Company, based on the premiums as of the Date of Termination.

The amounts payable under Section 6(a) and (b) shall be paid out in substantially equal installments in accordance with the Company’s payroll practice over twelve (12) months commencing within sixty (60) days after the Date of Termination; provided, however, that if the 60-day period begins in one (1) calendar year and ends in a second calendar year, the severance shall begin to be paid in the second calendar year by the last day of such 60-day period; provided further, that the initial payment shall include a catch-up payment to cover amounts retroactive to the day immediately following the Date of Termination. Each payment pursuant to this Plan is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2).

7. Termination in Connection with a Change in Control. In the event the Qualified Termination Event occurs within the Change in Control Period, then with respect to such Covered Executive, in addition to the Accrued Benefits, subject to his or her execution and non-revocation of the Separation Agreement and Release, all within the time period set forth in the Separation Agreement and Release, but in no event more than sixty (60) days after the Date of Termination, the Company shall:
(a) cause 100% of the outstanding and unvested equity awards with time-based vesting held by the Covered Executive to immediately become fully exercisable or nonforfeitable as of the Date of Termination. Notwithstanding the foregoing, in the event of a Change in Control where the parties to such Change in Control do not provide for the assumption, continuation or substitution of equity awards of the Company, any and all outstanding and unvested equity awards held by the Covered Executive shall be subject to Section 3(d) of the Company’s 2018 Stock Option and Incentive Plan, if adopted by the Board.

(b) pay to the Covered Executive an amount equal to the sum of (i) 150% of the Covered Executive’s annual base salary in effect immediately prior to the Qualified Termination Event (or the Covered Executive’s annual base salary in effect immediately prior to the Change in Control, if higher) plus (ii) 150% of the Covered Executive’s annual target bonus in effect immediately prior to the Qualified Termination Event (or the Covered Executive’s target bonus in effect immediately prior to the Change in Control, if higher, (such higher annual target bonus, the “Applicable Bonus”)) plus (iii) an amount equal to the Covered Executive’s Applicable Bonus multiplied by a fraction with a numerator equal to the number of full weeks elapsed in the then current fiscal year prior to the Date of Termination and with a denominator equal to fifty-two (52); and

(c) if the Covered Executive was participating in the Company’s group health plan immediately prior to the Date of Termination and elects COBRA health continuation, then the Company shall pay to the Covered Executive a lump sum cash payment in an amount equal to the monthly employer contribution that the Company would have made to provide health insurance to the Covered Executive if the Covered Executive had remained employed by the Company for eighteen (18) months after the Date of Termination, based on the premiums as of the Date of Termination.

The amounts payable under Section 7(b) and (c), as applicable, shall be paid out in a lump sum within sixty (60) days after the Date of Termination; provided, however, that if the 60-day period begins in one calendar year and ends in a second calendar year, the amounts shall be paid in the second calendar year no later than the last day of the 60-day period. For the avoidance of doubt, the severance pay and benefits provided in this Section 7 shall apply in lieu of, and expressly supersede, the provisions of Section 6 and no Covered Executive shall be entitled to the severance pay and benefits under both Section 6 and 7 hereof.

8. Additional Limitation.

(a) Anything in this Plan to the contrary notwithstanding, in the event that the amount of any compensation, payment or distribution by the Company to or for the benefit of the Covered Executive, whether paid or payable or distributed or distributable pursuant to the terms of this Plan or otherwise, calculated in a manner consistent with Section 280G of the Code and the applicable regulations thereunder (the “Aggregate Payments”), would be subject to the excise tax imposed by Section 4999 of the Code, then the Aggregate Payments shall be reduced (but not below zero) so that the sum of all of the Aggregate Payments shall be $1.00 less than the amount at which the Covered Executive becomes subject to the excise tax imposed by Section 4999 of the Code; provided that such reduction shall only occur if it would result in the Covered Executive receiving a higher After Tax Amount (as defined below) than the Covered Executive.
would receive if the Aggregate Payments were not subject to such reduction. In the event of such reduction, the Aggregate Payments shall be reduced in the following order, in each case, in reverse chronological order beginning with the Aggregate Payments that are to be paid the furthest in time from consummation of the transaction that is subject to Section 280G of the Code: (1) cash payments not subject to Section 409A of the Code; (2) cash payments subject to Section 409A of the Code; (3) equity-based payments and acceleration; and (4) non-cash forms of benefits; provided that in the case of all the foregoing Aggregate Payments all amounts or payments that are not subject to calculation under Treas. Reg. §1.280G-1, Q&A-24(b) or (c) shall be reduced before any amounts that are subject to calculation under Treas. Reg. §1.280G-1, Q&A-24(b) or (c).

(b) For purposes of this Section 8, the “After Tax Amount” means the amount of the Aggregate Payments less all federal, state, and local income, excise and employment taxes imposed on the Executive as a result of the Executive’s receipt of the Aggregate Payments. For purposes of determining the After Tax Amount, the Executive shall be deemed to pay federal income taxes at the highest marginal rate of federal income taxation applicable to individuals for the calendar year in which the determination is to be made, and state and local income taxes at the highest marginal rates of individual taxation in each applicable state and locality, net of the maximum reduction in federal income taxes (if any) which could be obtained from deduction of such state and local taxes.

(c) The determination as to whether a reduction in the Aggregate Payments shall be made pursuant to Section 8(a) shall be made by the Accounting Firm, which shall provide detailed supporting calculations both to the Company and the Covered Executive within fifteen (15) business days of the Date of Termination, if applicable, or at such earlier time as is reasonably requested by the Company or the Covered Executive. Any determination by the Accounting Firm shall be binding upon the Company and the Covered Executive.

9. Employee Non-Competition, Non-Solicitation and Confidentiality and Assignment Agreement.

(a) *Employee Non-Competition, Non-Solicitation and Confidentiality and Assignment Agreement*. As a condition to participating in the Plan, each Covered Executive shall continue to comply with the terms and conditions contained in the Restrictive Covenants Agreements or similar agreement entered into between the Covered Executive and the Company and such other agreement(s) as designated in the applicable Participation Agreement. If a Covered Executive has not entered into a Restrictive Covenants Agreement or similar agreement with the Company, he or she shall enter into such agreement prior to participating in the Plan.

10. Withholding. All payments made by the Company under this Plan shall be subject to any tax or other amounts required to be withheld by the Company under applicable law.
Section 409A.

(a) Anything in this Plan to the contrary notwithstanding, if at the time of the Covered Executive’s “separation from service” within the meaning of Section 409A of the Code, the Company determines that the Covered Executive is a “specified employee” within the meaning of Section 409A(a)(2)(B)(i) of the Code, then to the extent any payment or benefit that the Covered Executive becomes entitled to under this Plan would be considered deferred compensation subject to the twenty (20) percent additional tax imposed pursuant to Section 409A(a) of the Code as a result of the application of Section 409A(a)(2)(B)(i) of the Code, such payment shall not be payable and such benefit shall not be provided until the date that is the earlier of (i) six (6) months and one (1) day after the Covered Executive’s separation from service, or (ii) the Covered Executive’s death. If any such delayed cash payment is otherwise payable on an installment basis, the first payment shall include a catch-up payment covering amounts that would otherwise have been paid during the six-month period but for the application of this provision, and the balance of the installments shall be payable in accordance with their original schedule.

(b) The parties intend that this Plan will be administered in accordance with Section 409A of the Code and that all amounts payable hereunder shall be exempt from the requirements of such section as a result of being “short term deferrals” for purposes of Section 409A of the Code to the greatest extent possible. To the extent that any provision of this Plan is not exempt from Section 409A of the Code and ambiguous as to its compliance with Section 409A of the Code, the provision shall be read in such a manner to comply with Section 409A of the Code. Each payment pursuant to this Plan is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2). The parties agree that this Plan may be amended, as reasonably requested by either party, and as may be necessary to fully comply with Section 409A of the Code and all related rules and regulations in order to preserve the payments and benefits provided hereunder without additional cost to either party.

(c) To the extent that any payment or benefit described in this Plan constitutes “non-qualified deferred compensation” under Section 409A of the Code, and to the extent that such payment or benefit is payable upon the Covered Executive’s termination of employment, then such payments or benefits shall be payable only upon the Covered Executive’s “separation from service.” The determination of whether and when a separation from service has occurred shall be made in accordance with the presumptions set forth in Treasury Regulation Section 1.409A-1(h).

(d) All in-kind benefits provided and expenses eligible for reimbursement under this Plan shall be provided by the Company or incurred by the Covered Executive during the time periods set forth in this Plan. All reimbursements shall be paid as soon as administratively practicable, but in no event shall any reimbursement be paid after the last day of the taxable year following the taxable year in which the expense was incurred. The amount of in-kind benefits provided or reimbursable expenses incurred in one taxable year shall not affect the in-kind benefits to be provided or the expenses eligible for reimbursement in any other taxable year (except for any lifetime or other aggregate limitation applicable to medical expenses). Such right to reimbursement or in-kind benefits is not subject to liquidation or exchange for another benefit.

(e) The Company makes no representation or warranty and shall have no liability to the Covered Executive or any other person if any provisions of this Plan are determined to constitute deferred compensation subject to Section 409A of the Code but do not satisfy an exemption from, or the conditions of, such Section.
12. **Notice and Date of Termination.**

   (a) **Notice of Termination.** A termination of the Covered Executive’s employment shall be communicated by Notice of Termination from the Company to the Covered Executive or vice versa in accordance with this Section 12.

   (b) **Notice to the Company.** Any notices, requests, demands, and other communications provided for by this Plan shall be sufficient if in writing and delivered in person or sent by registered or certified mail, postage prepaid, to a Covered Executive at the last address the Covered Executive has filed in writing with the Company, or to the Company at the following physical or email address:

   Moderna, Inc.
   Attention: Chief Human Resources Officer
   200 Technology Square
   Cambridge, MA 02139
   Annie.drapeau@modernatx.com

13. **No Mitigation.** The Covered Executive is not required to seek other employment or to attempt in any way to reduce any amounts payable to the Covered Executive by the Company under this Plan.

14. **Benefits and Burdens.** This Plan shall inure to the benefit of and be binding upon the Company and the Covered Executives, their respective successors, executors, administrators, heirs and permitted assigns. In the event of a Covered Executive’s death after a termination of employment but prior to the completion by the Company of all payments due to him or her under this Plan, the Company shall continue such payments to the Covered Executive’s beneficiary designated in writing to the Company prior to his or her death (or to his or her estate, if the Covered Executive fails to make such designation).

15. **Enforceability.** If any portion or provision of this Plan shall to any extent be declared illegal or unenforceable by a court of competent jurisdiction, then the remainder of this Plan, or the application of such portion or provision in circumstances other than those as to which it is so declared illegal or unenforceable, shall not be affected thereby, and each portion and provision of this Plan shall be valid and enforceable to the fullest extent permitted by law.

16. **Waiver.** No waiver of any provision hereof shall be effective unless made in writing and signed by the waiving party. The failure of any party to require the performance of any term or obligation of this Plan, or the waiver by any party of any breach of this Plan, shall not prevent any subsequent enforcement of such term or obligation or be deemed a waiver of any subsequent breach.

17. **Non-Duplication of Benefits and Effect on Other Plans.** Notwithstanding any other provision in the Plan to the contrary, the benefits provided hereunder shall be in lieu of any other severance payments and/or benefits provided by the Company, including any such payments and/or benefits pursuant to an employment agreement or offer letter between the Company and the Covered Executive, other than as provided in Section 3(d) of the Company’s 2018 Stock Option and Incentive Plan, if adopted by the Board.
18. **No Contract of Employment**. Nothing in this Plan shall be construed as giving any Covered Executive any right to be retained in the employ of the Company or shall affect the terms and conditions of a Covered Executive’s employment with the Company.

19. **Amendment or Termination of Plan**. The Company may amend or terminate this Plan at any time or from time to time, but no such action shall adversely affect the rights of any Covered Executive without the Covered Executive’s written consent.

20. **Governing Law**. This Plan shall be construed under and be governed in all respects by the laws of the Commonwealth of Massachusetts, without giving effect to the conflict of laws principles.

21. **Obligations of Successors(c)**. In addition to any obligations imposed by law upon any successor to the Company, any successor (whether direct or indirect, by purchase, merger, consolidation or otherwise) to all or substantially all of the business or assets of the Company shall expressly assume and agree to perform this Plan in the same manner and to the same extent that the Company would be required to perform if no such succession had taken place.

