INOVIO PHARMACEUTICALS, INC.
Form 10-K
March 12, 2019

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

FORM 10-K

x ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
FOR THE FISCAL YEAR ENDED DECEMBER 31, 2018

OR

¨ TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
FOR THE TRANSITION PERIOD FROM TO

COMMISSION FILE NO. 001-14888

INOVIO PHARMACEUTICALS, INC.
(EXACT NAME OF REGISTRANT AS SPECIFIED IN ITS CHARTER)

DELAWARE	33-0969592
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)
660 W. GERMANTOWN PIKE, SUITE 110 PLYMOUTH MEETING, PENNSYLVANIA	19462
(Address of principal executive offices)	(Zip Code)

REGISTRANT'S TELEPHONE NUMBER, INCLUDING AREA CODE: (267) 440-4200

SECURITIES REGISTERED PURSUANT TO SECTION 12(B) OF THE ACT:

COMMON STOCK, $0.001 PAR VALUE	Nasdaq Global Select Market
(Title of Class)	(Name of Each Exchange on Which Registered)

SECURITIES REGISTERED PURSUANT TO SECTION 12(G) OF THE ACT: NONE

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes ¨ No x
Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes ¨ No x
Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the Registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes x No ¨
Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes x No ¨
Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained, to the best of Registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. x
Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company, or emerging growth company. See definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act. (Check one):
Large accelerated filer ¨ Accelerated filer x

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 pursuant to Section 13(a) of the Exchange Act.

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Act). Yes ¨ No x

The aggregate market value of the voting and non-voting common equity (which consists solely of shares of Common Stock) held by non-affiliates of the Registrant as of June 30, 2018 was approximately $335,998,116 based on $3.92, the closing price on that date of the Registrant's Common Stock on the Nasdaq Global Select Market.

The number of shares outstanding of the Registrant's Common Stock, $0.001 par value, was 97,636,364 as of March 8, 2019.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's definitive proxy statement to be filed with the Commission pursuant to Regulation 14A in connection with the registrant's 2019 Annual Meeting of Stockholders (the "Proxy Statement') are incorporated by reference into Part III of this Report. Such Proxy Statement will be filed with the Commission not later than 120 days after the conclusion of the registrant's fiscal year ended December 31, 2018.

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Unless stated to the contrary, or unless the context otherwise requires, references to "Inovio," "the company," "our company," "our," or "we" in this report include Inovio Pharmaceuticals, Inc. and subsidiaries.

PART I

ITEM 1. BUSINESS

This Annual Report on Form 10-K (including the following section regarding Management's Discussion and Analysis of Financial Condition and Results of Operations), or this Annual Report, contains forward-looking statements regarding our business, financial condition, results of operations and prospects. Words such as "expects," "anticipates," "intends," "plans," "believes," "seeks," "estimates" and similar expressions or variations of such words are intended to identify forward-looking statements, but are not the exclusive means of identifying forward-looking statements in this Annual Report. Additionally, statements concerning future matters, including statements regarding our business, our financial position, the research and development of our products and other statements regarding matters that are not historical are forward-looking statements.

Although forward-looking statements in this Annual Report reflect the good faith judgment of our management, such statements can only be based on facts and factors currently known by us. Consequently, forward-looking statements are inherently subject to risks and uncertainties and actual results and outcomes may differ materially from the results and outcomes discussed in or anticipated by the forward-looking statements. Factors that could cause or contribute to such differences in results and outcomes include without limitation those discussed under the heading "Risk Factors" below, as well as those discussed elsewhere in this Annual Report. Readers are urged not to place undue reliance on these forward-looking statements, which speak only as of the date of this Annual Report. We undertake no obligation to revise or update any forward-looking statements in order to reflect any event or circumstance that may arise after the date of this Annual Report. Readers are urged to carefully review and consider the various disclosures made in this Annual Report, which attempt to advise interested parties of the risks and factors that may affect our business, financial condition, results of operations and prospects.

This Annual Report includes trademarks and registered trademarks of Inovio Pharmaceuticals, Inc. Products or service names of other companies mentioned in this Annual Report may be trademarks or registered trademarks of their respective owners. References herein to "we," "our," "us," "Inovio" or the "Company" refer to Inovio Pharmaceuticals and its subsidiary.

Overview

We are a late-stage biotechnology company focused on the discovery, development and commercialization of DNA-based immunotherapies and vaccines that transform the treatment and prevention of cancers and infectious diseases. Our DNA-based immunotherapies and vaccines, in combination with our proprietary, efficacy-enabling delivery devices, are intended to generate robust immune responses, in particular functional CD8+ killer T cells and antibodies, to fight targeted diseases and conditions.

Our novel SynCon® immunotherapy design has shown the ability to help break the immune system's tolerance of cancerous cells. Our SynCon® product design approach is also intended to facilitate cross-strain protection against known and new unmatched strains of pathogens, such as influenza. Our CELLECTRA® delivery system facilitates optimized cellular uptake of the SynCon® immunotherapies, overcoming a key limitation of other DNA-based immunotherapies. Human data in clinical trials to date have shown a favorable safety profile of our SynCon® immunotherapies delivered using CELLECTRA® in over 6,000 administrations across almost 2,000 patients.

We or our collaborators are currently conducting or planning clinical studies of our proprietary SynCon® immunotherapies for HPV-caused pre-cancers, including cervical, vulvar, and anal dysplasia; HPV-caused cancers, including head & neck, cervical, anal, penile, vulvar, and vaginal; bladder cancer; glioblastoma multiforme, or GBM; hepatitis B virus; hepatitis C virus; HIV; Ebola; Middle East Respiratory Syndrome, or MERS; Lassa fever; and Zika virus.

Our corporate strategy is to advance, protect and exploit our differentiated immunotherapy platform. With our unique capabilities in terms of both design and development, we are progressing and validating an array of cancer and infectious disease immunotherapy and vaccine product candidates. We aim to advance product candidates through to commercialization and continue to leverage third-party resources through collaborations and partnerships, including product license agreements. Our partners and collaborators include AstraZeneca, Regeneron Pharmaceuticals, Inc., F. Hoffmann-La Roche AG/Genentech, Inc., ApolloBio Corporation, The Bill and Melinda Gates Foundation, The Wistar Institute, the University of Pennsylvania, The Parker Institute for Cancer Immunotherapy, Coalition for

Epidemic Preparedness Innovations (CEPI), Defense Advanced Research Projects Agency (DARPA), GeneOne Life Science, Inc., Plumbline Life Sciences, Inc., National Institutes of Health (NIH), HIV Vaccines Trial Network (HVTN), National Cancer Institute (NCI), United States Military HIV Research Program, Drexel University and Laval University.

Our Differentiated Technology Platform

We believe that stimulating the immune system specifically to treat or prevent cancers and infections is a compelling concept and that today the opportunity for immune activating technologies is promising, especially in light of notable technology advancements such as checkpoint inhibitors leading the way in oncology. Despite drug approvals in limited indications and promising results in clinical trials, there remains a significant need and opportunity for further advancements.

Our technology platform comprising our DNA-based SynCon® immunotherapy and CELLECTRA® delivery devices has versatile capabilities with a number of possible disease targets and product opportunities. The basic goal of our platform is to enable in vivo (in the body) generation of functional immune responses to achieve desired therapeutic and preventive outcomes. We have historically been primarily focused on in vivo production of disease-specific antigens directly in the body in order to stimulate prophylactic or therapeutic immune responses. More recently, we have explored an additional new application for the platform: in vivo generation of monoclonal antibodies to achieve preventive and therapeutic outcomes complementary to our antigen-generating immunotherapies.

The essence of our platform is that we encode a DNA plasmid (circular string of DNA) for an engineered and optimized genetic sequence of an antigen or monoclonal antibody specific to a targeted disease. We can combine multiple such plasmids into a "product," inject the plasmids into tissue of the body, and use CELLECTRA® devices to apply transient electrical energy to facilitate significant cellular uptake of the plasmids, which then enhances the ability of the intracellular machinery to temporarily produce the target antigen or monoclonal antibody. An antigen produced in this manner will then induce the immune system to generate polyclonal antibodies or T cells with the ability to perform their preventive or therapeutic functions. Similarly, DNA-encoded monoclonal antibodies (dMAbs™) generated in this manner can also trigger desired immune system functions.

With our core platform technologies, we have developed a pipeline of clinical-stage product candidates that have generated best-in-class in vivo immune responses, in particular CD8+ T cells that are fundamental in eliminating cancerous or infected cells. Our lead immunotherapy product candidate, VGX-3100, met all of its primary and secondary endpoints in a controlled Phase 2b clinical trial of patients with HPV-related cervical pre-cancer, achieving statistically significant and clinically relevant efficacy in association with robust T cell activation. This data was published in 2015 in the scientific journal The Lancet in a paper entitled, "Safety, efficacy, and immunogenicity of VGX-3100, a therapeutic synthetic DNA vaccine targeting human papillomavirus 16 and 18 E6 and E7 proteins for cervical intraepithelial neoplasia 2/3: a randomised, double-blind, placebo-controlled phase 2b trial."

These results were achieved without serious adverse events. The most common adverse event was temporary injection site pain and redness.

Our immunotherapies are non-live and non-replicating, and therefore do not cause the underlying disease. Compared to other technologies, our immunotherapies are designed to work more naturally with the immune system and within its controls to reduce or minimize the risk of unwanted inflammatory responses.

The results of our Phase 2b clinical trial of VGX-3100 suggest that our platform can be used to design and develop a number of cancer and infectious disease product candidates.

SynCon® Immunotherapies

Our SynCon® immunotherapies are designed to treat an existing disease (therapeutic) or prevent a disease (prophylactic) by activating and magnifying an immune response to one or more disease-specific antigens (proteins associated with a cancer or infectious disease that the body will recognize as foreign or not normal). Our product candidates are able to direct the patient's immune system to fight specific organisms or cells in a highly targeted and robust fashion, without the potential cost and quality control and manufacturing challenges of medicines involving ex vivo processes, such as T cells with chimeric antigen receptors, or CAR-Ts. We do this by introducing the genetic code for a target antigen into the cells of the body that will serve as a temporary antigen production facility.

Our immunotherapies consist of one or more DNA plasmids encoding one or more selected antigens. Our proprietary delivery technology enables significant uptake of the DNA plasmids by cells in localized tissue, which are typically muscle in the arm for immunotherapies or in the skin for vaccines, as described below.

After the DNA code for the targeted antigen(s) is introduced to cells, the cells' natural machinery for producing proteins temporarily produce the selected antigen(s) encoded by the DNA sequences. The antigenic proteins manufactured through this process are then presented to the immune system and trigger one or both of two arms of the

immune system:

- the production of preventive antibodies, known as a humoral immune response; and/or
- the activation of therapeutic CD8+ T cells, known as a cellular or cell-mediated immune response.

These responses then neutralize or eliminate infectious agents, such as viruses, bacteria, and other microorganisms, or abnormal cells, such as malignant tumor or infected cells. T cells can be immediately "trafficked" to parts of the body where cells are displaying the target antigen. Memory cells are also created for durable effects.

Our SynCon® immunotherapies are designed to generate antigen-specific antibody and T cell responses. First, we identify one or more antigens that we believe are the best targets to direct the immune system toward a particular cancer or infectious disease. We then apply our SynCon® design process, which uses the genetic make-up of the selected antigens from multiple variants of a cancer or strains of a virus.

For each antigen we synthetically create a new genetic sequence that represents a consensus of the slightly different DNA from multiple variants or strains of the targeted antigen. We can synthetically create a differentiated SynCon® variant to help the immune system better recognize a cancer self-antigen (a cell and antigen grown in the body) and "break the tolerance" of cancer cells in the body. In human clinical trials, we have generated immune responses with SynCon® immunotherapies that were not matched to different strains of an infectious disease, such as influenza or HIV, indicating that such immunotherapies may have more universal protective capabilities against unmatched strains of a circulating virus. As a result, these SynCon® constructs may provide a solution to broadly cover the genetic "shift" and "drift" that is typical of many infectious diseases. This new synthetically engineered sequence is similar to the originating sequences but does not match any. It does not exist in nature and is patentable.

The SynCon® sequence is inserted into a circular DNA plasmid with its own promoter. The plasmid is optimized at the DNA level for codon usage, improved mRNA stability, and provided with enhanced leader sequences for ribosome loading; it is optimized at the genetic level to enable high expression in human cells. We believe these design capabilities allow us to better target appropriate immune system mechanisms and produce a higher level of the coded antigen to enhance the overall ability of the immunotherapy to induce the desired immune response.

The plasmids are manufactured in a bacterial fermentation process using scalable technology. These DNA-based immunotherapies can be stable under normal environmental conditions for extended periods of time.

Our product development platform also allows for rapid design, pre-clinical testing, manufacturing and clinical development of our vaccine and immunotherapy product candidates. Speed is an important feature, particularly as it relates to developing a response to globally emerging infectious diseases. In 2016, we were the first entity able to advance a Zika vaccine into human clinical trials, just 4.5 months after World Health Organization, or WHO, declared the emerging Zika infections to be a Pandemic Health Emergency of International Concern. Previously, we led the development of the first MERS vaccine in human clinical trials. We believe that our development platform is well positioned to support global health agencies in order to develop preparedness countermeasures against bioterrorism and/or emerging pandemic agents.

CELLECTRA® Delivery Technology

Despite how compelling the idea of delivering DNA encoding an antigen has been, delivering the DNA or nucleic acids directly into a cell through the cell's protective membrane has been a significant challenge in the broad field of DNA and RNA vaccines. Our immunotherapies are delivered into cells of the body in a small local area of tissue using our proprietary CELLECTRA® in vivo DNA delivery technology. CELLECTRA® uses controlled, locally applied millisecond electric pulses to create temporary and reversible permeability, or pores, in the cell membrane. Using this method increases the cellular uptake of the DNA plasmids by more than one thousand times when compared to the injection of a DNA plasmid alone without other delivery mechanisms. This improved cellular uptake has enabled the immune responses that we have observed in our clinical trials, along with the efficacy results generated by these immune responses.

Alternative delivery approaches based on the use of viruses, bacteria, nanoparticles and lipids are complex and expensive and have generated concerns regarding their safety. Because the vector itself possesses many additional antigens specific to the vector, it can attract unwanted immune responses against itself that are believed to compromise the vectors' ability to deliver their DNA "payload" and provide protection. In contrast, DNA plasmid vectors possess no antigens of their own; the plasmid results in production of only the target antigen.

We have published preclinical data in which immune responses generated by our SynCon® immunotherapies delivered using CELLECTRA® were improved as compared to a leading viral vector (Adenovirus type 5) based approach. We are not aware of any published data indicating the capability of alternative technologies focused on using genetic code to generate preventive or therapeutic antigens to exceed our immune response data obtained to

date, nor to match the efficacy and immune response data generated in our controlled Phase 2b study based on in vivo production of such immune responses.

The delivery of our synthetic DNA immunotherapies using our CELLECTRA® devices has to date shown a favorable safety profile in clinical trials, without serious adverse events and only mild local injection-related side effects

such as redness and swelling. Our delivery is designed to be tolerable without the need for an anesthetic, and because it does not induce unwanted immune responses, it can be repeatedly administered for booster vaccinations.

We believe CELLECTRA® provides a relatively straightforward, cost-effective method for delivering DNA and RNA into cells with high efficiency, minimal complications and the ability to enable what we believe to be clinically relevant levels of gene expression, immune responses and efficacy.

Choice of Tissue for DNA Delivery

Skeletal muscle has been a core focus for delivery of DNA-based immunotherapies via CELLECTRA® because it is mainly composed of large elongated cells that are non-dividing, meaning that longer-term expression can be obtained without integration of the gene of interest into the genome. We have generated pre-clinical and clinical evidence that muscle cells may have a capacity for secretion of proteins into the blood stream. Secreted therapeutic proteins may therefore act systemically and produce therapeutic effects in distant tissues of the body. In this respect, the muscle functions as a factory for the production of the biopharmaceutical needed by the body. In our Phase 2 clinical trial of VGX-3100 for HPV-related cervical dysplasia, intramuscular delivery by CELLECTRA® of DNA-encoded antigens induced both humoral (antibody) and cellular (T cell) immune responses. We envision that delivery of DNA by CELLECTRA® to muscle cells will circumvent the costly and complicated production procedures of viral gene delivery vectors, bacterial gene delivery vectors, protein-based drugs, conventional vaccines and monoclonal antibodies. This approach may provide long-term stable expression of a therapeutic protein or monoclonal antibody at a sustained level.

In addition to generating pre-clinical and clinical evidence that intramuscular DNA delivery can be effective for a number of immunotherapies, we are also exploring delivery to the skin, with early preclinical evidence suggesting that this may also be a relevant route of administration. Skin or intradermal administration is important and is becoming an attractive site for immunization given its high density of antigen presenting cells (APCs). Unlike muscle, skin is the first line of defense against most pathogens and is therefore rich in immune cells and molecules. Skin specifically contains certain cells that are known to help in generating a robust immune response. With intradermal delivery, we may be able to demonstrate a comparable immune response to muscle delivery. Drug delivery into skin, or dermal tissue, is attractive given that the skin is the largest, most accessible, and most easily monitored organ of the human body, and it is highly immuno-competent, meaning that it is able to recognize antigens and mount an immune response to them.

Our CELLECTRA® Delivery Systems

There are several configurations in the CELLECTRA® device family. The first configuration covers intramuscular (IM) delivery of DNA; the second covers intradermal/subcutaneous delivery (ID) of DNA. Devices with these configurations have been validated, manufactured under Current Good Manufacturing Practices (cGMP) and are being used in human clinical trials. We have filed a device master file (MAF) with the U.S. Food and Drug Administration (FDA) covering the use of the CELLECTRA® devices in human clinical trials. These devices are intended to be used in combination with a DNA plasmid-based immunotherapy.

Our CELLECTRA®-SP devices combine the functionality of our current generation of skin and intramuscular devices in clinical testing with enhanced form, design and portability. All components of the pulse generator and applicator are integrated into a cordless, rechargeable device. The rechargeable battery can enable immunization of several hundred subjects, making the device useful for mass vaccinations. The devices are designed to accommodate different electrode arrays to meet the requirements of the particular immunotherapy and targeted tissue for delivery.