22. **Effectiveness and Term**. The Executive Severance Plan is effective as of June 13, 2018 and was amended and restated as of November 4, 2018.
Exhibit A

Covered Executives

11
Re: Amended and Restated Executive Severance Plan

Dear [NAME],

Moderna, Inc. (the “Company”) is pleased to inform you that you have been designated as an eligible participant in the Company’s Amended and Restated Executive Severance Plan, as amended from time to time (the “Severance Plan”), a copy of which (excluding the exhibits thereto) is attached hereto as Exhibit A. You have been designated as a Covered Executive under the Severance Plan.

Under certain circumstances, you will be eligible for certain severance benefits as described in the Severance Plan. Any and all such severance benefits are subject to the terms and conditions of the Severance Plan.

As a condition to participate in the Severance Plan, you hereby acknowledge that the severance benefits that may be provided to you under the Severance Plan will supersede and replace any severance benefit plan, policy or practice previously maintained by the Company or any of its affiliates that may have been applicable to you and any severance benefits under any individually negotiated employment agreement, offer letter agreement or equity award agreement between you and the Company or any of its affiliates, as may be amended from time to time, including without limitation the [offer letter][equity award agreement] between you and Moderna, Inc., dated [DATE], but other than Section 3(d) of the Company’s 2018 Stock Option and Incentive Plan, if adopted by the Company’s board of directors. In addition, as a condition to participate in the Severance Plan, you hereby acknowledge that you will continue to comply with the Employee Confidentiality, Non-Competition, Non-Solicitation and Inventions Assignment Agreement entered into between you and the Company on [DATE].

Please review the information in this letter and the Severance Plan carefully. If you have any questions regarding the letter or the Severance Plan, please contact Annie Drapeau at Annie.drapeau@modernatx.com.

To accept the terms of this letter and participate in the Severance Plan, please sign and date this letter in the space provided below and return the signed copy to Annie Drapeau by [DATE] (the “Expiration Date”). If you do not return the signed copy by the Expiration Date, the terms of this letter shall be null and void and you may not participate in the Severance Plan.

Moderna, Inc.

Name:
Title:

Agreed and Accepted:

Name:
Date:
February 23, 2011

Stephane Bancel
Boston, MA

Dear Stephane:

It is my pleasure to confirm our offer to you for the position of Chief Executive Officer and Board Member for ModeRNA Therapeutics, Inc. (“Company”).

**Compensation:** You will receive a base salary of $400,000 annually prorated for four-fifths (4/5) time, which will be paid semi-monthly during the term of your employment in accordance with the Company’s standard payroll policies and will be subject to applicable tax reporting and tax withholding.

**Annual Performance Bonus:** You will be eligible to receive an annual performance bonus up to thirty-five (35) percent of annual base salary prorated for four-fifths (4/5) time based on achieving certain milestones which shall be mutually agreed to between the Board of Directors and you.

**Stock Option and Restricted Stock:** You will be granted as incentive stock restricted shares totaling 10% of the Company’s common stock (1.87M shares) subject to approval of, and at a price to be determined by the Company’s Board of Directors, which will be equal to the fair market value of our common stock on the date of grant. Your restricted shares, which will be subject to the standard terms and conditions of ModeRNA Therapeutics, Inc.’s 2010 stock incentive plan, will be brought to the Board of Directors for approval soon after you begin employment with the Company. Following the approval by the Company’s Board of Directors the shares will vest, subject to continued employment, over four years at a rate of 25% on the first anniversary of the commencement date of your employment and an additional 6.25% per quarter for the next twelve successive quarters of employment.

**Company Agreements:** The offer of employment is contingent upon you signing ModeRNA Therapeutics Confidentiality, Intellectual Property and Non-compete and Non-solicitation agreements. These agreements are attached to this offer letter. You will be required to submit documentation that establishes identity and employment eligibility in accordance with the US Immigration and Naturalization requirements. The I-9 Employment Verification form is attached.

If there are any other agreements of any type that you are aware of which may impact or limit your ability to perform your job at ModeRNA Therapeutics, please let us know as soon as possible.
You may indicate your acceptance of this offer by signing on the appropriate space below and returning a signed copy along with the necessary agreements referenced in this letter in the enclosed stamped envelope to my attention. Your anticipated start date is April 1, 2011 but may be delayed to allow you to receive appropriate US immigration status.

Stephane, we are all excited about the opportunity to work with you. Feel free to contact any of us if you have any questions or need more information. On behalf of all our team members, let me extend a sincere welcome.

Sincerely,

/s/ Noubar Afeyan
Noubar Afeyan
Board Member
ModeRNA Therapeutics

Accepted and Agreed to:

/s/ Stephane Bancel
Stephane Bancel

Date
2/24/2011
Re: Employment by Moderna Therapeutics, Inc.

Moderna Therapeutics, Inc. (the “Company”) is pleased to confirm its offer to employ you as the Senior Vice President Corporate Development reporting to the CEO. It is understood that you will be employed by the Company in such capacity or such other capacity as may be mutually agreed upon by the Company and you from time to time. Your effective date of hire will be January 1, 2013 (the “Start Date”), and you will perform services for the Company as a regular, full-time employee.

Your compensation for this position will initially be at the rate of $290,000 per year, payable monthly in accordance with the Company’s normal pay schedule.

You will be eligible to receive an annual performance bonus. The Company will target a cash bonus of 30% of your annual base salary rate. The actual bonus percentage is discretionary and will be subject to the Company’s assessment of your performance, as well as business conditions at the Company. The bonus also will be subject to your employment for the full period covered by the bonus, approval by and adjustment at the discretion of the Board of Directors of the Company (the “Board”) and the terms of any applicable bonus plan. The Company expects to review your job performance on an annual basis and will discuss with you the criteria which the Company will use to assess your performance for bonus purposes. The Company also may make adjustments in the targeted amount of your annual performance bonus.

Subject to the approval of the Board, you will be granted a stock option to purchase 300,000 shares of the Common Stock of the Company, for a price per share equal to the fair market value established by the Board at the time of grant (the “Option”). The Option will be subject to time-based vesting, as follows: 25% of the shares underlying the Option will vest on the first anniversary of the Start Date, and the balance of those shares underlying the Option will vest in equal calendar quarterly installments over the next three years, provided in each case that you continue to provide continuous services to the Company as of such vesting date. For 50,000 shares of the Common Stock of the Company out of the 300,000 stock option grant, there will be two (2) tranches with one (1) personal goal within 12 months of starting: 25,000 options for achieving goal one (1), and 25,000 for achieving goal two (2). The two goals will be defined with your manager by end of January 2013.
The company will pay directly for the cost of your full relocation cost from New York, NY to Boston Area including the movers for packing, moving and unpacking your personal belonging. In addition to your compensation, you may take advantage of various benefits offered by the Company, including group medical and dental insurance, short term disability coverage, group life insurance and a 401(k) plan. These benefits, of course, may be modified, changed or eliminated from time to time at the sole discretion of the Company, and the provision of such benefits to you in no way changes or impacts your status as an at-will employee. Where a particular benefit is subject to a formal plan (for example, medical insurance or life insurance), eligibility to participate in and receive any particular benefit is governed solely by the applicable plan document. Should you ever have any questions about Company benefits, you should ask for a copy of the applicable plan document.

It is understood that you are an “at-will” employee. You are not being offered employment for a definite period of time, and either you or the Company may terminate the employment relationship at any time and for any reason without prior notice and without additional compensation to you.

Your normal place of work will be Cambridge, Massachusetts; however, it is understood that the Company may change your normal place of work according to the Company’s future needs. Enclosed for your review is a “Confidentiality, Intellectual Property, and Non-Competition/Non-Solicitation Agreement” (the “Agreement”). This offer of employment is conditioned on your willingness to sign and abide by the terms of the Agreement. You will be expected to sign the Agreement before you report for work.

Protecting the company by maintaining company confidential information is a critical responsibility of each employee. The company policy is that employees can ONLY share outside the company the information that is publicly available through the company web site. No other information regarding the company plans, its technology, its research programs or any other topic, can be shared without a proper current CDA in place.

In making this offer, the Company understands, and in accepting it you represent that you are not under any obligation to any former employer or any person or entity which would prevent, limit, or impair in any way the performance by you of your duties as an employee of the Company.

The Immigration Reform and Control Act requires employers to verify the employment eligibility and identity of new employees. Enclosed is a copy of the Form I-9 that you will be required to complete. Please bring the appropriate documents listed on that form with you when you report for work. We will not be able to employ you if you fail to comply with this requirement.

Please indicate your acceptance of this offer by signing and dating the enclosed copy of this letter and returning it in the enclosed envelope by November 21, 2012.
Stephen, we look forward to your joining the Company and are pleased that you will be working with us to build a transformative company for patients.

Very truly yours,

MODERNA THERAPEUTICS, INC.

By: Stephane Bancel

Title: President and Founding CEO

/s/ Stephane Bancel

Accepted and Agreed:
Stephen Hoge

/s/ Stephen Hoge

11/27/2012
Date
February 20th, 2014

Mr. Lorence Kim
200 Chambers Street, Apt 9 A
New York, NY 10007

Re: Employment by Moderna Therapeutics, Inc.

Dear Lorence,

Moderna Therapeutics, Inc. (the “Company”) is pleased to confirm its offer to employ you as Chief Financial Officer. Your effective date of hire will be on or before April 21st (the “Start Date”), and you will perform services for the Company as a regular, full-time employee.

Your initial base salary for this position will be at the rate of $350,000 per year, payable semi-monthly in accordance with the Company’s normal pay schedule. Your salary will be subject to periodic review and adjustments at the Company’s discretion.

You will be eligible to receive an annual performance bonus. The Company will initially target the bonus at up to 30% of your annual salary rate (pro-rated based on your Start Date). The actual bonus percentage is discretionary and will be subject to the Company’s assessment of your performance, as well as business conditions at the Company. The bonus also will be subject to approval by and adjustment at the discretion of the Board of Directors of the Company (the “Board”) and the terms of any applicable bonus plan. You must be employed on the date a bonus is paid to earn that bonus. The Company expects to review your job performance on an annual basis and expects to discuss with you the criteria which the Company will use to assess your performance for bonus purposes.

Subject to the commencement of your employment with the Company, the Company will recommend to the Board of Directors of Moderna LLC, the Company’s parent entity, that you be eligible to participate in Moderna LLC’s equity incentive program and be granted a “profits interest” in Moderna LLC, at such time as the Board determines, in an aggregate amount of 240,000 Non-Voting Incentive Units, pursuant to a plan to be adopted by the Board. The Non-Voting Incentive Units shall vest according to the following schedule: 25% of the Non-Voting Incentive Units will vest on the first anniversary of the Start Date, and the remaining 75% of the Non-Voting Incentive Units will vest in equal calendar quarterly installments over the next three years, provided in each case that you continue to provide continuous services to the Company as of such vesting date. The grant of the Non-Voting Incentive Units will be conditioned upon your execution of Moderna LLC’s form incentive unit grant agreement and a counterpart signature page to Moderna LLC’s Amended and Restated Limited Liability Agreement (the “Operating Agreement”). The terms and conditions with respect to your Non-Voting Incentive Units shall be set forth in the equity incentive plan to be adopted by the Board and the associated incentive unit grant agreement and the Operating Agreement.
The Company will pay reasonable costs associated with your relocation to the Cambridge area. The Company will determine in its reasonable judgment what, if any, of your relocation expenses are for non-deductible expenses in accordance with applicable law and will comply with associated withholding and tax reporting obligations. In the event that, at any time within 12 months from your Start Date, you voluntarily terminate your employment with the Company, or the Company terminates you for cause, as reasonably determined by the Company, you agree to reimburse the Company for any relocation expenses made to you under this provision.

The company will pay directly your transportation from NYC and accommodation cost in Cambridge, until your family relocates to Boston. These cost will be paid until June 2015 at the latest. Moderna will gross-up this taxable income.

In addition to your compensation, you may take advantage of various benefits offered by the Company. Currently the Company provides group medical, dental and vision insurance, short term disability coverage, group life insurance and a 401(k) plan. These benefits, of course, may be modified, changed or eliminated from time to time at the sole discretion of the Company, and the provision of such benefits to you in no way changes or impacts your status as an at-will employee. Where a particular benefit is subject to a formal plan (for example, medical insurance or life insurance), eligibility to participate in and receive any particular benefit is governed solely by the applicable plan document. Should you ever have any questions about Company benefits, you should ask for a copy of the applicable plan document. You will also be eligible for vacation pursuant to the Company’s policies.

All forms of compensation referred to in this offer letter are subject to reduction to reflect applicable withholding and payroll taxes and other deductions required by law.

It is understood that you are an "at-will" employee. You are not being offered employment for a definite period of time, and either you or the Company may terminate the employment relationship at any time and for any reason without prior notice and without additional compensation to you.