In preparation for our Phase 3 clinical trial of VGX-3100 and potential commercial use, we designed and manufactured a new delivery device, CELLECTRA®-5PSP, a fully automated, smaller and user-friendly device. The new CELLECTRA®-5PSP device is being used in our ongoing VGX-3100 Phase 3 trial, which started in June 2017.

Next-Generation Device Development

While our current IM and ID CELLECTRA® delivery technologies have been well tolerated, we are also advancing a new generation of ID delivery devices called CELLECTRA®-3P. Currently used ID devices penetrate no more than 3 mm into the target tissue, compared to IM devices that go deeper. All of our current vaccine studies in the clinic are using these CELLECTRA®-3P devices to deliver the vaccines.

We have also been researching other avenues for needle-free, contactless technology for immunotherapy delivery. In February 2011, Human Vaccines published our paper entitled, “Piezoelectric permeabilization of mammalian dermal

tissue for in vivo DNA delivery leads to enhanced protein expression and increased immunogenicity." This innovative method is based on the generation of an electric field or electric potential by certain materials in response to applied mechanical stress.

With the advancement of these devices our aim is to make DNA delivery amenable to mass prophylactic vaccination by decreasing dose levels, increasing tolerability of the vaccination, increasing the breadth of viable immunotherapy targets, and enhancing portability. Based on our data from preclinical studies of influenza, HIV, malaria,

and smallpox antigens, we believe that DNA delivery with this newer generation of ID delivery, including surface electroportation (SEP) devices, has the potential to yield levels of immunogenicity in terms of both antibody and T cell responses and/or efficacy against a virus challenge that are comparable to intramuscular delivery devices currently in clinical development.

In March 2016, we acquired needle-free jet injection technology, devices and intellectual property from Bioject Medical Technologies Inc. We are developing an integrated non-invasive delivery device combining Bioject's jet injection technology with our needle-free, SEP technology. Bioject's needle-free devices, which use high pressure gas or springs to propel liquid medicine into skin, have been observed to have desirable utility, safety and tolerability attributes in preclinical studies and clinical trials. Under a prior research agreement, we had assessed the combination of Bioject technology with our new delivery system and generated compelling antigen expression and immune responses in animal studies.

Our Immunotherapy Products and Product Development

Our primary focus is to advance and potentially commercialize the product candidates developed from our integrated technology platform. Using this platform, we are currently developing a number of DNA-based immunotherapies for the prevention or treatment of cancer and infectious diseases. The table below summarizes the status of our product development programs.

Active SynCon® Immunotherapy Development Programs

		Development Status				
Product Area	Product and Indication(s)	Pre-Clinical	Phase 1	Phase 2	Phase 3	Partner/Funding/Sponsor
Cancer	Cervical dysplasia (cervical HSIL) (VGX-3100)	X	X	X	IP	Inovio
	Vulvar dysplasia (vulvar HSIL) (VGX-3100)	X	X	IP		Inovio
	Anal dysplasia (anal HSIL) (VGX-3100)	X	X	IP		Inovio
	Head and neck cancer (MEDI0457)	X	X	IP		AstraZeneca
	HPV-related cancers (cervical, anal, penile, vulvar, vaginal) (MEDI0457)	X	X	IP		AstraZeneca/MD Anderson
	Bladder cancer (INO-5401 + atezolizumab)	X	X			Roche/Genentech
	Glioblastoma (INO-5401 + cemiplimab)	X	X			Regeneron
	Prostate cancer (INO-5150 + INO-9012)	X	X	SP		Inovio
	hTERT expressing cancers (breast, lung, pancreatic) (INO-1400 + INO-9012)	X	IP			Inovio
Infectious Disease	Hepatitis B Virus (INO-1800)	X	X	SP		Inovio

Hepatitis C Virus (GLS-6150)	X	IP		GeneOne Life Science
Zika (GLS-5700)	X	IP		GeneOne Life Science
Ebola (INO-4212)	X	IP		GeneOne Life Science/DARPA
MERS (GLS-5300)	X	IP		GeneOne Life Science/IVI
HIV (preventive & therapeutic) (PENNVAX®-GP)	X	IP	SP	NIH/NIAID

X = Completed
IP = In Progress
SP= Seeking Partner

Cancer Vaccines/Immunotherapies

Background

In recent years there have been multiple technology advancements and product approvals that have highlighted the potential of immunotherapies to usher in a new era of cancer therapeutics. Monoclonal antibodies (mAbs) such as Herceptin® and dendritic cell therapy Provenge® for prostate cancer have had varying degrees of success. While a significant step forward, suitable monoclonal antibodies with desired characteristics have been difficult to design or identify and expensive to produce, and the technology does not lend itself to designing mAbs for many diseases. Dendritic or other cell-based therapy is a highly personalized medicine involving removing cells from the patient, modifying them, multiplying them, then returning them to the body. In addition to the high cost and complex processes to manufacture products, a weakness of this approach is that it has not been shown to generate high levels of cancer-specific T cells.

Progress in the field of immune checkpoint inhibitors (CIs) has resulted in optimism regarding the potential for new immunotherapies against a spectrum of cancers. The immune system relies on a safeguard system of checkpoint mechanisms to prevent excessive or incorrectly directed immune responses. Many cancer cells have the ability to "hijack" these checkpoints and neutralize T cells sent by the immune system to eliminate them. Checkpoint inhibitors prevent cancer cells' ability to interfere with these checkpoints and enable T cells (especially CD8+ killer T cells) to complete their appropriate and intended killing function against cancer cells. Clinical trials of checkpoint inhibitors have shown notable therapeutic impact against melanoma and other cancers, but with response rates in the 15-20% range (and only in the case of melanoma going up to the 40% range or higher), there remains a significant opportunity. Observations suggest CIs may be less effective if there is not a high enough pre-existing level of antigen-specific CD8+ T cells in the tumor micro-environment, meaning that the tumor is "cold" rather than "hot" (with a significant level of CD8+ T cells). More recently, scientists have recognized that a strong CD8+ T cell generating "active" immunotherapy may be able to transform a "cold" tumor into a "hot" tumor and in combination with CIs may possess significant therapeutic potential to fight cancers.

More recently, a new category of immunotherapies called adoptive cell transfer, for example CAR-T technology, has provided further evidence of the merit of providing an enhanced T cell presence to fight cancer. CAR-T therapies have achieved dramatic results in B cell cancers. Unfortunately, they have also been associated with significant side effects. When this technology has been applied to solid tumors, it has generated significant cytokine storms that have resulted in severe side effects, including deaths. Moreover, adoptive cell transfer such as CAR-T, like dendritic cell therapy, involves removing T cells from a patient, modifying them to better target a cancer cell, multiplying the T cells, then returning them to the patient. These complex therapeutic products need to be manufactured and released for each patient, leading to expensive manufacturing and increased supply chain complexity.

Even though there have been promising technology advancements in recent years that better harness or activate capable killer T cells, we believe there is still significant untapped potential to develop "ideal" immunotherapies to fight cancers and infectious diseases.

What is an "ideal" active immunotherapy? We seek to advance product candidates that are effective, efficient and safe, specifically those that:

- target disease-specific antigens or proteins unique to a cancer or infectious disease;
- do not depend on complex manufacturing processes such as removal of dendritic cells or T cells from the patient that are then modified in the laboratory, amplified and then re-introduced in the patient as autologous or allogeneic cell based therapies;
- activate functional killer T cells with the necessary killing tools, such as granzyme and perforin;
- generate robust T cell responses or a significant number of T cells that are persistent and durable over time (memory response);
- do not induce unwanted immune responses;
- do not induce toxic inflammatory responses; and
- are capable of "breaking tolerance" of cancer cells grown in the body.

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Data from our Phase 2b data of VGX-3100, discussed below, show that our product candidates are capable of achieving these characteristics with our approach to activating significant antigen-targeted T cells. Based on this approach, we are advancing a growing pipeline of pre-clinical and clinical immunotherapy product candidates.

VGX-3100 for the Treatment of HPV-related Precancerous Lesions

Overview and Background

Human papillomavirus, or HPV, is sexually-transmitted, persistent infection with one or more high-risk (HR) genotypes of that virus can lead to, and thus are the causative agents responsible for, cervical pre-cancers (cervical dysplasia), cervical cancer, other anogenital cancers, and head & neck cancer, which is one of the most rapidly growing cancers in men. Scientific literature estimates that, at any given time, approximately 43% of the U.S. and world's adult population is infected with HPV, and about 25% of adult men and 20% of adult women in the U.S. have a genital infection with one or more HR-HPV genotypes. The lifetime risk for acquiring an HPV infection of any genotype is about 70% in sexually active U.S. adults and about 80% worldwide.

HPV is the most common viral infection of the reproductive tract and is the major cause of cervical cancers. Almost 300 million women globally are estimated to be infected with HPV, with another 30 million additional cases that have progressed to the pre-cancerous stage. Nearly 570,000 new cases of cervical cancer are diagnosed annually world-wide, and more than 311,000 women die from this cancer each year. Virtually all cases are linked with persistent infection with HPV. Challenges with acceptance, accessibility and compliance of vaccines to prevent HPV infection and the resulting pre-cancers and cancers have resulted in only 40% of young women being vaccinated in the United States, and even less in some of the other countries around the world which have access to those vaccines. While roughly 90% of HPV infections are ultimately cleared naturally by the body's own immune system, persistent cervical infection with one or more HR-HPV genotypes can lead to cervical high grade squamous intraepithelial lesions (HSILs) and, if untreated, eventually invasive cervical cancer. Researchers have estimated the global prevalence of clinically pre-cancerous HPV infections at between 28 and 40 million. HPV-16 and HPV-18 are the two most prevalent high-risk types of HPV worldwide, causing the significant majority of HPV-related cancers. In the U.S., HPV-16/18 are found in about 45% to 50% of all cervical HSILs and about 70% of invasive cervical cancers. The estimated annual incidence of cervical HSIL caused by HPV-16 and/or HPV-18 is approximately 195,000 persons in the United States and 233,000 persons in Europe. We believe these patients represent a significant market opportunity for our product candidates. Cervical HSIL can only be treated by an invasive surgical procedure.

To prevent HPV infection, there is currently one FDA approved preventive vaccine available in the U.S., called Gardasil® 9. That vaccine protects against infection by nine total HPV genotypes, consisting of seven genotypes that confer high risk for cancer and two that confer risk for genital warts. Preventive HPV vaccines cannot treat or protect those already infected with the same HPV genotypes, which is a large population. In addition, many girls and women eligible to be vaccinated have not been receiving these vaccines. In 2017, a U.S. national survey found that only 57% of girls aged 13-17 years were up to date with the HPV vaccine series. Currently there is no viable immunotherapy or drug to fight established HPV infection or treat cervical dysplasia and/or cancer caused by HPV.

Current management options for cervical HSIL are unappealing. The "watch-and-wait" process associated with low grade squamous intraepithelial lesions (LSIL, formerly called low-grade dysplasia or CIN 1) and in some young women with higher grade lesions (CIN 2) is a stressful approach. The only available treatment option for cervical HSIL is surgery, which involves ablating or cutting a women's cervix to remove the pre-cancerous lesions. While surgical procedures are generally initially effective in removing lesions, they can lead to short-term adverse effects including cervical scarring, excess bleeding and infection, and to longer-term reproductive risks such as pre-term birth, miscarriage, and perhaps infertility. Current excisional and ablative procedures increase the overall risk of pre-term births from 5.4% to 10.7%, according to Kyrgiou et al in a major meta-analysis published June 2016 in the British Medical Journal. Anticipation of these procedures produces significant anxiety for patients, despite their doctor's reassurances, and full recovery from surgery can take up to several weeks. Because surgery does not clear the underlying HPV infection, there is a 10-16% chance of high-grade pre-cancer lesion recurrence after surgery as a result of persistent HPV infection and/or incomplete removal of the lesion, with the persistent HPV infection being the better predictor of recurrence.

Our product candidate VGX-3100 is designed to significantly increase T cell immune responses against the E6 and E7 antigens of HPV types 16 and 18 that are present in both precancerous and cancerous cells transformed by these HPV

types. E6 and E7 are oncogenes that play an integral role in transforming HPV-infected cells into precancerous and cancerous cells. The goal of the immunotherapy is to stimulate the body's immune system to mount a killer T cell response strong enough to cause the killing of cells producing the E6/E7 protein. The potential of such an immunotherapy would be to treat precancerous dysplasias caused by these HPV types.

VGX-3100 for the Treatment of Cervical High Grade Squamous Intraepithelial Lesion (HSIL)

Phase 2b Study Results

In March 2011, we initiated a randomized, placebo-controlled, double-blind Phase 2b study of VGX-3100 delivered using our CELLECTRA® device in women with HPV type 16 or 18 and diagnosed with, but not yet treated for, cervical high grade squamous intraepithelial lesion (HSIL) (also called high grade cervical intraepithelial neoplasia (CIN 2/3)). The women in the study received either 6 mg of VGX-3100 or a placebo. VGX-3100 and placebo were administered using the CELLECTRA® device at months 0, 1 and 3. The study assessed efficacy by measuring regression of cervical lesions from CIN 2/3 to CIN 1 or normal in the treated versus control subjects. Immunological responses were also measured in this clinical study to assess the ability of this therapy to generate strong T cell responses in a larger, controlled study. Safety was also assessed.

The primary endpoint of the trial, histologic regression, was evaluated 36 weeks after the first treatment. In the per protocol analysis of this three-immunization regimen, CIN 2/3 resolved to CIN 1 or no disease in 53 of 107 (49.5%) women treated with VGX-3100, compared to 11 of 36 (30.6%) who received placebo. This difference was statistically significant (p=0.017). Intent to treat results were also similar and statistically significant.

There was also a high level of complete clearance of CIN 2/3. In a post-hoc analysis, CIN 2/3 resolved to no disease in 43 of 107 (40.2%) women treated with VGX-3100, compared to 6 of 36 (16.7%) who received placebo (p=0.006).

A secondary endpoint of the trial was virological clearance of HPV 16 or 18 from the cervix in conjunction with histopathological regression of cervical dysplasia to CIN 1 or no disease. This endpoint was achieved in 43 of 107 (40.2%) VGX-3100 recipients, compared to 5 of 35 (14.3%) placebo recipients (p=0.001). We believe this is an important outcome, as persistence of the HPV virus is associated with recurrence of cervical dysplasia.

All Phase 2b patients were monitored for an additional 52 weeks for a safety follow up. No significant safety issues were observed through week 88 following treatment.

In September 2015, this data was published in The Lancet in a paper entitled, “Safety, efficacy, and immunogenicity of VGX-3100, a therapeutic synthetic DNA vaccine targeting human papillomavirus 16 and 18 E6 and E7 proteins for cervical intraepithelial neoplasia 2/3: a randomized, double-blind, placebo-controlled Phase 2b trial.”

This paper reported further details regarding the characteristics of T cells generated and their association with efficacy outcomes. Analyses of patient immune responses showed that overall antigen-specific T cell levels in women treated with VGX-3100 were greater than those treated by placebo at all observation periods. At week 14, levels of CD8+ T cells specific to the E6 and E7 HPV antigens in women treated with VGX-3100 were ten times greater than those in the placebo group. This response increased with each of the three immunizations, then declined modestly to a sustained and durable level of T cells (memory T cells) measured through 36 weeks (24 weeks post-treatment).

Patients whose lesions regressed had higher frequencies of HPV-specific CD8+ T cells which co-expressed key molecules important in the T cell killing cascade and directly correlated with clinical efficacy. Specifically, higher levels of CD8+ killer T cells co-expressing checkpoint molecule CD137 on their surface, as well as the cytolytic protein perforin, were observed to be a predictive tool for efficacy. As a strong activation marker for CD8+ T cells, stimulation through CD137 has been shown in some systems to confer resistance of CD8+ T cells to the suppressive activity of regulatory T cells, indicating that its presence can identify tumor reactive T cells. Perforin is a pore-forming protein deployed by killer T cells to bore holes into the target cell's plasma membrane and destroy the cell. The difference in frequencies of CD8+ T cells expressing CD137 and perforin was greatest in patients who had both regressed their lesions and cleared HPV as compared to patients who did not.

To our knowledge, this was the first published study from which a direct correlation between antigen-specific CD8+ T cells generated in vivo and clinical efficacy was observed. We have identified several key biomarkers of killer T cells that we believe can be used to predict the clinical efficacy of VGX-3100, as well as other immunotherapies, which we will seek to confirm in our ongoing Phase 3 trial.

Our Phase 2b clinical trial of VGX-3100 highlights the ability of a DNA-based immunotherapy to be locally administered in tissue distant from the diseased tissue target, generate robust functional CD8+ killer T cells, traffic those T cells to the diseased tissue, infiltrate diseased cells displaying the target antigen, and facilitate the elimination of these cells both in “healthy” tissue and in diseased tissue (a lesion) with a statistically significant, clinically relevant outcome. We believe these results have significant implications in displaying the broad therapeutic and preventive potential of our existing and future cancer and infectious disease products.