Your normal place of work will be Cambridge, Massachusetts; however, it is understood that the Company may change your normal place of work according to the Company’s future needs. As a condition of your employment, you will need to enter into a "Non-Competition, Non-Solicitation, Confidentiality and Assignment Agreement", a copy of which is enclosed. This offer is conditioned on your representation that you are not subject to any confidentiality, non-competition agreement or any other similar type of restriction that may affect your ability to devote full time and attention to your work at the Company. If you have entered into any agreement that may restrict your activities on behalf of the Company, please provide me with a copy of the agreement as soon as possible. You further represent that you have not used and will not use or disclose any trade secret or other proprietary right of any previous employer or any other party in the course of your employment with the Company.

The Immigration Reform and Control Act requires employers to verify the employment eligibility and identity of new employees. Enclosed is a copy of the Form I-9 that you will be required to complete. Please bring the appropriate documents listed on that form with you when you report for work. We will not be able to employ you if you fail to comply with this requirement.
Please indicate your acceptance of this offer by signing and dating this letter (PDF by email) and returning it by Monday February 24th.

Lorence, we look forward to your joining the Company and are pleased that you will be working with us to build a transformative company for patients.

Very truly yours,
MODERNA THERAPEUTICS, INC.
By: Stephane Bancel
Title: President and CEO
/s/ Stephane Bancel
February 20th, 2014

Accepted and Agreed:

Lorence Kim

/s/ Lorence Kim
Date 2/24/14
June 13, 2018

Stephane Bancel
21 Chestnut Street
Boston, MA 02108

Dear Stephane:

As you know, Moderna Therapeutics, Inc. (the “Company”) is currently undertaking preparations for the Company’s initial public offering of shares of its common stock (the “IPO”). We are pleased to inform you that in connection with the IPO, you shall be granted an option to purchase 10,000,000 shares of the Company’s common stock (the “Option”), subject to the following terms, conditions and contingencies:

(i) The Option shall be contingent on, and effective immediately following, the time a registration statement on Form S-1 filed by the Company (the “Registration Statement”) with respect to its IPO is declared effective by the U.S. Securities and Exchange Commission (the “IPO Effective Date”);

(ii) You must remain employed by the Company through the IPO Effective Date in order to be granted the Option, and if the IPO does not close within five business days after the IPO Effective Date then this Option shall be forfeited at such time;

(iii) The IPO Effective Date must occur no later than December 31, 2019;

(iv) The Option shall have a per share exercise price equal to the “Price to the Public” (or equivalent) set forth on the cover page of the final prospectus included in the Registration Statement, which shall be the fair market value of a share of the Company’s common stock on the grant date of the Option;

(v) The “Vesting Commencement Date” for the Option shall be the date that you execute this letter agreement, as set forth below, which shall in no event be later than June 13, 2018 (the “Expiration Date”). In the event that you do not execute this letter agreement by the Expiration Date, then this letter agreement and the terms herein shall be null and void;

(vi) The Option shall be divided into two (2) tranches. Fifty percent (50%) of the shares subject to the Option (the “Tranche 1 Portion”) shall vest on the fifth (5th) anniversary of the Vesting Commencement Date, subject to your continued employment with the Company through such date, and the remaining fifty percent (50%) of the shares subject to the Option (the “Tranche 2 Portion”) shall vest in accordance with the following schedule: twenty-five percent (25%) of the shares subject to the Tranche 2 Portion shall vest on the second (2nd) anniversary of the Vesting Commencement Date and the remaining shares subject to the Tranche 2 Portion shall vest in equal quarterly installments thereafter for the next three (3) years, subject to your continued employment with the Company through each applicable vesting date. For the avoidance of doubt, the Option (including the Tranche 1 Portion and the Tranche 2 Portion) shall be fully vested on the fifth (5th) anniversary of the Vesting Commencement Date, subject to your continued employment with the Company through each applicable vesting date;
In the event of a stock split, stock consolidation or similar event prior to the grant of the Option, the number of shares subject thereto shall be adjusted proportionately; and

The Option shall be subject to the terms, conditions, definitions and provisions of the Company’s 2019 Stock Option and Incentive Plan, as amended from time to time, which shall be adopted by the board of directors of the Company, contingent on and prior to the IPO Effective Date, and the form of stock option agreement thereunder, to be signed by you and the Company.

This letter agreement sets forth the entire agreement between the Company and you regarding the Option, and supersedes any prior written or oral agreement or arrangement concerning such subject matter.

You may indicate your agreement with these terms by executing and dating this letter agreement and returning them to me by the Expiration Date.

Very truly yours,

Modern Therapeutics, Inc.

By: /s/ Noubar Afeyan
   Noubar Afeyan
   Chairman of the Board of Directors

I have read and accept the terms of this letter agreement:

/s/ Stephane Bancel
Signature of Stephane Bancel
Dated: 6/13/2018
AMENDMENT NO. 1 TO LETTER AGREEMENT

This Amendment No. 1 to Letter Agreement (the “Amendment”) is entered into by and between Moderna, Inc. (formerly known as Moderna Therapeutics, Inc.) (the “Company”) and Stephane Bancel (the “Executive”), and is effective as of this 4th day of November, 2018.

WHEREAS, the Company and the Executive have previously entered into a letter agreement, dated as of June 13, 2018 (the “Letter Agreement”);

WHEREAS, the Executive and the Company desire to amend the Letter Agreement to revise and replace all references therein to “the Company’s 2019 Stock Option and Incentive Plan, as amended from time to time” with “the Company’s 2018 Stock Option and Incentive Plan, as amended from time to time (including, without limitation, any amendment to the name of such plan)”.

NOW, THEREFORE, in consideration of good and adequate consideration, the receipt and sufficiency of which are hereby acknowledged, the parties hereto, intending to be legally bound, agree as follows:

1. Amendment to Section (viii). Section (viii) of the Letter Agreement is hereby amended, by deleting “the Company’s 2019 Stock Option and Incentive Plan, as amended from time to time”, and inserting the following in its place: “the Company’s 2018 Stock Option and Incentive Plan, as amended from time to time (including, without limitation, any amendment to the name of such plan)”. All other terms and conditions set forth in the Letter Agreement shall remain the same.

2. Entire Agreement. The Amendment supersedes any previous agreements or understandings between the Company and the Executive, except to the extent that any agreement is expressly preserved in the Amendment.

3. Governing Law. The Amendment shall be construed and governed according to the laws of the Commonwealth of Massachusetts, without regard to any conflict of laws provisions.

4. Counterparts. The Amendment may be executed simultaneously in any number of counterparts (telecopied or otherwise), each of which when so executed and delivered shall be taken to be an original but all of which together shall constitute one and the same agreement.

5. Successors and Assigns. The Amendment shall be binding upon, inure to the benefit of and be enforceable by and against the parties hereto and their respective successors and assigns.

[Remainder of Page Intentionally Left Blank]
IN WITNESS WHEREOF, the Amendment has been executed by the Company and the Executive effective as of the day and year first above written.

Executive

/s/ Stéphane Bancel

Date: Nov. 5, 2018

Modern, Inc.

/s/ Noubar Afeyan

By: Dr. Noubar Afeyan
Title: Chairman

Date: 11-6-2018
CONFIDENTIAL
October 17, 2017
Stephen Hoge
66 Summit Avenue
Brookline, MA 02446

Re: Bonus Payment

Dear Mr. Hoge:

Moderna Therapeutics, Inc. (“Moderna”) values your contributions to Moderna and looks forward to you continuing to be a productive member of the leadership team. In recognition of your continued commitment, Moderna is offering you an opportunity to receive certain bonus compensation, all as described in detail in this letter agreement (the “Agreement”).

1. **Bonus Payment.** In exchange for your continued employment to Moderna, you will receive a cash bonus payment equal to $4 million (the “Bonus”), which will be subject to vesting in substantially equal annual installments over six years (i.e., $666,667 each year) from date of this Agreement (each such anniversary of the date of this Agreement, a “Vesting Date”).

2. **Form and Time of Bonus Payment.** The Bonus shall be paid to you in a lump sum, less applicable deductions and withholdings, on Moderna’s first regular payroll date that is at least 10 days following your execution of this Agreement; provided, however, that such Bonus shall be subject to repayment pursuant to the terms and conditions set forth in Section 3 below.

3. **Termination of Employment.** Notwithstanding anything herein to the contrary, in the event your employment with Moderna is terminated for any reason, including by Moderna for cause (as determined by Moderna’s board of directors in its reasonable good faith discretion) or by you for any reason, prior to October 3, 2023, you will be required to repay Moderna the portion of the Bonus that remains unvested as of the date of your termination. You agree to make any such repayment not later than 15 days from the date of your termination, after which date interest at the maximum legal rate on any unpaid balance shall be due and owing by you, together with all costs and attorneys’ fees which are incurred by Moderna in the collection of such amounts. In addition, you may also elect to repay all or a portion of the unvested portion of the Bonus in vested shares of Moderna’s common stock then currently held by you (and vested) as of such date, with the value of such shares being equal to the then fair market value of such shares, as determined by Moderna’s board of directors in its sole discretion.

[Signature Page – Bonus Agreement]
4. **Section 409A.** The provisions regarding the payment of the Bonus hereunder shall be interpreted in such a manner that any such payments are exempt from the requirements of Section 409A of the Internal Revenue Code of 1986, as amended (the “Code”), as “short-term deferrals” as described in Section 409A of the Code.

5. **Miscellaneous.** Nothing in this Agreement alters the at-will relationship between Moderna and you, meaning that either you or Moderna can terminate your employment relationship at any time, with or without cause. This Agreement constitutes the entire agreement between you and Moderna with respect to the subject matter hereof and supersedes all prior oral and written agreements and understandings between you and Moderna with respect to any related subject matter. This Agreement may not be amended or modified other than by a written agreement executed by you and Moderna. This Agreement is delivered and shall be enforceable in accordance with the laws of the Commonwealth of Massachusetts, and shall be construed in accordance therewith.

Sincerely,

MODERNA THERAPEUTICS, INC.

/s/ Stephane Bancel
Name: Stephane Bancel
Title: CEO

Accepted and agreed to by:

/s/ Stephen Hoge
Name: Stephen Hoge
Date: October 18, 2017
MODERNA INC.
SENIOR EXECUTIVE CASH INCENTIVE BONUS PLAN

1. **Purpose**

   This Senior Executive Cash Incentive Bonus Plan (the “Incentive Plan”) is intended to provide an incentive for superior work and to motivate eligible executives of Moderna Inc. (the “Company”) and its subsidiaries toward even higher achievement and business results, to tie their goals and interests to those of the Company and its stockholders and to enable the Company to attract and retain highly qualified executives. The Incentive Plan is for the benefit of Covered Executives (as defined below).

2. **Covered Executives**

   From time to time, the Compensation Committee of the Board of Directors of the Company (the “Compensation Committee”) may select certain key executives (the “Covered Executives”) to be eligible to receive bonuses hereunder. Participation in this Plan does not change the “at will” nature of a Covered Executive’s employment with the Company.

3. **Administration**

   The Compensation Committee shall have the sole discretion and authority to administer and interpret the Incentive Plan.

4. **Bonus Determinations**

   (a) **Corporate Performance Goals**. A Covered Executive may receive a bonus payment under the Incentive Plan based upon the attainment of one or more performance objectives that are established by the Compensation Committee and relate to financial and operational metrics with respect to the Company or any of its subsidiaries (the “Corporate Performance Goals”), including the following: developmental, publication, clinical or regulatory milestones; cash flow (including, but not limited to, operating cash flow and free cash flow); revenue; corporate revenue; earnings before interest, taxes, depreciation and amortization; net income (loss) (either before or after interest, taxes, depreciation and/or amortization); changes in the market price of the Company’s common stock; economic value-added; acquisitions, licenses or strategic transactions; financing or other capital raising transactions; operating income (loss); return on capital, assets, equity, or investment; stockholder returns; return on sales; total shareholder return; gross or net profit levels; productivity; expense efficiency; margins; operating efficiency; customer satisfaction; working capital; earnings (loss) per share of the Company’s common stock; bookings, new bookings or renewals; sales or market shares; number of prescriptions or prescribing physicians; coverage decisions; leadership development, employee retention, and recruiting and other human resources matters; operating income and/or net annual recurring revenue, any of which may be (A) measured in absolute terms or compared to any incremental increase, (B) measured in terms of growth, (C) compared to another company or companies or to results of a peer group, (D) measured against the market as a whole and/or as compared to applicable market indices and/or (E) measured on a pre-tax or
post-tax basis (if applicable). Further, any Corporate Performance Goals may be used to measure the performance of the Company as a whole or a
business unit or other segment of the Company, or one or more product lines or specific markets. The Corporate Performance Goals may differ from
Covered Executive to Covered Executive.

(b) **Calculation of Corporate Performance Goals.** At the beginning of each applicable performance period, the Compensation Committee will
determine whether any significant element(s) will be included in or excluded from the calculation of any Corporate Performance Goal with respect to
any Covered Executive. In all other respects, Corporate Performance Goals will be calculated in accordance with the Company’s financial statements,
generally accepted accounting principles, or under a methodology established by the Compensation Committee at the beginning of the performance
period and which is consistently applied with respect to a Corporate Performance Goal in the relevant performance period.

(c) **Target; Minimum; Maximum.** Each Corporate Performance Goal shall have a “target” (100 percent attainment of the Corporate Performance
Goal) and may also have a “minimum” hurdle and/or a “maximum” amount.

(d) **Bonus Requirements; Individual Goals.** Except as otherwise set forth in this Section 4(d): (i) any bonuses paid to Covered Executives under
the Incentive Plan shall be based upon objectively determinable bonus formulas that tie such bonuses to one or more performance targets relating to
the Corporate Performance Goals, (ii) bonus formulas for Covered Executives shall be adopted in each performance period by the Compensation
Committee and communicated to each Covered Executive at the beginning of each performance period and (iii) no bonuses shall be paid to Covered
Executives unless and until the Compensation Committee makes a determination with respect to the attainment of the performance targets relating to
the Corporate Performance Goals. Notwithstanding the foregoing, the Compensation Committee may adjust bonuses payable under the Incentive Plan
based on achievement of one or more individual performance objectives or pay bonuses (including, without limitation, discretionary bonuses) to
Covered Executives under the Incentive Plan based on individual performance goals and/or upon such other terms and conditions as the
Compensation Committee may in its discretion determine.

(e) **Individual Target Bonuses.** The Compensation Committee shall establish a target bonus opportunity for each Covered Executive for each
performance period. For each Covered Executive, the Compensation Committee shall have the authority to apportion the target award so that a portion
of the target award shall be tied to attainment of Corporate Performance Goals and a portion of the target award shall be tied to attainment of individual
performance objectives.

(f) **Employment Requirement.** Subject to any additional terms contained in a written agreement between the Covered Executive and the
Company, the payment of a bonus to a Covered Executive with respect to a performance period shall be conditioned upon the Covered Executive’s
employment by the Company on the bonus payment date. If a Covered Executive was not employed for an entire performance period, the
Compensation Committee will pro rate the bonus based on the number of days employed during such period.

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5. **Timing of Payment**

   (a) With respect to Corporate Performance Goals established and measured on a basis more frequently than annually (e.g., quarterly or semi-annually), the Corporate Performance Goals will be measured at the end of each performance period after the Company’s financial reports with respect to such period(s) have been published. If the Corporate Performance Goals and/or individual goals for such period are met, payments will be made as soon as practicable following the end of such period, but not later 74 days after the end of the fiscal year in which such performance period ends.

   (b) With respect to Corporate Performance Goals established and measured on an annual or multi-year basis, Corporate Performance Goals will be measured as of the end of each such performance period (e.g., the end of each fiscal year) after the Company’s financial reports with respect to such period(s) have been published. If the Corporate Performance Goals and/or individual goals for any such period are met, bonus payments will be made as soon as practicable, but not later than 74 days after the end of the relevant fiscal year.

   (c) For the avoidance of doubt, bonuses earned at any time in a fiscal year must be paid no later than 74 days after the last day of such fiscal year.

6. **Amendment and Termination**

   The Company reserves the right to amend or terminate the Incentive Plan at any time in its sole discretion.

Adopted by the Board of Directors: September 29, 2018
Exhibit 10.18

Moderna, Inc.
Non-Employee Director Compensation Policy

The purpose of this Non-Employee Director Compensation Policy (the “Policy”) of Moderna, Inc., a Delaware corporation (the “Company”), is to provide a total compensation package that enables the Company to attract and retain, on a long-term basis, high-caliber directors who are not employees or officers of the Company or its subsidiaries (“Outside Directors”). This Policy will become effective as of the effective time of the registration statement for the Company’s initial firm commitment underwritten public offering of equity securities (the “Effective Date”). In furtherance of the purpose stated above, all Outside Directors shall be paid compensation for services provided to the Company as set forth below:

I. Cash Retainers

(a) Annual Retainer for Board Membership: $50,000 for general availability and participation in meetings and on conference calls of our Board of Directors (the “Board of Directors”). No additional compensation for attending individual Board of Director meetings.

(b) Additional Annual Retainer for Non-Executive Chairman of the Board of Directors: $30,000

(c) Additional Annual Retainers for Committee Membership:

<table>
<thead>
<tr>
<th>Committee Chairperson/Committee</th>
<th>Retainer</th>
</tr>
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<tbody>
<tr>
<td>Audit Committee Chairperson:</td>
<td>$20,000</td>
</tr>
<tr>
<td>Audit Committee non-Chairperson member:</td>
<td>$10,000</td>
</tr>
<tr>
<td>Compensation &amp; Talent Committee Chairperson:</td>
<td>$15,000</td>
</tr>
<tr>
<td>Compensation &amp; Talent Committee non-Chairperson member:</td>
<td>$7,500</td>
</tr>
<tr>
<td>Nominating and Corporate Governance Committee Chairperson:</td>
<td>$10,000</td>
</tr>
<tr>
<td>Nominating and Corporate Governance Committee non-Chairperson member:</td>
<td>$5,000</td>
</tr>
<tr>
<td>Product Development Committee Chairperson:</td>
<td>$15,000</td>
</tr>
<tr>
<td>Product Development non-Chairperson member:</td>
<td>$7,500</td>
</tr>
</tbody>
</table>

No additional compensation for attending individual committee meetings. All cash retainers will be paid quarterly, in arrears, or upon the earlier resignation or removal of the Outside Director.
Cash retainers owing to Outsider Directors shall be annualized, meaning that with respect to Outside Directors who join the Board of Directors during the calendar year, such amounts shall be pro-rated based on the number of calendar days served by such director.

II. Equity Retainers

All grants of equity retainer awards to Outside Directors pursuant to this Policy will be automatic and nondiscretionary and will be made in accordance with the following provisions:

(a) **Value.** For purposes of this Policy, “Value” means with respect to (i) any award of stock options the grant date fair value of the option (i.e., Black-Scholes Value) determined in accordance with the reasonable assumptions and methodologies employed by the Company for calculating the fair value of options under ASC 718; and (ii) any award of restricted stock and restricted stock units the product of (A) the closing market price on The Nasdaq Global Market (or such other market on which the Company’s common stock is then principally listed) of one share of the Company’s common stock on the grant date, and (B) the aggregate number of shares pursuant to such award.

(b) **Revisions.** The Compensation & Talent Committee (the “Compensation Committee”) in its discretion may change and otherwise revise the terms of awards to be granted under this Policy, including, without limitation, the number of shares subject thereto, for awards of the same or different type granted on or after the date the Compensation Committee determines to make any such change or revision.

(c) **Sale Event Acceleration.** In the event of a Sale Event (as defined in the Company’s 2018 Stock Option and Incentive Plan (the “Stock Plan”)), the equity retainer awards granted to Outside Directors pursuant to this Policy shall become 100% vested and exercisable.

(d) **Initial Grant.** Upon initial election to the Board of Directors, each new Outside Director will receive an initial, one-time grant of a non-statutory stock option (the “Initial Grant”) with a Value of $355,000, an exercise price per share equal to the closing price of a share of the Company’s common stock on the date of grant and a term of ten years, that vests in full on the one-year anniversary of the grant date; provided, however, that all vesting ceases if the director resigns from our Board of Directors or otherwise ceases to serve as a director, unless the Board of Directors determines that the circumstances warrant continuation of vesting. If any Initial Grant to an Outside Director is to become effective as of Effective Date, it shall have an exercise price per share equal to the per share “price to the public” (or equivalent) set forth on the cover page for the final prospectus relating to the Company’s initial public offering.

(e) **Annual Grant.** On the date of the Company’s Annual Meeting of Stockholders, each Outside Director who will continue as a member of the Board of Directors following such Annual Meeting of Stockholders will receive a grant of a non-statutory stock option on the date of such Annual Meeting of Stockholders (the “Annual Grant”) with a Value of $355,000, an exercise price per share equal to the closing price of a share of the Company’s common stock on the date of grant and a term of ten years, that vests in full on the earlier of (i) the one-year anniversary of the grant date or (ii) the next Annual Meeting of Stockholders; provided, however, that all vesting ceases if the director resigns from our Board of Directors or otherwise
ceases to serve as a director, unless the Board of Directors determines that the circumstances warrant continuation of vesting. If a new Outside Director joins our Board of Directors on a date other than the date of the Company’s Annual Meeting of Stockholders, then such Outside Director will be granted a pro-rata portion of the Annual Grant based on the time between such Outside Director’s appointment and the next Annual Meeting of Stockholders, on the first eligible grant date following such Outside Director’s appointment to our Board of Directors.

III. Expenses
The Company will reimburse all reasonable out-of-pocket expenses incurred by Outside Directors in attending meetings of the Board of Directors or any committee thereof.

IV. Maximum Annual Compensation
The aggregate amount of compensation, including both equity compensation and cash compensation, paid to any Outside Director in a calendar year period shall not exceed $1,500,000 for the first year of service and $1,000,000 for each year of service thereafter (or such other limits as may be set forth in Section 3(b) of the Stock Plan or any similar provision of a successor plan). For this purpose, the “amount” of equity compensation paid in a calendar year shall be determined based on the grant date fair value thereof, as determined in accordance with ASC 718 or its successor provision, but excluding the impact of estimated forfeitures related to service-based vesting conditions.

Date Policy Approved: September 29, 2018
MODERNA, INC.

[FORM OF] OFFICER INDEMNIFICATION AGREEMENT

This Indemnification Agreement ("Agreement") is made as of [___________] by and between Moderna, Inc., a Delaware corporation (the "Company"), and [Officer] ("Indemnitee").

RECITALS

WHEREAS, the Company desires to attract and retain the services of highly qualified individuals, such as Indemnitee, to serve the Company;

WHEREAS, in order to induce Indemnitee to provide or continue to provide services to the Company, the Company wishes to provide for the indemnification of, and advancement of expenses to, Indemnitee to the maximum extent permitted by law;

WHEREAS, the Amended and Restated Certificate of Incorporation (as amended and in effect from time to time, the "Charter") and the Amended and Restated Bylaws (as amended and in effect from time to time, the "Bylaws") of the Company require indemnification of the officers and directors of the Company, and Indemnitee may also be entitled to indemnification pursuant to the General Corporation Law of the State of Delaware (the "DGCL");

WHEREAS, the Charter, the Bylaws and the DGCL expressly provide that the indemnification provisions set forth therein are not exclusive, and thereby contemplate that contracts may be entered into between the Company and members of the board of directors, officers and other persons with respect to indemnification;

WHEREAS, the Board of Directors of the Company (the "Board") has determined that the increased difficulty in attracting and retaining highly qualified persons such as Indemnitee is detrimental to the best interests of the Company’s stockholders;

WHEREAS, it is reasonable and prudent for the Company contractually to obligate itself to indemnify, and to advance expenses on behalf of, such persons to the fullest extent permitted by applicable law, regardless of any amendment or revocation of the Charter or the Bylaws, so that they will serve or continue to serve the Company free from undue concern that they will not be so indemnified; and

WHEREAS, this Agreement is a supplement to and in furtherance of the indemnification provided in the Charter, the Bylaws and any resolutions adopted pursuant thereto, and shall not be deemed a substitute therefor, nor to diminish or abrogate any rights of Indemnitee thereunder.

NOW, THEREFORE, in consideration of the premises and the covenants contained herein, the Company and Indemnitee do hereby covenant and agree as follows:

Section 1. Services to the Company. Indemnitee agrees to [continue to] serve as [a director and] an officer of the Company. Indemnitee may at any time and for any reason resign.
Section 2. Definitions.

As used in this Agreement:

(a) “Change in Control” shall mean (i) the sale of all or substantially all of the assets of the Company on a consolidated basis to an unrelated person or entity, (ii) a merger, reorganization or consolidation pursuant to which the holders of the Company’s outstanding voting power and outstanding stock immediately prior to such transaction do not own a majority of the outstanding voting power and outstanding stock or other equity interests of the resulting or successor entity (or its ultimate parent, if applicable) immediately upon completion of such transaction, (iii) the sale of all of the Stock of the Company to an unrelated person, entity or group thereof acting in concert, or (iv) any other transaction in which the owners of the Company’s outstanding voting power immediately prior to such transaction do not own at least a majority of the outstanding voting power of the Company or any successor entity immediately upon completion of the transaction other than as a result of the acquisition of securities directly from the Company.