Preparation and Launch of VGX-3100 Phase 3 Study

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In preparation for pivotal Phase 3 development and commercialization, we completed a manufacturing technology-transfer to a commercial manufacturing facility and scaled up manufacturing of VGX-3100.
We also designed and manufactured a new delivery device, our CELLECTRA® 5PSP device, which is fully automated, smaller and more user-friendly compared to our device previously used in the Phase 2b clinical trial.
We have conducted additional market research with physicians and patients that have further characterized the unmet medical needs relating to the treatment of CIN 2/3 cervical dysplasia. These include a preference for a non-invasive, non-surgical procedure for removing cervical lesions; a treatment that can clear HPV, the cause of the pre-cancer, throughout the body and not just in the limited area of the lesion; and a treatment that does not result in pre-term births or infertility. We believe that CIN 2/3 represents a unique market opportunity for a novel therapy capable of providing a first-line alternative to surgery and in some cases even an alternative to watchful waiting. This market research will help guide our communication and interaction with the physician, patient and support communities.
Phase 3 Program for VGX-3100 (REVEAL)
Our Phase 3 program, named REVEAL, consists of a primary study (REVEAL 1) and confirmatory study (REVEAL 2), in accordance with the FDA's general guidance for Phase 3 programs, to be conducted in parallel. The studies will each enroll 198 patients. Mark Einstein, MD, MS, FACS, FACOG, Professor and Chair Department of Obstetrics, Gynecology and Women’s Health Assistant Dean, Clinical Research Unit, Rutgers New Jersey Medical School, is Principal Investigator for the studies.
The REVEAL studies are prospective, randomized (2:1), double-blind, placebo-controlled trials evaluating adult women with HPV 16/18 positive biopsy-proven cervical HSIL (CIN 2/3). The primary endpoint is regression of cervical HSIL and virologic clearance of HPV-16 and/or HPV-18 in the cervix, which was a secondary endpoint that was achieved in our Phase 2b trial described above. Overall, the Phase 3 studies will evaluate cervical tissue changes at approximately 9 months after beginning a three-dose regimen of VGX-3100 administered at months 0, 1 and 3. Secondary endpoints include safety; tolerability; regression of CIN 2/3 to CIN 1 or normal; virologic clearance of HPV; efficacy measured by non-progression to cancer; and clearance of HPV from non-cervical anatomic locations. If the results of the REVEAL trials are positive, we are targeting the submission of a biologics license application, or BLA, to the U.S. Food and Drug Administration, or FDA, by the end of 2021.
VGX-3100 for the Treatment of Vulvar High Grade Squamous Intraepithelial Lesion (HSIL)
In April 2017, we commenced a Phase 2 trial to evaluate the efficacy of VGX-3100 in patients with pre-cancerous lesions of the vulva, or vulvar intraepithelial neoplasia (VIN). VIN has less than a 5% rate of spontaneous, or natural, regression and there are no FDA approved non-surgical treatments. Surgery, the most common treatment, is associated with high rates of disease recurrence and can cause disfigurement, long-term pain, and psychological distress for the women who undergo the procedure. VIN recurs in approximately one of every two patients who undergo surgical treatment.
This randomized, open-label Phase 2 clinical trial will assess the efficacy of VGX-3100 in 36 women with high-grade HPV-related vulvar lesions. The immunotherapy will be administered with our CELLECTRA® intramuscular delivery device. The primary endpoint of the study is histologic clearance of high-grade lesions and virologic clearance of the HPV virus in vulvar tissue samples. The study will also evaluate safety and tolerability of VGX-3100.
Interim efficacy results from the Phase 2 vulvar trial are anticipated in the second half of 2019.
VGX-3100 for the Treatment of Anal High Grade Squamous Intraepithelial Lesion (HSIL)
We have expanded the clinical development program for VGX-3100 to include treatment of HPV-16/18-associated anal high grade squamous intraepithelial lesions (anal HSIL, formerly called anal intraepithelial neoplasia, or AIN). This included launch of a Phase 2 study in 2018 for such patients who were also HIV-negative and a partnership with the AIDS Malignancy Consortium (AMC) for a similar trial in HIV-positive patients. The randomized, open-label trial in HIV-negative patients will assess the efficacy of VGX-3100 in 24 patients, and the immunotherapy will be administered with our CELLECTRA® intramuscular (IM) delivery device. The primary endpoint of the study is histologic clearance of the high-grade lesions and virologic clearance of the HPV-16/18 virus in anal/peri-anal tissue samples. The study will also evaluate safety and tolerability of VGX-3100.
Left untreated, anal HSIL may progress to cancer. Spontaneous regression of anal HSIL may occur, but only in the range of 20% to 29% of patients after one year of follow-up. Persistent infection with a high-risk HPV genotype is responsible for a large portion of anal cancer. In the U.S., about 55% to 80% of anal HSIL cases are associated with

HPV-16/18, and worldwide about 80% of anal HSIL cases are associated with HPV-16/18. In the U.S., over 90% of anal cancer is attributable to HPV, and about 87% of those HPV anal cancers are attributable to HPV-16/18 specifically.

It is estimated that nearly 8,600 new cases of and more than 1,100 deaths from anal cancer occurred in the United States in 2018. Anal cancer incidence has increased in the United States by an annual average 2.2% over the last ten years. The incidence of this cancer is considerably higher among certain risk groups, such as HIV-positive men and women, men who have sex with men, and other immunocompromised individuals, such as solid organ transplant patients, as compared to the overall population.

There are no validated screening tests or a general screening recommendation consensus for anal HSIL. Currently, the treatments for anal HSIL consist of excising or ablating the lesion(s). Treatment usually consists of repeated ablation, most commonly radiofrequency ablation (RFA), resections or laser therapy. However, treatment of anal HSIL represents a significant unmet medical need due primarily to the high recurrence rates up to 49% one year after treatment.

VGX-3100 Immune Correlates and Biomarker Signatures

In November 2017, we announced that a post-hoc analysis of data generated from our Phase 2b trial of VGX-3100 identified immune correlates and biomarker signatures that were predictive of potential treatment success. Details of the new biomarker and immunologic data are highlighted in the peer-reviewed journal Clinical Cancer Research in the article, “Clinical and Immunologic Biomarkers for Histologic Regression of High-grade Cervical Dysplasia and Clearance of HPV-16 and HPV-18 after Immunotherapy,” by Inovio and its academic collaborators.

ApolloBio Collaboration Agreement

In December 2017, we entered an amended agreement providing ApolloBio Corporation with the exclusive right to develop and commercialize VGX-3100 within Greater China (defined as China, Hong Kong, Macao and Taiwan). Additional details on the ApolloBio Agreement are provided below under "Business-License, Collaboration and Supply Agreements." The transaction closed in March 2018.

Upon the closing of the transaction in March 2018, we received proceeds of $19.4 million which comprised the upfront payment of $23.0 million less $2.2 million in foreign income taxes and $1.4 million in certain foreign non-income taxes. We may also receive potential milestone payments of up to $20 million in the aggregate. In addition, we are entitled to receive double-digit tiered royalty payments on sales. This collaboration of VGX-3100 encompasses the treatment and/or prevention of precancerous HPV infections and HPV-driven dysplasias (including cervical, vulvar and anal precancers) and excludes HPV-driven cancers and all combinations of VGX-3100 with other immunostimulants. The agreement also provides for potential inclusion of the Republic of Korea during the first three years of the term of the agreement.

MEDI0457 (VGX-3100 + INO-9012) for the Treatment of HPV-Related Cancers

Overview and Background

HPV is also associated with some head and neck cancers, especially those in the oropharynx and perhaps to some extent the larynx and oral cavity. The incidence of HPV-caused oropharyngeal squamous cell cancer (OPSCC) has increased significantly within the last 30 years in the U.S., including a 225% increase from 1988 to 2004, an average annual increase of 14%. More recently in the U.S., from 1999 to 2015, HPV-associated OPSCC incidence increased among men at an annual average rate of 2.7% and among women at an annual average rate of 0.8%, and in approximately 2009 the incidence of these HPV-associated mouth and throat cancers in men exceeded that of cervical cancers in women. Oropharyngeal cancer is the fastest-rising cancer among young white men in the United States, and U.S. men in general are about four times more likely than women to be diagnosed with HPV-associated oropharynx cancer. Increasing trends of the cancer in the U.S. are projected to continue at least through the year 2030. The estimated U.S. prevalence of HPV-caused oral cavity and pharynx cancer was approximately 108,000 cases in 2015. In 2015, OPSCC was the most common HPV-associated cancer in the U.S., with nearly 19,000 new cases diagnosed that year (15,479 cases among men and 3,438 cases among women). An estimated 51,540 new cases of this cancer in general, whether or not HPV-associated, occurred in 2018 in the U.S., and 10,030 persons died of this cancer that year. Worldwide, an estimated nearly 93,000 new cases of oropharyngeal cancer overall occurred in 2018, and about 25,400 to 29,000 cases per year of this cancer are HPV-associated.

Scientists have estimated that by 2030 OPSCC will constitute the majority of all head & neck cancers. About 70% of cancers of the oropharynx are now caused by HPV, with HPV-16 being the most prevalent genotype and causing about 86% of those HPV-caused cancers.

Improvements in primary treatment modalities (surgery and radiation) have produced significant improvements in morbidity, but intensive radiation has a profound long-term impact on mortality and quality of life. Based on these factors, we believe there is a significant opportunity for an effective immunotherapy.

Considering the several known cancers caused by HPV, the relative and total burden of those in terms of the annual U.S. average annual incidence rates and portions attributable to the HPV-16/18 genotypes for the period of 2008 to 2010

are shown in the table below. In total for that period, an average of more than 30,000 cases of HPV cancers per year were diagnosed in the U.S., and 80% (nearly 25,000) of those per year were specifically due to HPV-16/18 genotypes.

Annual Incidence of HPV-Attributable Invasive Cancers by Site in the United States, 2008-2010

Invasive Cancer tissue site	Avg. n in Sites where HPV is often found (i.e. HPV-associated cancers)	Cancers Attributable to Any HPV n (% of HPV-pos.)	Cancers Attributable to HPV-16/18 n (% of any HPV-attributable)
Oropharynx	14,972	10,567 (100%)	9,118 (86.3%)
Cervix	12,114	10,976 (100%)	8,018 (73.1%)
Anus	5,715	5,203 (100%)	4,537 (87.2%)
Vulva	4,131	2,840 (100%)	2,009 (70.8%)
Vagina	1,106	830 (100%)	609 (73.4%)
Penis	1,183	749 (100%)	567 (75.7%)
Total	39,221	31,164 (100%)	24,858 (80.0%)

Worldwide data estimates for the year 2012 are shown in the table below. For that year, an estimated 630,000 cases of new HPV cancer cases occurred, and more than 70% (430,000) of those cases were specifically due to HPV-16/18 genotypes.