(b) “Corporate Status” describes the status of a person as a current or former director or officer of the Company or current or former director, manager, partner, officer, employee, agent or trustee of any other Enterprise which such person is or was serving at the request of the Company.

(c) “Enforcement Expenses” shall include all reasonable attorneys’ fees, court costs, transcript costs, fees of experts, travel expenses, duplicating costs, printing and binding costs, telephone charges, postage, delivery service fees, and all other out-of-pocket disbursements or expenses of the types customarily incurred in connection with an action to enforce indemnification or advancement rights, or an appeal from such action. Expenses, however, shall not include fees, salaries, wages or benefits owed to Indemnitee.

(d) “Enterprise” shall mean any corporation (other than the Company), partnership, joint venture, trust, employee benefit plan, limited liability company, or other legal entity of which Indemnitee is or was serving at the request of the Company as a director, manager, partner, officer, employee, agent or trustee.

(e) “Expenses” shall include all reasonable attorneys’ fees, court costs, transcript costs, fees of experts, travel expenses, duplicating costs, printing and binding costs, telephone charges, postage, delivery service fees, and all other out-of-pocket disbursements or expenses of the types customarily incurred in connection with prosecuting, defending, preparing to prosecute or defend, investigating, being or preparing to be a witness in, or otherwise participating in, a Proceeding or an appeal resulting from a Proceeding. Expenses, however, shall not include amounts paid in settlement by Indemnitee, the amount of judgments or fines against Indemnitee or fees, salaries, wages or benefits owed to Indemnitee.
 Independent Counsel" means a law firm, or a partner (or, if applicable, member or shareholder) of such a law firm, that is experienced in matters of Delaware corporation law and neither presently is, nor in the past five (5) years has been, retained to represent: (i) the Company, any subsidiary of the Company, any Enterprise or Indemnitee in any matter material to any such party; or (ii) any other party to the Proceeding giving rise to a claim for indemnification hereunder. Notwithstanding the foregoing, the term "Independent Counsel" shall not include any person who, under the applicable standards of professional conduct then prevailing, would have a conflict of interest in representing either the Company or Indemnitee in an action to determine Indemnitee’s rights under this Agreement. The Company agrees to pay the reasonable fees and expenses of the Independent Counsel referred to above and to fully indemnify such counsel against any and all expenses, claims, liabilities and damages arising out of or relating to this Agreement or its engagement pursuant hereto.

(g) The term “Proceeding” shall include any threatened, pending or completed action, suit, arbitration, alternate dispute resolution mechanism, investigation, inquiry, administrative hearing or any other actual, threatened or completed proceeding, whether brought in the right of the Company or otherwise and whether of a civil, criminal, administrative, regulatory or investigative nature, and whether formal or informal, in which Indemnitee was, is or will be involved as a party or otherwise by reason of the fact that Indemnitee is or was [a director or] an officer of the Company or is or was serving at the request of the Company as a director, manager, partner, officer, employee, agent or trustee of any Enterprise or by reason of any action taken by Indemnitee or of any action taken on his or her part while acting as [a director or] an officer of the Company or while serving at the request of the Company as a director, manager, partner, officer, employee, agent or trustee of any Enterprise, in each case whether or not serving in such capacity at the time any liability or expense is incurred for which indemnification, reimbursement or advancement of expenses can be provided under this Agreement; provided, however, that the term “Proceeding” shall not include any action, suit or arbitration, or part thereof, initiated by Indemnitee to enforce Indemnitee's rights under this Agreement as provided for in Section 12(a) of this Agreement.

Section 3. **Indemnity in Third-Party Proceedings.** The Company shall indemnify Indemnitee to the extent set forth in this Section 3 if Indemnitee is, or is threatened to be made, a party to or a participant in any Proceeding, other than a Proceeding by or in the right of the Company to procure a judgment in its favor. Pursuant to this Section 3, Indemnitee shall be indemnified against all Expenses, judgments, fines, penalties, excise taxes, and amounts paid in settlement actually and reasonably incurred by Indemnitee or on his or her behalf in connection with such Proceeding or any claim, issue or matter therein, if Indemnitee acted in good faith and in a manner he or she reasonably believed to be in or not opposed to the best interests of the Company and, in the case of a criminal proceeding, had no reasonable cause to believe that his or her conduct was unlawful.

Section 4. **Indemnity in Proceedings by or in the Right of the Company.** The Company shall indemnify Indemnitee to the extent set forth in this Section 4 if Indemnitee is, or
is threatened to be made, a party to or a participant in any Proceeding by or in the right of the Company to procure a judgment in its favor. Pursuant to
this Section 4, Indemnitee shall be indemnified against all Expenses actually and reasonably incurred by Indemnitee or on his or her behalf in
connection with such Proceeding or any claim, issue or matter therein, if Indemnitee acted in good faith and in a manner he or she reasonably believed
to be in or not opposed to the best interests of the Company. No indemnification for Expenses shall be made under this Section 4 in respect of any
claim, issue or matter as to which Indemnitee shall have been finally adjudged by a court to be liable to the Company, unless and only to the extent
that the Delaware Court of Chancery (the “Delaware Court”) shall determine upon application that, despite the adjudication of liability but in view of
all the circumstances of the case, Indemnitee is fairly and reasonably entitled to indemnification for such expenses as the Delaware Court shall deem
proper.

Section 5.  Indemnification for Expenses of a Party Who is Wholly or Partly Successful. Notwithstanding any other provisions of this Agreement
and except as provided in Section 7, to the extent that Indemnitee is a party to or a participant in any Proceeding and is successful in such Proceeding
or in defense of any claim, issue or matter therein, the Company shall indemnify Indemnitee against all Expenses actually and reasonably incurred by
him or her in connection therewith. If Indemnitee is not wholly successful in such Proceeding but is successful as to one or more but less than all
claims, issues or matters in such Proceeding, the Company shall indemnify Indemnitee against all Expenses actually and reasonably incurred by
Indemnitee or on his or her behalf in connection with each successfully resolved claim, issue or matter. For purposes of this Section and without
limitation, the termination of any claim, issue or matter in such a Proceeding by dismissal, with or without prejudice, shall be deemed to be a successful
result as to such claim, issue or matter.

Section 6.  Reimbursement for Expenses of a Witness or in Response to a Subpoena. Notwithstanding any other provision of this Agreement, to
the extent that Indemnitee, by reason of his or her Corporate Status, (i) is a witness in any Proceeding to which Indemnitee is not a party and is not
threatened to be made a party or (ii) receives a subpoena with respect to any Proceeding to which Indemnitee is not a party and is not threatened to be
made a party, the Company shall reimburse Indemnitee for all Expenses actually and reasonably incurred by him or her or on his or her behalf in
connection therewith.

Section 7.  Exclusions. Notwithstanding any provision in this Agreement to the contrary, the Company shall not be obligated under this
Agreement:

(a) to indemnify for amounts otherwise indemnifiable hereunder (or for which advancement is provided hereunder) if and to the extent
that Indemnitee has otherwise actually received such amounts under any insurance policy, contract, agreement or otherwise;

(b) to indemnify for an accounting of profits made from the purchase and sale (or sale and purchase) by Indemnitee of securities of the
Company within the meaning of Section 16(b) of the Securities Exchange Act of 1934, as amended, or similar provisions of state statutory law or
common law, or from the purchase or sale by Indemnitee of such securities in violation of Section 306 of the Sarbanes-Oxley Act of 2002, as amended
(“SOX”).
(c) to indemnify for any reimbursement of, or payment to, the Company by Indemnitee of any bonus or other incentive-based or equity-based compensation or of any profits realized by Indemnitee from the sale of securities of the Company pursuant to Section 304 of SOX or any formal policy of the Company adopted by the Board (or a committee thereof), or any other remuneration paid to Indemnitee if it shall be determined by a final judgment or other final adjudication that such remuneration was in violation of law;

(d) to indemnify with respect to any Proceeding, or part thereof, brought by Indemnitee against the Company, any legal entity which it controls, any director or officer thereof or any third party, unless (i) the Board has consented to the initiation of such Proceeding or part thereof and (ii) the Company provides the indemnification, in its sole discretion, pursuant to the powers vested in the Company under applicable law; provided, however, that this Section 7(d) shall not apply to (A) counterclaims or affirmative defenses asserted by Indemnitee in an action brought against Indemnitee or (B) any action brought by Indemnitee for indemnification or advancement from the Company under this Agreement or under any directors’ and officers’ liability insurance policies maintained by the Company in the suit for which indemnification or advancement is being sought as described in Section 12; or

(e) to provide any indemnification or advancement of expenses that is prohibited by applicable law (as such law exists at the time payment would otherwise be required pursuant to this Agreement).

Section 8. Advancement of Expenses. Subject to Section 9(b), the Company shall advance, to the extent not prohibited by law, the Expenses incurred by Indemnitee in connection with any Proceeding, and such advancement shall be made as incurred, and such advancement shall be made within thirty (30) days after the receipt by the Company of a statement or statements requesting such advances (including any invoices received by Indemnitee, which such invoices may be redacted as necessary to avoid the waiver of any privilege accorded by applicable law) from time to time, whether prior to or after final disposition of any Proceeding. Advances shall be unsecured and interest free. Advances shall be made without regard to Indemnitee’s (i) ability to repay the expenses, (ii) ultimate entitlement to indemnification under the other provisions of this Agreement, and (iii) entitlement to and availability of insurance coverage, including advancement, payment or reimbursement of defense costs, expenses of covered loss under the provisions of any applicable insurance policy (including, without limitation, whether such advancement, payment or reimbursement is withheld, conditioned or delayed by the insurer(s)). Indemnitee shall qualify for advances upon the execution and delivery to the Company of this Agreement which shall constitute an undertaking providing that Indemnitee undertakes to the fullest extent required by law to repay the advance if and to the extent that it is ultimately determined by a court of competent jurisdiction in a final judgment, not subject to appeal, that Indemnitee is not entitled to be indemnified by the Company. The right to advances under this paragraph shall in all events continue until final disposition of any Proceeding, including any appeal therein. Nothing in this Section 8 shall limit Indemnitee’s right to advancement pursuant to Section 12(e) of this Agreement.

(a) To obtain indemnification under this Agreement, Indemnitee shall submit to the Company a written request therefor specifying the basis for the claim, the amounts for which Indemnitee is seeking payment under this Agreement, and all documentation related thereto as reasonably requested by the Company.

(b) In the event that the Company shall be obligated hereunder to provide indemnification for or make any advancement of Expenses with respect to any Proceeding, the Company shall be entitled to assume the defense of such Proceeding, or any claim, issue or matter therein, with counsel approved by Indemnitee (which approval shall not be unreasonably withheld or delayed) upon the delivery to Indemnitee of written notice of the Company’s election to do so. After delivery of such notice, approval of such counsel by Indemnitee and the retention of such counsel by the Company, the Company will not be liable to Indemnitee under this Agreement for any fees or expenses of separate counsel subsequently employed by or on behalf of Indemnitee with respect to the same Proceeding; provided that (i) Indemnitee shall have the right to employ separate counsel in any such Proceeding at Indemnitee’s expense and (ii) if (A) the employment of separate counsel by Indemnitee has been previously authorized by the Company, (B) Indemnitee shall have reasonably concluded that there may be a conflict of interest between the Company and Indemnitee in the conduct of such defense, or (C) the Company shall not continue to retain such counsel to defend such Proceeding, then the fees and expenses actually and reasonably incurred by Indemnitee with respect to his or her separate counsel shall be Expenses hereunder.

(c) In the event that the Company does not assume the defense in a Proceeding pursuant to paragraph (b) above, then the Company will be entitled to participate in the Proceeding at its own expense.

(d) The Company shall not be liable to indemnify Indemnitee under this Agreement for any amounts paid in settlement of any Proceeding effected without its prior written consent (which consent shall not be unreasonably withheld or delayed). The Company shall not, without the prior written consent of Indemnitee (which consent shall not be unreasonably withheld or delayed), enter into any settlement which (i) includes an admission of fault of Indemnitee, any non-monetary remedy imposed on Indemnitee or any monetary damages for which Indemnitee is not wholly and actually indemnified hereunder or (ii) with respect to any Proceeding with respect to which Indemnitee may be or is made a party or may be otherwise entitled to seek indemnification hereunder, does not include the full release of Indemnitee from all liability in respect of such Proceeding.

Section 10. Procedure Upon Application for Indemnification.1

(a) Upon written request by Indemnitee for indemnification pursuant to Section 9(a), a determination, if such determination is required by applicable law, with respect to Indemnitee’s entitlement to indemnification hereunder shall be made in the specific case by one of the following methods: [(x) if a Change in Control shall have occurred and indemnification is being requested by Indemnitee hereunder in his or her capacity as a director of the Company, by Independent Counsel in a written opinion to the Board; or (y) in any other case,] (i) by a majority

1 Bracketed portions for CEO Director version only

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vote of the disinterested directors, even though less than a quorum; (ii) by a committee of disinterested directors designated by a majority vote of the disinterested directors, even though less than a quorum; or (iii) if there are no disinterested directors or if the disinterested directors so direct, by Independent Counsel in a written opinion to the Board. For purposes hereof, disinterested directors are those members of the Board who are not parties to the action, suit or proceeding in respect of which indemnification is sought. In the case that such determination is made by Independent Counsel, a copy of Independent Counsel’s written opinion shall be delivered to Indemnitee and, if it is so determined that Indemnitee is entitled to indemnification, payment to Indemnitee shall be made within thirty (30) days after such determination. Indemnitee shall cooperate with the Independent Counsel or the Company, as applicable, in making such determination with respect to Indemnitee’s entitlement to indemnification, including providing to such counsel or the Company, upon reasonable advance request, any documentation or information which is not privileged or otherwise protected from disclosure and which is reasonably available to Indemnitee and reasonably necessary to such determination. Any out-of-pocket costs or expenses (including reasonable attorneys’ fees and disbursements) actually and reasonably incurred by Indemnitee in so cooperating with the Independent Counsel or the Company shall be borne by the Company (irrespective of the determination as to Indemnitee’s entitlement to indemnification) and the Company hereby indemnifies and agrees to hold Indemnitee harmless therefrom.

(b) If the determination of entitlement to indemnification is to be made by Independent Counsel pursuant to Section 10(a), the Independent Counsel shall be selected by the Board; [provided that, if a Change in Control shall have occurred and indemnification is being requested by Indemnitee hereunder in his or her capacity as a director of the Company, the Independent Counsel shall be selected by Indemnitee.] Indemnitee [or the Company, as the case may be,] may, within ten (10) days after written notice of such selection, deliver to the Company [or Indemnitee, as the case may be,] a written objection to such selection; [provided, however, that such objection may be asserted only on the ground that the Independent Counsel so selected does not meet the requirements of “Independent Counsel” as defined in Section 2 of this Agreement, and the objection shall set forth with particularity the factual basis of such assertion. Absent a proper and timely objection, the person so selected shall act as Independent Counsel. If such written objection is so made and substantiated, the Independent Counsel so selected may not serve as Independent Counsel unless and until such objection is withdrawn or the Delaware Court has determined that such objection is without merit. If, within twenty (20) days after the later of (i) submission by Indemnitee of a written request for indemnification pursuant to Section 9(a), and (ii) the final disposition of the Proceeding, including any appeal therein, no Independent Counsel shall have been selected without objection, either Indemnitee or the Company may petition the Delaware Court for resolution of any objection which shall have been made by Indemnitee or the Company to the selection of Independent Counsel and/or for the appointment as Independent Counsel of a person selected by the court or by such other person as the court shall designate. The person with respect to whom all objections are so resolved or the person so appointed shall act as Independent Counsel under Section 10(a) hereof. Upon the due commencement of any judicial proceeding or arbitration pursuant to Section 12(a) of this Agreement, Independent Counsel shall be discharged and relieved of any further responsibility in such capacity (subject to the applicable standards of professional conduct then prevailing).]
Section 11. Presumptions and Effect of Certain Proceedings

(a) To the extent permitted by applicable law, in making a determination with respect to entitlement to indemnification hereunder, it shall be presumed that Indemnitee is entitled to indemnification under this Agreement if Indemnitee has submitted a request for indemnification in accordance with Section 9(a) of this Agreement, and the Company shall have the burden of proof to overcome that presumption in connection with the making of any determination contrary to that presumption. Neither (i) the failure of the Company or of Independent Counsel to have made a determination prior to the commencement of any action pursuant to this Agreement that indemnification is proper in the circumstances because Indemnitee has met the applicable standard of conduct, nor (ii) an actual determination by the Company or by Independent Counsel that Indemnitee has not met such applicable standard of conduct, shall be a defense to the action or create a presumption that Indemnitee has not met the applicable standard of conduct.

(b) The termination of any Proceeding or of any claim, issue or matter therein, by judgment, order, settlement or conviction, or upon a plea of guilty, nolo contendere or its equivalent, shall not (except as otherwise expressly provided in this Agreement) of itself adversely affect the right of Indemnitee to indemnification or create a presumption that Indemnitee did not act in good faith and in a manner which he or she reasonably believed to be in or not opposed to the best interests of the Company or, with respect to any criminal Proceeding, that Indemnitee had reasonable cause to believe that his or her conduct was unlawful.

(c) The knowledge and/or actions, or failure to act, of any director, manager, partner, officer, employee, agent or trustee of the Company, any subsidiary of the Company, or any Enterprise shall not be imputed to Indemnitee for purposes of determining the right to indemnification under this Agreement.

Section 12. Remedies of Indemnitee

(a) Subject to Section 12(f), in the event that (i) a determination is made pursuant to Section 10 of this Agreement that Indemnitee is not entitled to indemnification under this Agreement, (ii) advancement of Expenses is not timely made pursuant to Section 8 of this Agreement, (iii) no determination of entitlement to indemnification shall have been made pursuant to Section 10(a) of this Agreement within sixty (60) days after receipt by the Company of the request for indemnification for which a determination is to be made other than by Independent Counsel, (iv) payment of indemnification or reimbursement of expenses is not made pursuant to Section 5 or 6 or the last sentence of Section 10(a) of this Agreement within thirty (30) days after receipt by the Company of a written request therefor (including any invoices received by Indemnitee, which such invoices may be redacted as necessary to avoid the waiver of any privilege accorded by applicable law) or (v) payment of indemnification pursuant to Section 3 or 4 of this Agreement is not made within thirty (30) days after a determination has been made that Indemnitee is entitled to indemnification, Indemnitee shall be entitled to an adjudication by the Delaware Court of his or her entitlement to such indemnification or advancement. Alternatively, Indemnitee, at his or her option, may seek an award in arbitration to be conducted by a single arbitrator pursuant to the Commercial Arbitration Rules of the
American Arbitration Association. Indemnitee shall commence such proceeding seeking an adjudication or an award in arbitration within 180 days following the date on which Indemnitee first has the right to commence such proceeding pursuant to this Section 12(a); provided, however, that the foregoing time limitation shall not apply in respect of a proceeding brought by Indemnitee to enforce his or her rights under Section 5 of this Agreement. The Company shall not oppose Indemnitee’s right to seek any such adjudication or award in arbitration.

(b) In the event that a determination shall have been made pursuant to Section 10(a) of this Agreement that Indemnitee is not entitled to indemnification, any judicial proceeding or arbitration commenced pursuant to this Section 12 shall be conducted in all respects as a de novo trial, or arbitration, on the merits and Indemnitee shall not be prejudiced by reason of that adverse determination. In any judicial proceeding or arbitration commenced pursuant to this Section 12, the Company shall have the burden of proving Indemnitee is not entitled to indemnification or advancement, as the case may be.

(c) If a determination shall have been made pursuant to Section 10(a) of this Agreement that Indemnitee is entitled to indemnification, the Company shall be bound by such determination in any judicial proceeding or arbitration commenced pursuant to this Section 12, absent (i) a misstatement by Indemnitee of a material fact, or an omission of a material fact necessary to make Indemnitee’s statement not materially misleading, in connection with the request for indemnification, or (ii) a prohibition of such indemnification under applicable law.

(d) The Company shall be precluded from asserting in any judicial proceeding or arbitration commenced pursuant to this Section 12 that the procedures and presumptions of this Agreement are not valid, binding and enforceable and shall stipulate in any such court or before any such arbitrator that the Company is bound by all the provisions of this Agreement.

(e) The Company shall indemnify Indemnitee to the fullest extent permitted by law against any and all Enforcement Expenses and, if requested by Indemnitee, shall (within thirty (30) days after receipt by the Company of a written request therefor) advance, to the extent not prohibited by law, such Enforcement Expenses to Indemnitee, which are incurred by Indemnitee in connection with any action brought by Indemnitee for indemnification or advancement from the Company under this Agreement or under any directors’ and officers’ liability insurance policies maintained by the Company in the suit for which indemnification or advancement is being sought. Such written request for advancement shall include invoices received by Indemnitee in connection with such Enforcement Expenses but, in the case of invoices in connection with legal services, any references to legal work performed or to expenditures made that would cause Indemnitee to waive any privilege accorded by applicable law need not be included with the invoice.

(f) Notwithstanding anything in this Agreement to the contrary, no determination as to entitlement to indemnification under this Agreement shall be required to be made prior to the final disposition of the Proceeding, including any appeal therein.
Section 13. Non-exclusivity; Survival of Rights; Insurance; Subrogation.

(a) The rights of indemnification and to receive advancement as provided by this Agreement shall not be deemed exclusive of any other rights to which Indemnitee may at any time be entitled under applicable law, the Charter, the Bylaws, any agreement, a vote of stockholders or a resolution of directors, or otherwise. No amendment, alteration or repeal of this Agreement or of any provision hereof shall limit or restrict any right of Indemnitee under this Agreement in respect of any action taken or omitted by such Indemnitee in his or her Corporate Status prior to such amendment, alteration or repeal. To the extent that a change in Delaware law, whether by statute or judicial decision, permits greater indemnification or advancement than would be afforded currently under the Charter, Bylaws and this Agreement, it is the intent of the parties hereto that Indemnitee shall enjoy by this Agreement the greater benefits so afforded by such change. No right or remedy herein conferred is intended to be exclusive of any other right or remedy, and every other right and remedy shall be cumulative and in addition to every other right and remedy given hereunder or now or hereafter existing at law or in equity or otherwise. The assertion or employment of any right or remedy hereunder, or otherwise, shall not prevent the concurrent assertion or employment of any other right or remedy.

(b) To the extent that the Company maintains an insurance policy or policies providing liability insurance for directors, managers, partners, officers, employees, agents or trustees of the Company or of any other Enterprise, Indemnitee shall be covered by such policy or policies in accordance with its or their terms to the maximum extent of the coverage available for any such director, manager, partner, officer, employee, agent or trustee under such policy or policies. If, at the time of the receipt of a notice of a claim pursuant to the terms hereof, the Company has director and officer liability insurance in effect, the Company shall give prompt notice of the commencement of such proceeding to the insurers in accordance with the procedures set forth in the respective policies. The Company shall thereafter take all necessary or desirable action to cause such insurers to pay, on behalf of Indemnitee, all amounts payable as a result of such proceeding in accordance with the terms of such policies.

(c) In the event of any payment under this Agreement, the Company shall be subrogated to the extent of such payment to all of the rights of recovery of Indemnitee, who shall execute all papers required and take all action necessary to secure such rights, including execution of such documents as are necessary to enable the Company to bring suit to enforce such rights.

(d) The Company’s obligation to provide indemnification or advancement hereunder to Indemnitee who is or was serving at the request of the Company as a director, manager, partner, officer, employee, agent or trustee of any other Enterprise shall be reduced by any amount Indemnitee has actually received as indemnification or advancement from such other Enterprise.

Section 14. Duration of Agreement. This Agreement shall continue until and terminate upon the later of: (a) ten (10) years after the date that Indemnitee shall have ceased to serve as [both a director and] an officer of the Company or (b) one (1) year after the final termination of any Proceeding, including any appeal, then pending in respect of which Indemnitee is granted rights of indemnification or advancement hereunder and of any proceeding.
commenced by Indemnitee pursuant to Section 12 of this Agreement relating thereto. This Agreement shall be binding upon the Company and its successors and assigns and shall inure to the benefit of Indemnitee and his or her heirs, executors and administrators. The Company shall require and cause any successor (whether direct or indirect by purchase, merger, consolidation or otherwise) to all, substantially all or a substantial part, of the business and/or assets of the Company, by written agreement in form and substance satisfactory to Indemnitee, expressly to assume and agree to perform this Agreement in the same manner and to the same extent that the Company would be required to perform if no such succession had taken place.