Annual Incidence of HPV-Attributable Cancers by Site Worldwide

MEDI0457 for the Treatment of Head & Neck Cancer

In June 2014, we initiated a Phase 1 clinical trial assessing the immunogenicity and safety of our product candidate INO-3112 (consisting of a combination of VGX-3100 and our product candidate INO-9012) in head & neck cancer patients. INO-3112 is now called MEDI0457, following our collaboration with AstraZeneca, described below. We added INO-9012, a DNA-based IL-12 immune activator, to VGX-3100 for this cancer study because our prior HIV vaccine clinical study had indicated that the addition of IL-12 to our DNA immunotherapy could enhance the activation of CD8+ T cells.

We enrolled 22 adults with HPV16 and/or HPV18-positive head & neck squamous cell carcinoma (HNSCC) in this open-label Phase 1 trial. Patients were treated with 4 doses of MEDI0457 and then followed for safety, immune and clinical responses. In one part of the study, six patients were treated once with MEDI0457 before and after resection of their tumor. These patients received 3 additional doses subsequent to surgery and chemoradiation therapies. In the second part of the study, 16 patients were recruited into the study after their surgery and completion of chemotherapy

and radiation therapy. These patients were treated with 4 doses of MEDI0457 and followed. Each MEDI0457 treatment was administered using our CELLECTRA® delivery system.

In November 2016, at the Annual Meeting of the Society for Immunotherapy of Cancer (SITC), we reported interim immunology results showing that in the group of six patients treated before resection (one dose averaging 14 days and ranging 7 to 28 days prior to definitive surgery) and post-surgery (three additional doses), MEDI0457 generated robust HPV16/18 specific CD8+ T cell responses in peripheral blood in four of five subjects who also showed increased T cell activation in resected tumor tissue samples. One subject withdrew consent after surgery, leaving five evaluable subjects in this group.

In October 2018, we announced a paper published in Clinical Cancer Research, a major cancer journal, detailing results of a patient with head and neck cancer treated with MEDI0457 who achieved a sustained complete response (full remission) on treatment with a subsequent PD-1 checkpoint inhibitor. In the Inovio-sponsored study of 22 patients with head and neck squamous cell carcinoma we reported 91% (20/22) of patients showed T cell activity in the blood or tissue.

In January 2019, we announced that a second patient with HPV-related head and neck cancer treated with MEDI0457 in a Phase 1 trial achieved a sustained complete response (full remission) after subsequent treatment with a PD-1 checkpoint inhibitor.

Both patients who achieved full cancer remission were treated with four doses of synthetic DNA vaccine as part of the Phase 1 trial. This shows that synthetic DNA vaccine generated robust HPV16/18 specific CD8+ T cell responses in peripheral blood and increased CD8+ T cell infiltration in resected tumor tissue samples.

Of the four patients who developed progressive disease and were subsequently administered a PD-1 checkpoint inhibitor, two patients rapidly exhibited a complete response. The most recent patient for which data was presented in January 2019 received pembrolizumab (KEYTRUDA®), while the previously reported complete responder was treated with nivolumab (OPDIVO®). The patients moved from metastatic head and neck cancer to no evidence of disease and they remain alive two years after treatment.

Increasing evidence suggests that response rates from checkpoint inhibitors can be enhanced when used in combination with cancer vaccines like MEDI0457 that generate tumor-specific T cells. Interim data from a MEDI0457 monotherapy study of head and neck cancer patients demonstrated that MEDI0457 generated robust HPV16/18 specific CD8+ T cell responses in peripheral blood and increased CD8+ T cell infiltration in resected tumor tissue samples.

Collaboration with AstraZeneca

In August 2015, we formed a strategic collaboration with MedImmune, the global biologics research and development arm of AstraZeneca (AstraZeneca), focused on cancer immunotherapies. Under this agreement AstraZeneca licensed INO-3112 (renamed MEDI0457), to be studied in combination with selected immunotherapy molecules within its pipeline in HPV-driven cancers. See “Business- License, Collaboration and Supply Agreements” for additional information about the collaboration agreement.

In May 2017, we announced that AstraZeneca will conduct a Phase 1/2 clinical trial investigating the combination of MEDI0457 and durvalumab, a PD-L1 checkpoint inhibitor. The combination trial will enroll patients with metastatic HPV-related HNSCC with persistent or recurrent disease after chemotherapy treatment.

The open-label clinical trial is designed to evaluate the safety and efficacy of the combination therapy in approximately 50 subjects with metastatic head and neck cancer at multiple U.S. sites. Subjects will receive multiple doses of MEDI0457 and durvalumab. The primary endpoints of the trial are safety and objective response rate. The trial will also evaluate immunological impact, progression-free survival and overall survival. The Phase 2 portion of this study was initiated in December 2017 and this event triggered a $7 million milestone payment from AstraZeneca.

In December 2018, we announced the dosing of the first patient in an open-label, Phase 2 combination trial to evaluate MEDI0457, in combination with durvalumab, in patients with HPV-associated cervical, anal, penile and vulvar cancers. This trial, which is being funded by AstraZeneca, has an estimated total enrollment of 77 patients.

The first dosing of a cervical cancer patient in this trial resulted in an undisclosed milestone payment from AstraZeneca to us in 2018. A first dosing of a patient with a third distinct HPV-associated cancers other than H&N or cervical will trigger another Phase 2 milestone payment in 2019.

Under our collaboration agreement, AstraZeneca will fund all of the costs of developing MEDI0457.

INO-5150 for the Treatment of Prostate Cancer

The development of a new treatment for prostate cancer would be a significant medical advance given that present treatment options (surgery, radiation and hormone deprivation), while somewhat effective, all carry deleterious side

effects and often do not confer long-term cure. In the United States in 2018, there were an estimated 164,690 new cases of prostate cancer and more than 29,000 deaths occurred due to this cancer. Worldwide in 2018, an estimated 1.28 million new cases of and nearly 360,000 deaths occurred due to this cancer.

In July 2015, we initiated a Phase 1 trial to evaluate our DNA immunotherapy for prostate cancer, INO-5150, in men with biochemically relapsed prostate cancer. This study is evaluating the safety, tolerability and immunogenicity of INO-5150 alone or in combination with INO-9012. The multi-centered study is also evaluating changes in prostate specific antigen, or PSA, levels, an important biomarker in prostate cancer. We have fully enrolled 62 patients in the trial across 4 dose cohorts.

An interim data analysis presented in September 2017 at the European Society of Medical Oncology (ESMO) meeting in Madrid, Spain showed that INO-5150 had generated antigen-specific CD8+ killer T cell responses measured in peripheral blood from subjects with biochemically recurrent prostate cancer. Treatment with INO-5150 as a monotherapy generated PSA and prostate specific membrane antigen, or PSMA, specific T cell responses in peripheral blood in 60% (35/58) of the subjects. Patients with specific CD8+ T cell responses experienced dampening in the rise of PSA and significant increases in PSA Doubling Times (PSADT).

In June 2018, additional prostate cancer data from the trial was presented at the American Society of Clinical Oncology (ASCO) annual meeting. The additional data showed clinically meaningful PSA stabilization after administration of INO-5150 in patients, with no documented disease progression during the study. Of note, this effect was also observed in the patients with the fastest PSA doubling at the time of study entry.

In October 2018, we announced new data from the trial in which a slowing of Prostate-Specific Antigen Doubling Time (PSADT) was observed in men with prostate cancer. Eighty-six percent (86%) of patients remained progression-free at Week 72 of the study, and immunogenicity was observed in 77% (47/61) of patients by multiple immunologic assessments. These data were presented in a poster entitled “Synthetic DNA immunotherapy in Biochemically Relapsed Prostate Cancer” at the 2018 European Society for Medical Oncology (ESMO) congress.

We have announced that we are seeking strategic collaborators in order to continue the development of INO-5150.

INO-1400 for the Treatment of Multiple Solid Tumor Types (hTERT antigen)

Human telomerase reverse transcriptase (hTERT) is a significant cancer immunotherapy target. High levels of hTERT have been detected in more than 85% of all human cancers, including breast, lung, and pancreatic cancers, while normal cells showed undetectable levels of telomerase expression. Immunological analysis indicated that hTERT is a widely applicable target recognized by T-cells and can be potentially used as a universal cancer immunotherapy. In 2018, over 555,000 new cases of breast, lung, or pancreatic cancers are estimated to have occurred in the United States and nearly 240,000 people died from these cancers collectively. Worldwide in 2018, more than 4.6 million new cases of these cancers occurred and more than 2.8 million people died from these cancers collectively. Despite available treatments, mortality rates remain unacceptably high in these tumor types. In addition, many existing treatment modalities are associated with significant adverse events.

In December 2014, we initiated a Phase 1 clinical trial of INO-1400 alone or in combination with INO-9012 in adults with breast, lung or pancreatic cancer at high risk of relapse after surgery and other cancer treatments. This open label, dose escalation study is evaluating the safety, tolerability, and immunogenicity of INO-1400, as well as another hTERT construct called INO-1401. To date, we have treated 90 patients with nine different types of solid tumors. All patients received treatment using our CELLECTRA® delivery device.

In November 2017, in poster presentations at the SITC Annual Meeting, we reported additional results from the ongoing Phase 1 trial in which that INO-1400 generated hTERT-specific IFN-gamma secreting T cells, suggesting an ability to break immune tolerance.

INO-5401: Immunotherapy targeting WT1, hTERT, and PSMA cancer antigens

INO-1400 is also part of our product candidate INO-5401, an immunotherapy comprising hTERT and two other tumor-associated antigens, Wilms' tumor gene, or WT1, and PSMA, for which we intend to initiate a clinical study in combination with a checkpoint inhibitor.

In February 2017, we reported data indicating that our SynCon® WT1 cancer antigen was capable of breaking immune tolerance, a major challenge to researchers striving to develop potent cancer therapies, and induced neo-antigen-like T cell responses to cause tumor regression in pre-clinical studies. The results were published in the scientific journal Molecular Therapy in an article entitled, “A novel DNA vaccine platform enhances neo-antigen-like T cell responses

against WT1 to break tolerance and induce anti-tumor immunity."

While mice in the preclinical study did not mount an immune response to native mouse WT1 antigens, mice immunized with our SynCon® WT1 antigen broke tolerance and generated robust neo-antigen-like T cells. The immunized mice also

exhibited smaller tumors and prolonged survival in a tumor challenge study. SynCon® WT1 DNA vaccination also broke tolerance and generated neo-antigen-like T cell immune responses in Rhesus monkeys, a species whose immune system closely resembles that of humans. The ability to overcome the immune system's usual tolerance of WT1 antigen suggests the potential of our SynCon® WT1 antigen to tackle any WT1-expressing cancer in humans, including pancreatic, brain, lung, thyroid, breast, testicular, ovarian, and melanoma.

We previously reported similar results for our SynCon® hTERT and PSMA cancer antigens.

The National Cancer Institute previously highlighted WT1, hTERT and PSMA among a list of attractive cancer antigens, designating them as high priorities for cancer immunotherapy development. WT1 was at the top of the list. The hTERT antigen relates to 85% of cancers and WT1 and PSMA antigens are also widely prevalent in many cancers.

These attributes of breaking tolerance and having broader prevalence across different cancers create the potential for INO-5401 to be an effective universal cancer immunotherapy in combination with different checkpoint inhibitors.

INO-5401 for the Treatment of Metastatic Bladder Cancer

In the U.S., an estimated 81,190 new cases of bladder cancer and 17,240 deaths due to bladder cancer occurred in 2018. Worldwide, nearly 550,000 new cases of urinary bladder cancer are estimated to have occurred in 2018 worldwide, with this cancer accounting for nearly 200,000 deaths. Advanced unresectable or metastatic urothelial carcinoma, or UC, the most common type of bladder cancer, remains a high unmet medical need, as survival remains poor for most patients who experience disease progression or intolerance to treatment during or after platinum-containing chemotherapy. The approval of several checkpoint inhibitors for advanced unresectable or metastatic UC has improved response and survival rates for some patients; however, the majority of patients do not experience meaningful clinical responses to checkpoint inhibitor monotherapy.

In August 2018, we dosed the first patient in an open-label, Phase 1/2a study designed to evaluate the safety, immunogenicity and clinical efficacy of INO-5401, in combination with INO-9012 and Roche/Genentech's product, atezolizumab, PD-L1 inhibitor, for the treatment of advanced or metastatic bladder cancer. The trial, which we are managing, is expected to enroll approximately 85 patients at sites located in the United States and Spain.

Patients will be divided into two cohorts. Cohort A includes patients with confirmed disease progression during or following prior checkpoint inhibitor therapy, while Cohort B patients are treatment naïve and unfit for cisplatin-based therapy. Primary endpoints are incidence of adverse events (AEs), antigen-specific immunologic activation and objective response rate (ORR) in Cohort A. Secondary endpoints are Cohort B's ORR, duration of response, progression free survival and overall survival. Exploratory endpoints are correlation of biomarkers to anti-tumor activity. A safety run-in will be performed for the first six patients enrolled in Cohort A to monitor emergence of any dose limiting toxicities. INO-5401 and INO-9012 (10 mg DNA combined in 1ml) will be administered by intramuscular injection followed by electroporation every 3 weeks for first 4 doses, every 6 weeks for 6 doses and every 12 weeks until disease progression. Atezolizumab (1200 mg IV) will be administered every 3 weeks until disease progression. Tumor imaging, disease assessment (per RECIST and iRECIST) and biopsies, blood and urine samples will be collected at set time points including prior to study treatment, on treatment and at disease progression.

INO-5401 for the Treatment of Glioblastoma Multiforme (GBM)

GBM is a devastating disease for both patients and caregivers. It is the most aggressive brain cancer and its prognosis is extremely poor, despite a limited number of new therapies approved over the last 10 years. The latest available U.S. data for GBM is for the period of 2011 to 2015, when an average annual number of reported new cases was 11,229. The median overall survival for patients receiving standard of care therapy is approximately 15 months and the average five-year survival rate is only 5.8% for urban residents and only 3.9% for rural residents.

In June 2018, we dosed the first patient as part of a Phase 1/2 immuno-oncology trial in patients with newly diagnosed GBM. The trial is designed to evaluate INO-5401 and INO-9012, in combination with cemiplimab (REGN2810), a PD-1 inhibitor developed by Regeneron Pharmaceuticals.

The open-label trial of 50 newly diagnosed GBM patients will be conducted at approximately 25 U.S. sites, and the primary endpoint is safety and tolerability. The study will also evaluate immunological impact, progression-free survival and overall survival.

Infectious Disease Vaccines/Immunotherapies

INO-1800 for the Treatment of Hepatitis B Virus

Although an effective preventive vaccine against hepatitis B virus, or HBV, infection has existed for over three decades, HBV remains a major epidemic, especially among people of Asian and African descent. The World Health Organization estimates that 2 billion people globally are or have been infected with HBV, with over 257 million people chronically infected with the virus and at risk of developing the major complications of cirrhosis or liver cancer. It is

estimated that over two million people in the United States are chronically infected with the virus, including those who were foreign-born. Currently, the only therapies available for chronically infected individuals are interferon-alpha and nucleoside analog treatments, which function by controlling viral replication, but they do not clear infection. Interferon can prevent viral replication in only 30% of patients and does so with undesirable side effects.

Liver cancer is the fourth most common cause of death from cancer worldwide, and it kills the vast majority of patients within five years of diagnosis in the U.S. An estimated more than 841,000 new cases arose in 2018 worldwide, including 42,220 cases in the U.S. One of the major causes and risk factors for liver cancer is infection by hepatitis B. Chronically infected individuals may develop a permanent scarring of the liver, a condition called cirrhosis. Liver cirrhosis can evolve into hepatocellular carcinoma, which claimed an estimated 780,000 lives worldwide in 2018.

INO-1800 is encoded for the HBcAg antigen and represents a consensus of the unique HBcAg DNA sequences of all major HBV genotypes (A through E). When delivered by CELLECTRA®, in a preclinical study, INO-1800 elicited strong HBcAg-specific T cell and antibody responses in the periphery (outside of the liver) as measured by ELISpot, ICS and cell proliferation assays. Researchers observed that the immunization could also induce antigen-specific CD8+ and CD4+ T cells that produced both IFN-y and TNF-a in the liver, indicating that a strong immunotherapy-induced T cell response was also present in the liver.

In the preclinical study, the antigen-specific T cells exhibited a killing function and were able to migrate to and stay in the liver and cause clearance of target cells without any evidence of liver injury. This was the first study to provide evidence that intramuscular immunization could induce killer T cells that can migrate to the liver and eliminate target cells.

In April 2015, we initiated a Phase 1 trial to evaluate INO-1800 in patients chronically infected with HBV. This randomized, open-label, active-controlled, dose escalation study was designed to evaluate the safety, tolerability and immunogenicity of INO-1800 alone or in combination with INO-9012. This international study enrolled patients in the United States and Asia Pacific region with a primary endpoint of safety and tolerability of the therapy. Secondary endpoints are evaluating the cellular and humoral immune response to INO-1800 and its effect on several viral and antiviral parameters. All trial subjects are also medicated with standard-of-care antiviral therapies.

In March 2018, we announced interim results from the trial, in which INO-1800 was well-tolerated and generated virus-specific T cells, including CD8+ killer T cells, meeting the objectives of the clinical study. Preliminary immunology data from the trial revealed that treatment of patients with INO-1800 resulted in the generation of T cells that recognized key components of the hepatitis B virus and reacted by making antiviral cytokines such as Interferon gamma, a protein believed to be linked to clearance of HBV from the liver. In the trial, INO-1800 was also able to activate and expand CD8+ killer T cells that displayed markers believed to be important for retention in the liver as well as multiple potential mechanisms for killing virally infected cells.

We are currently seeking a collaboration partner in order to further advance the clinical development of INO-1800.

GLS-6150 for the Treatment of Hepatitis C Virus

In September 2018, we announced the dosing of the first patient in a Phase 1 study designed to evaluate a preventive vaccine candidate, GLS-6150, against hepatitis C infection. Recruitment has begun in South Korea, where our collaborator GeneOne Life Science, or GeneOne, is responsible for conducting and funding this Phase 1 trial to assess the ability of GLS-6150 to boost immunity in people who have been treated and cleared of the virus. We believe that the vaccine could potentially be employed to prevent infection and re-infection.