Section 15. **Severability.** If any provision or provisions of this Agreement shall be held to be invalid, illegal or unenforceable for any reason whatsoever: (a) the validity, legality and enforceability of the remaining provisions of this Agreement (including, without limitation, each portion of any section of this Agreement containing any such provision held to be invalid, illegal or unenforceable, that is not itself invalid, illegal or unenforceable) shall not in any way be affected or impaired thereby and shall remain enforceable to the fullest extent permitted by law; (b) such provision or provisions shall be deemed reformed to the extent necessary to conform to applicable law and to give the maximum effect to the intent of the parties hereto; and (c) to the fullest extent possible, the provisions of this Agreement (including, without limitation, each portion of any section of this Agreement containing any such provision held to be invalid, illegal or unenforceable, that is not itself invalid, illegal or unenforceable) shall be construed so as to give effect to the intent manifested thereby.

Section 16. **Enforcement.**

(a) The Company expressly confirms and agrees that it has entered into this Agreement and assumed the obligations imposed on it hereby in order to induce Indemnitee to serve or continue to serve as [a director and] an officer of the Company, and the Company acknowledges that Indemnitee is relying upon this Agreement in serving as [a director and] an officer of the Company.

(b) This Agreement constitutes the entire agreement between the parties hereto with respect to the subject matter hereof and supersedes all prior agreements and understandings, oral, written and implied, between the parties hereto with respect to the subject matter hereof; provided, however, that this Agreement is a supplement to and in furtherance of the Charter, the Bylaws and applicable law, and shall not be deemed a substitute therefor, nor to diminish or abrogate any rights of Indemnitee thereunder.

Section 17. **Modification and Waiver.** No supplement, modification or amendment, or waiver of any provision, of this Agreement shall be binding unless executed in writing by the parties thereto. No waiver of any of the provisions of this Agreement shall be deemed or shall constitute a waiver of any other provisions of this Agreement nor shall any waiver constitute a continuing waiver. No supplement, modification or amendment of this Agreement or of any provision hereof shall limit or restrict any right of Indemnitee under this Agreement in respect of any action taken or omitted by such Indemnitee prior to such supplement, modification or amendment.
Section 18. Notice by Indemnitee. Indemnitee agrees promptly to notify the Company in writing upon being served with any summons, citation, subpoena, complaint, indictment, information or other document relating to any Proceeding or matter which may be subject to indemnification, reimbursement or advancement as provided hereunder. The failure of Indemnitee to so notify the Company shall not relieve the Company of any obligation which it may have to Indemnitee under this Agreement or otherwise.

Section 19. Notices. All notices, requests, demands and other communications under this Agreement shall be in writing and shall be deemed to have been duly given if (i) delivered by hand and receipted for by the party to whom said notice or other communication shall have been directed, (ii) mailed by certified or registered mail with postage prepaid, on the third business day after the date on which it is so mailed, (iii) mailed by reputable overnight courier and receipted for by the party to whom said notice or other communication shall have been directed or (iv) sent by facsimile transmission, with receipt of oral confirmation that such transmission has been received:

(a) If to Indemnitee, at such address as Indemnitee shall provide to the Company.

(b) If to the Company:

   Moderna, Inc.
   200 Technology Square
   Cambridge, Massachusetts 02139
   Attention: Chief Executive Officer

or to any other address as may have been furnished to Indemnitee by the Company.

Section 20. Contribution. To the fullest extent permissible under applicable law, if the indemnification provided for in this Agreement is unavailable to Indemnitee for any reason whatsoever, the Company, in lieu of indemnifying Indemnitee, shall contribute to the amount incurred by Indemnitee, whether for judgments, fines, penalties, excise taxes, amounts paid or to be paid in settlement and/or for Expenses, in connection with any Proceeding in such proportion as is deemed fair and reasonable in light of all of the circumstances in order to reflect (i) the relative benefits received by the Company and Indemnitee in connection with the event(s) and/or transaction(s) giving rise to such Proceeding; and/or (ii) the relative fault of the Company (and its directors, officers, employees and agents) and Indemnitee in connection with such event(s) and/or transactions.

Section 21. Internal Revenue Code Section 409A. The Company intends for this Agreement to comply with the Indemnification exception under Section 1.409A-1(b)(10) of the regulations promulgated under the Internal Revenue Code of 1986, as amended (the “Code”), which provides that indemnification of, or the purchase of an insurance policy providing for payments of, all or part of the expenses incurred or damages paid or payable by Indemnitee with respect to a bona fide claim against Indemnitee or the Company do not provide for a deferral of compensation, subject to Section 409A of the Code, where such claim is based on actions or failures to act by Indemnitee in his or her capacity as a service provider of the Company. The parties intend that this Agreement be interpreted and construed with such intent.
Section 22. **Applicable Law and Consent to Jurisdiction.** This Agreement and the legal relations among the parties shall be governed by, and construed and enforced in accordance with, the laws of the State of Delaware, without regard to its conflict of laws rules. Except with respect to any arbitration commenced by Indemnitee pursuant to Section 12(a) of this Agreement, the Company and Indemnitee hereby irrevocably and unconditionally (i) agree that any action or proceeding arising out of or in connection with this Agreement shall be brought only in the Delaware Court, and not in any other state or federal court in the United States of America or any court in any other country, (ii) consent to submit to the exclusive jurisdiction of the Delaware Court for purposes of any action or proceeding arising out of or in connection with this Agreement, (iii) consent to service of process at the address set forth in Section 19 of this Agreement with the same legal force and validity as if served upon such party personally within the State of Delaware, (iv) waive any objection to the laying of venue of any such action or proceeding in the Delaware Court, and (v) waive, and agree not to plead or to make, any claim that any such action or proceeding brought in the Delaware Court has been brought in an improper or inconvenient forum.

Section 23. **Headings.** The headings of the paragraphs of this Agreement are inserted for convenience only and shall not be deemed to constitute part of this Agreement or to affect the construction thereof.

Section 24. **Identical Counterparts.** This Agreement may be executed in one or more counterparts, each of which shall for all purposes be deemed to be an original but all of which together shall constitute one and the same Agreement. Only one such counterpart signed by the party against whom enforceability is sought needs to be produced to evidence the existence of this Agreement.

[Remainder of Page Intentionally Left Blank]
IN WITNESS WHEREOF, the parties have caused this Agreement to be signed as of the day and year first above written.

MODERNA, INC.

By: ________________________________
Name: ______________________________
Title: _______________________________

[Name of Indemnitee]
MODERNA, INC.

2018 EMPLOYEE STOCK PURCHASE PLAN

The purpose of the Moderna, Inc. 2018 Employee Stock Purchase Plan (“the Plan”) is to provide eligible employees of Moderna, Inc. (the “Company”) and each Designated Company (as defined in Section 11) with opportunities to purchase shares of the Company’s common stock, par value $0.001 per share (the “Common Stock”). An aggregate of 810,000 shares of Common Stock have been approved and reserved for this purpose, plus on January 1, 2020 and each January 1 thereafter, the number of shares of Common Stock reserved and available for issuance under the Plan shall be cumulatively increased by the lesser of (i) 3,240,000 shares of Common Stock, (ii) one percent of the number of shares of Common Stock of the Company issued and outstanding on the immediately preceding December 31 or (iii) such lesser number of shares of Common Stock as determined by the Administrator.

The Plan includes two components: a Code Section 423 Component (the “423 Component”) and a non-Code Section 423 Component (the “Non-423 Component”). It is intended for the 423 Component to constitute an “employee stock purchase plan” within the meaning of Section 423(b) of the U.S. Internal Revenue Code of 1986, as amended (the “Code”) and the 423 Component shall be interpreted in accordance with that intent (although the Company makes no undertaking or representation to maintain such qualification). In addition, this Plan authorizes the grant of options under the Non-423 Component that does not qualify as an “employee stock purchase plan” under Section 423 of the Code. Except as otherwise provided herein, the Non-423 Component will operate and be administered in the same manner as the 423 Component.
1. **Administration.** The Plan will be administered by the person or persons (the “Administrator”) appointed by the Company’s Board of Directors (the “Board”) for such purpose. The Administrator has authority at any time to: (i) adopt, alter and repeal such rules, subplans, guidelines and practices for the administration and operation of the Plan and for its own acts and proceedings as it shall deem advisable, including to accommodate the specific requirements of local laws, regulations and procedures for jurisdictions outside of the United States; (ii) interpret the terms and provisions of the Plan; (iii) make all determinations it deems advisable for the administration of the Plan; (iv) decide all disputes arising in connection with the Plan; and (v) otherwise supervise the administration of the Plan. All interpretations and decisions of the Administrator shall be binding on all persons, including the Company and the Participants. No member of the Board or individual exercising administrative authority with respect to the Plan shall be liable for any action or determination made in good faith with respect to the Plan or any option granted hereunder.

2. **Offerings.** The Company will make one or more offerings to eligible employees to purchase Common Stock under the Plan (“Offerings”). Unless otherwise determined by the Administrator, an Offering will begin on the first business day occurring on or after each June 1 and December 1 and will end on the last business day occurring on or before the following November 30th and May 30, respectively. The Administrator may, in its discretion, designate a different period for any Offering, provided that no Offering shall exceed 27 months in duration or overlap any other Offering.
3. **Eligibility.** All individuals classified as employees on the payroll records of the Company and each Designated Company are eligible to participate in any one or more of the Offerings under the Plan, provided that as of the first day of the applicable Offering (the “Offering Date”) they are customarily employed by the Company or a Designated Company for more than 20 hours a week, unless the exclusion of employees who do not meet this requirement is not permissible under applicable law, and have completed at least 30 days of employment. Notwithstanding any other provision herein, individuals who are not contemporaneously classified as employees of the Company or a Designated Company for purposes of the Company’s or applicable Designated Company’s payroll system are not considered to be eligible employees of the Company or any Designated Company and shall not be eligible to participate in the Plan. In the event any such individuals are reclassified as employees of the Company or a Designated Company for any purpose, including, without limitation, common law or statutory employees, by any action of any third party, including, without limitation, any government agency, or as a result of any private lawsuit, action or administrative proceeding, such individuals shall, notwithstanding such reclassification, remain ineligible for participation. Notwithstanding the foregoing, the exclusive means for individuals who are not contemporaneously classified as employees of the Company or a Designated Company on the Company’s or Designated Company’s payroll system to become eligible to participate in a plan which is equivalent to this Plan is through the adoption of a subplan, which specifically renders such individuals eligible to participate therein.
4. **Participation**

(a) **Participants.** An eligible employee who is not a Participant in any prior Offering may participate in a subsequent Offering by submitting (either in electronic or written form, according to procedures established by the Company) an enrollment form to his or her appropriate payroll location at least 15 business days before the Offering Date (or by such other deadline as shall be established by the Administrator for the Offering).

(b) **Enrollment.** The enrollment form will (a) state a whole percentage to be contributed from an eligible employee’s Compensation (as defined in Section 11) per pay period, (b) authorize the purchase of Common Stock in each Offering in accordance with the terms of the Plan and (c) specify the exact name or names in which shares of Common Stock purchased for such individual are to be issued or transferred pursuant to Section 10. An employee who does not enroll in accordance with these procedures will be deemed to have waived the right to participate. Unless a Participant submits (either in electronic or written form, according to procedures established by the Company) a new enrollment form or withdraws from the Plan, such Participant’s contributions and purchases will continue at the same percentage of Compensation for future Offerings, provided he or she remains eligible.

(c) Notwithstanding the foregoing, participation in the Plan will neither be permitted nor be denied contrary to the requirements of the Code and any applicable law.

5. **Employee Contributions.** Each eligible employee may authorize payroll deductions at a minimum of 1 percent up to a maximum of 50 percent of such employee’s Compensation for each pay period; provided, however, that if payroll deductions are not permitted or problematic under applicable law or for administrative reasons, the Company, in its discretion, may allow eligible employees to contribute to the Plan by other means. The Company will maintain book accounts showing the amount of payroll deductions or other contributions made by each Participant for each Offering. No interest will accrue or be paid on payroll deductions or other contributions, unless required under applicable law.
6. **Contribution Changes.** Except as may be determined by the Administrator in advance of an Offering, a Participant may not increase or decrease his or her payroll deduction during any Offering, but may increase or decrease his or her contributions with respect to the next Offering (subject to the limitations of Section 5) by submitting (either in electronic or written form, according to procedures established by the Company) a new enrollment form at least 15 business days before the next Offering Date (or by such other deadline as shall be established by the Administrator for the Offering). The Administrator may, in advance of any Offering, establish rules permitting a Participant to increase, decrease or terminate his or her contributions during an Offering.

7. **Withdrawal.** A Participant may withdraw from participation in the Plan by submitting a notice of withdrawal to his or her appropriate payroll location (either in electronic or written form, according to procedures established by the Company). The Participant’s withdrawal will be effective as of the next business day. Following a Participant’s withdrawal, the Company will promptly refund such individual’s entire account balance under the Plan to him or her (after payment for any Common Stock purchased before the effective date of withdrawal). Partial withdrawals are not permitted. Such an employee may not begin participation again during the remainder of the Offering, but may enroll in a subsequent Offering in accordance with Section 4.
8. **Grant of Options.** On each Offering Date, the Company will grant to each eligible employee who is then a Participant in the Plan an option ("Option") to purchase on the last day of such Offering (the "Exercise Date"), at the Option Price hereinafter provided for, the lowest of (a) a number of shares of Common Stock determined by dividing such Participant’s accumulated contributions on such Exercise Date by the lower of (i) 85 percent of the Fair Market Value of the Common Stock on the Offering Date, or (ii) 85 percent of the Fair Market Value of the Common Stock on the Exercise Date, (b) 3,000 shares; or (c) such other lesser maximum number of shares as shall have been established by the Administrator in advance of the Offering; provided, however, that such Option shall be subject to the limitations set forth below. Each Participant’s Option shall be exercisable only to the extent of such Participant’s accumulated payroll deductions and/or other contributions on the Exercise Date. The purchase price for each share purchased under each Option (the “Option Price”) will be 85 percent of the Fair Market Value of the Common Stock on the Offering Date or the Exercise Date, whichever is less.

Notwithstanding the foregoing, no Participant may be granted an Option hereunder if such Participant, immediately after the Option was granted, would be treated as owning stock possessing 5 percent or more of the total combined voting power or value of all classes of stock of the Company or any Parent or Subsidiary (as defined in Section 11). For purposes of the preceding sentence, the attribution rules of Section 424(d) of the Code shall apply in determining the stock ownership of a Participant, and all stock which the Participant has a contractual right to purchase shall be treated as stock owned by the Participant. In addition, no Participant may be granted an Option which permits his or her rights to purchase stock under the Plan, and any other employee stock purchase plan of the Company and its Parents and Subsidiaries, to accrue at a rate which exceeds $25,000 of the fair market value of such stock (determined on the Option grant date or dates) for each calendar year in which the Option is outstanding at any time. The purpose of the limitation in the preceding sentence is to comply with Section 423(b)(8) of the Code and shall be applied taking Options into account in the order in which they were granted.
9. **Exercise of Option and Purchase of Shares.** Each employee who continues to be a Participant in the Plan on the Exercise Date shall be deemed to have exercised his or her Option on such date and shall acquire from the Company such number of whole shares of Common Stock reserved for the purpose of the Plan as his or her accumulated contributions on such date will purchase at the Option Price, subject to any other limitations contained in the Plan. Any amount remaining in a Participant’s account at the end of an Offering solely by reason of the inability to purchase a fractional share will be carried forward to the next Offering; any other balance remaining in a Participant’s account at the end of an Offering will be refunded to the Participant promptly.

If a Participant has more than one Option outstanding under the Plan, unless he or she otherwise indicates in agreements or notices delivered hereunder: (i) each agreement or notice delivered by that Participant shall be deemed to apply to all of his or her Options under the Plan; and (ii) an Option with a lower Option Price (or an earlier granted Option, if different Options have identical Option Prices) shall be exercised to the fullest possible extent before an Option with a higher Option Price (or a later granted Option if different Options have identical Option Prices) shall be exercised.

10. **Issuance of Certificates.** Certificates, or book entries for uncertificated shares, representing shares of Common Stock purchased under the Plan may be issued only in the name of the employee or, if permitted by the Administrator, in the name of the employee and another person of legal age as joint tenants with rights of survivorship, or in the name of a broker authorized by the employee to be his, her or their, nominee for such purpose.
11. **Definitions.**

The term “Affiliate” means any entity that is directly or indirectly controlled by the Company which does not meet the definition of a Subsidiary below, as determined by the Administrator, whether new or hereafter existing.

The term “Compensation” means the amount of base pay, prior to salary reduction pursuant to Sections 125, 132(f) or 401(k) of the Code or comparable reductions under laws outside the United States, but excluding overtime, commissions, incentive or bonus awards, allowances and reimbursements for expenses such as relocation allowances or travel expenses, income or gains on the exercise, vesting or settlement of Company equity incentive awards, and similar items. The Administrator shall have the discretion to determine the application of this definition to Participants outside of the United States.

The term “Designated Company” means any present or future Affiliate or Subsidiary (as defined below) that has been designated by the Administrator to participate in the Plan. The Administrator may so designate any Affiliate or Subsidiary, or revoke any such designation, at any time and from time to time, either before or after the Plan is approved by the stockholders and may further designate such companies as participating in the 423 Component or the Non-423 Component. For purposes of the 423 Component, only Subsidiaries may be Designated Companies. The current list of Designated Companies is attached hereto as Appendix A.
The term “Fair Market Value of the Common Stock” on any given date means the fair market value of the Common Stock determined in good faith by the Administrator; provided, however, that if the Common Stock is admitted to quotation on the Nasdaq Global Market or another national securities exchange, the determination shall be made by reference to the closing price on such date. If there is no closing price for such date, the determination shall be made by reference to the last date preceding such date for which there is a closing price.

The term “Initial Public Offering” means the first day when trading prices for the Common Stock are reported on Nasdaq Global Market or another national securities exchange, pursuant to an effective registration statement under the U.S. Securities Act of 1933, as amended, covering the offer and sale by the Company of its Common Stock.

The term “Parent” means a “parent corporation” with respect to the Company, as defined in Section 424(e) of the Code.

The term “Participant” means an individual who is eligible as determined in Section 3 and who has complied with the provisions of Section 4.

The term “Subsidiary” means a “subsidiary corporation” with respect to the Company, as defined in Section 424(f) of the Code.

12. Rights on Termination of Employment. Unless otherwise required by applicable law, if a Participant’s employment terminates for any reason before the Exercise Date for any Offering, no contributions will be taken from any pay due and owing to the Participant and the balance in the Participant’s account will be paid to such Participant or, in the case of such Participant’s death, if permitted by the Administrator, to his or her designated beneficiary as if such Participant had withdrawn from the Plan under Section 7. An employee will be deemed to have terminated employment, for this purpose, if the corporation that employs him or her, having
been a Designated Company, ceases to be an Affiliate or a Subsidiary, as applicable, or if the employee is transferred to any corporation other than the Company or a Designated Company. An employee will not be deemed to have terminated employment for this purpose, if the employee is on an approved leave of absence for military service or sickness or for any other purpose approved by the Company, if the employee’s right to reemployment is guaranteed either by a statute or by contract or under the policy pursuant to which the leave of absence was granted or if the Administrator otherwise provides in writing.

13. Special Rules. Notwithstanding anything herein to the contrary, the Administrator may adopt special rules applicable to the employees of a particular Designated Company, whenever the Administrator determines that such rules are necessary or appropriate for the implementation of the Plan in a jurisdiction where such Designated Company has employees; provided that if such rules are inconsistent with the requirements of Section 423(b) of the Code, these employees will participate in the Non-423 Component. Any special rules established pursuant to this Section 13 shall, to the extent possible, result in the employees subject to such rules having substantially the same rights as other Participants in the Plan.

14. Optionees Not Stockholders. Neither the granting of an Option to a Participant nor the deductions from his or her pay or other contributions shall deem such Participant to be a holder of the shares of Common Stock covered by an Option under the Plan until such shares have been purchased by and issued or transferred to him or her.

15. Rights Not Transferable. Rights under the Plan are not transferable by a Participant other than by will or the laws of descent and distribution, and are exercisable during the Participant’s lifetime only by the Participant.
16. **Application of Funds.** All funds received or held by the Company under the Plan may be combined with other corporate funds and may be used for any corporate purpose; unless otherwise required under applicable law.

17. **Adjustment in Case of Changes Affecting Common Stock.** In the event of a subdivision of outstanding shares of Common Stock, the payment of a dividend in Common Stock or any other change affecting the Common Stock, the number of shares approved for the Plan and the share limitation set forth in Section 8 shall be equitably or proportionately adjusted to give proper effect to such event.

18. **Amendment of the Plan.** The Board may at any time and from time to time amend the Plan in any respect, except that without the approval within 12 months of such Board action by the stockholders, no amendment shall be made increasing the number of shares approved for the Plan or making any other change that would require stockholder approval in order for the 423 Component of the Plan, as amended, to qualify as an “employee stock purchase plan” under Section 423(b) of the Code.

19. **Insufficient Shares.** If the total number of shares of Common Stock that would otherwise be purchased on any Exercise Date plus the number of shares purchased under previous Offerings under the Plan exceeds the maximum number of shares issuable under the Plan, the shares then available shall be apportioned among Participants in proportion to the amount of payroll deductions accumulated on behalf of each Participant that would otherwise be used to purchase Common Stock on such Exercise Date.
20. **Termination of the Plan.** The Plan may be terminated at any time by the Board. Upon termination of the Plan, all amounts in the accounts of Participants shall be promptly refunded. The Plan shall automatically terminated on the ten year anniversary of the date of the Company’s Initial Public Offering.

21. **Compliance with Law.** The Company’s obligation to sell and deliver Common Stock under the Plan is subject to completion of any registration or qualification of the Common Stock under any U.S. or non-U.S. local, state or federal securities or exchange control law or under rulings or regulations of the U.S. Securities and Exchange Commission (“SEC”) or of any other governmental regulatory body, and to obtaining any approval or other clearance from any U.S. and non-U.S. local, state or federal governmental agency, which registration, qualification or approval the Company shall, in its absolute discretion, deem necessary or advisable. The Company is under no obligation to register or qualify the Common Stock with the SEC or any other U.S. or non-U.S. securities commission or to seek approval or clearance from any governmental authority for the issuance or sale of such stock.

22. **Governing Law.** This Plan and all Options and actions taken thereunder shall be governed by, and construed in accordance with the General Corporation Law of the State of Delaware as to matters within the scope thereof, and as to all other matters shall be governed by and construed in accordance with the internal laws of the Commonwealth of Massachusetts, applied without regard to conflict of law principles.

23. **Issuance of Shares.** Shares may be issued upon exercise of an Option from authorized but unissued Common Stock, from shares held in the treasury of the Company, or from any other proper source.

24. **Tax Withholding.** Participation in the Plan is subject to any minimum required tax withholding on income of the Participant in connection with the Plan. Each Participant agrees, by participating in the Plan, that the Company and its Affiliates and Subsidiaries shall
have the right to deduct any Tax Liability from any payment of any kind otherwise due to the Participant, including shares of Common Stock issuable under the Plan. Where a Tax Liability arises in connection with the Plan, the Company and/or a Designated Company may require that, as a condition of exercise of an Option and purchase of shares of Common Stock, a Participant must either:

(a) make a payment to the Company, or otherwise as the Company directs, of an amount equal to the Company’s estimate of the amount of the Tax Liability; or

(b) enter into arrangements acceptable to the Company to secure that such payment is made (whether by surrender of shares of Common Stock, net share issuance, the sale of shares of Common Stock or otherwise).

For these purposes, “Tax Liability” shall mean any amount of U.S. or non-U.S. federal, state or local income tax, social security (or similar) contributions, payroll tax, fringe benefits tax, payment on account and/or other tax-related items related to the participation in the Plan and legally applicable to the Participant, which the Company and/or an Affiliate or Subsidiary become liable to pay on the Participant’s behalf to the relevant authorities in any jurisdiction.

25. Notification Upon Sale of Shares. Each Participant who is subject to tax in the United States with respect to his or her participation in the Plan agrees, by entering the Plan, to give the Company prompt notice of any disposition of shares purchased under the Plan where such disposition occurs within two years after the date of grant of the Option pursuant to which such shares were purchased or within one year after the date such shares were purchased.

26. Effective Date and Approval of Shareholders. The Plan shall take effect on the date immediately preceding the date of the Company’s Initial Public Offering, subject to approval by the holders of a majority of the votes cast at a meeting of stockholders at which a quorum is present or by written consent of the stockholders.
APPENDIX A

Designated Companies

14
# Subsidiaries

<table>
<thead>
<tr>
<th>Subsidiary</th>
<th>Jurisdiction of Incorporation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ModernaTX, Inc.</td>
<td>Delaware</td>
</tr>
<tr>
<td>Modema AB</td>
<td>Sweden</td>
</tr>
<tr>
<td>Brizo Ltd.</td>
<td>Bermuda</td>
</tr>
<tr>
<td>Moderna Securities Inc.</td>
<td>Massachusetts</td>
</tr>
</tbody>
</table>
Consent of Independent Registered Public Accounting Firm

We consent to the reference to our firm under the caption “Experts” and to the use of our report dated August 30, 2018, in the Registration Statement (Form S-1) and related Prospectus of Moderna, Inc. for the registration of its common stock.

/s/ Ernst & Young LLP

Boston, MA
November 9, 2018