This jointly developed, open-label, Phase 1 study of GLS-6150 will evaluate a total of 24 patients who have a sustained virologic response (SVR) following treatment for Hepatitis C (n=8 per group) and an additional 8 healthy controls to compare immune responses. Subjects will receive one of two doses of vaccine, 1 or 2 mg, administered intra-dermally and followed by electroporation with our CELLECTRA®-3P device. Vaccinations will occur as a three-dose priming series (at 0, 4, 12 weeks) or as a two-dose priming series (at 0 and 8 weeks) and followed by a booster dose at 6 months. Final study visit is 4 weeks following the 6-month booster vaccination.

Zika Virus

Overview

First identified in the late 1940s in Uganda, Zika virus subsequently spread to equatorial Asia in 1969 and then rapidly spread through the Pacific, and still later, in the 2014-2016 period, to and through South America, Central America

and the Caribbean. In the end of that period, Zika virus emerged in two portions of the continental United States (extreme Southeastern Florida and extreme South Texas). Zika virus is a flavivirus, a family of viruses including yellow fever, dengue, and West Nile virus, which are introduced to people through mosquito bites. Because the Aedes species of mosquitoes that spread Zika virus are found in much of the world, there is concern that the virus will spread to new countries and cause additional outbreaks. There is also concern that Zika spreads sexually in humans, at least by males to

females, as has been reported for some returning travelers and documented in multiple studies. In February 2016, the WHO stated that 39 countries had reported locally acquired circulation of the Zika virus since January 2007. Geographical distribution of the virus had expanded since then, and although the incidence of infections has declined significantly since the 2014-2016 emergence in the Americas, currently the U.S. CDC still lists at least 94 countries and territories as having risk of Zika virus infection and notes that the virus is still a threat. No vaccine or therapy currently exists for the Zika virus.

The most common symptoms of Zika virus are fever, rash, joint pain, and conjunctivitis. More seriously, health authorities have observed neurological and autoimmune complications potentially associated with Zika virus, including microcephaly in newborn children and Guillain-Barre syndrome. Microcephaly is a rare condition marked by an abnormally small head and incomplete brain development. There may also be a link with Guillain-Barré syndrome, a disease in which the body's immune system mistakenly attacks peripheral nerves. Symptoms start with muscle weakness. In severe cases the person is almost totally paralyzed and the disorder can be life threatening.

In January 2016, we and GeneOne announced a joint research collaboration with academic collaborators of a SynCon® Zika virus vaccine known as GLS-5700.

Preclinical Studies - Zika Virus

In February 2016, we announced that our Zika vaccine administered using our CELLECTRA® delivery device resulted in seroconversion, or the development of detectable specific antibodies in the blood, in all vaccinated mice. The vaccinations also generated robust and broad T cell responses as analyzed by the standardized T cell ELISPOT assay. In data reported in May 2016, two doses of the Zika DNA vaccine delivered either intramuscularly or intradermally resulted in seroconversion, in all vaccinated non-human primates and broad T cell responses as analyzed by the standardized T cell ELISPOT assay.

These results were later published in Nature Partner Journals (npj) Vaccines in November 2016. Additional data indicated that in the study GLS-5700 protected animals from infection, brain damage and death. All GLS-5700 vaccinated animals were protected from Zika infection after exposure to the virus. In addition, vaccinated mice were protected from degeneration in the cerebral cortex and hippocampal areas of the brain while unvaccinated mice showed significant degeneration of the brain after Zika infection.

In another preclinical study, the results of which were published in June 2017, GLS-5700 was observed to have protected against Zika virus-induced damage to testes and sperm, and prevented persistence of the virus in the reproductive tract of all vaccinated male mice challenged with a high dose of the Zika virus. This preclinical study data was published in Nature Communications in an article entitled, “DNA Vaccination Protects Mice Against Zika Virus-Induced Damage to the Testes.”

Phase 1: 40 Patient Zika Study in U.S. & Canada

In June 2016, we were the first to commence a human Zika trial in healthy adult volunteers, with sites in the U.S. and Canada, with the first subject dosed in July. This Phase 1, open-label, dose-ranging study of 40 healthy adult volunteers was designed to evaluate the safety, tolerability and immunogenicity of GLS-5700 administered with CELLECTRA®-3P, our intradermal DNA delivery device.

In this Phase 1 trial, a total of 40 participants (20 in each of two groups) received GLS-5700 in a 1 mg or 2 mg dose. The vaccine was administered in 0.1 ml intradermal injections. In October 2017, we announced positive safety and immune response results from the Phase 1 trial. The GLS-5700 Zika vaccine induced binding antibodies in 100% of the participants after a three-dose vaccination regimen and in 95% after two doses of vaccine. In addition, neutralizing antibodies were observed in more than 95% of the serum samples that were assayed on neuronal-cell targets. Serum samples from vaccinated subjects when subsequently transferred to mice were found to be protective from death and illness in more than 90% of animals after they were challenged with a lethal dose of the Zika virus. These results appeared in the New England Journal of Medicine in the article, “Safety and Immunogenicity of an Anti-Zika Virus DNA Vaccine.”

Phase 1: 160 Patient Zika Study in Puerto Rico

In August 2017, we and GeneOne initiated a second clinical trial of GLS-5700. In this second trial, we have enrolled 160 subjects in Puerto Rico, where the Zika virus outbreak was declared a public health emergency. In this placebo-controlled, double-blind trial involving healthy adult volunteers, 80 subjects received GLS-5700 and 80 subjects received placebo. The study is evaluating the safety, tolerability and immunogenicity of GLS-5700

administered with our CELLECTRA®-3P device. We are also assessing differences in Zika infection rates in participants given either placebo or vaccine as part of an exploratory endpoint. We expect to report data from this trial in the first half of 2019.

Zika dMAb®

In December 2016, we received a sub-grant through The Wistar Institute to develop a DNA-based monoclonal antibody designed to provide a fast-acting treatment against Zika infection and its debilitating effects. The goal of this program, which was funded by the Bill & Melinda Gates Foundation, is for the researchers to develop a Zika dMAb® through human clinical trials. In the first quarter of 2019, we dosed our first subject with a Zika dMAb. See the section below entitled "Synthetic DNA-based Monoclonal Antibodies" for further information on our DNA-based monoclonal antibody program.

Ebola Virus

Overview

The Ebola virus has been described as one of the most virulent viral diseases, with lethality rates approaching 90%. Ebola can spread through human-to-human transmission by direct contact with the blood, secretions, organs or bodily fluids of an infected individual and with surfaces or materials that contain the contaminated fluids of an infected person, such as bedding and clothing. It is capable of causing death within two to twenty-one days of exposure. There are no approved preventive vaccines or effective therapeutic treatments for Ebola. In addition, various experimental approaches have already been associated with undesirable side effects and limited ability to scale manufacturing. According to the U.S. CDC, the 2014 West Africa Ebola epidemic was the largest in history, resulting in 28,610 suspected and confirmed cases and 11,308 deaths as of June 2016, when it was declared over.

In 2018, two Ebola outbreaks occurred, both in the Democratic Republic of Congo (DRC). The first of these outbreaks was declared in May and was relatively well-contained and short-lived, with a total of 54 cases and 33 deaths through the declared end of the outbreak in July. However, the second outbreak, which was declared in August, has persisted and continued into 2019. This latter, current outbreak is now the second largest Ebola outbreak in history, with a total of 838 cases, 534 deaths, and 6,772 contacts being followed as of February 2019. As of January 2019, 63 health workers had become infected with Ebola virus and 21 of them have died.

Preclinical and Clinical Development - Ebola

In 2014, we entered into a collaboration with GeneOne to advance a DNA immunotherapy for Ebola into clinical development. The decision to advance our Ebola immunotherapy was based on positive results observed in preclinical studies, in which 100% of immunized guinea pigs and mice were protected from death after being exposed to the Ebola virus. Unlike the non-immunized animals, immunized animals were also protected from weight loss, a measure of morbidity. Researchers found significant increases in neutralizing antibody titers and strong and broad levels of immunotherapy-induced T cells, including "killer" T cells, suggesting that DNA immunotherapy could provide both preventive and treatment benefits. This data was published in 2013 in the peer-reviewed journal Molecular Therapy in a paper titled, "Induction of Broad Cytotoxic T Cells by Protective DNA Vaccination Against Marburg and Ebola."

In April 2015, we received a contract from the Defense Advanced Research Projects Agency (DARPA) to lead a consortium to develop multiple treatment and prevention approaches against Ebola. Other collaborators are AstraZeneca; GeneOne and its manufacturing subsidiary, VGXI, Inc.; and David B. Weiner, Ph.D., a director of our company, who also serves as executive vice president at the Wistar Institute and retired professor of Pathology and Laboratory Medicine at The Perelman School of Medicine at the University of Pennsylvania, Emory University and Vanderbilt University. A previous collaboration agreement with GeneOne for Ebola was incorporated into this consortium funded by DARPA.

We are taking a multi-faceted approach to develop products to prevent and treat Ebola infection. These programs include development and early clinical testing of:

- a therapeutic DNA-based monoclonal antibody product against the Ebola virus infection, which we believe has properties that best fit a response to the outbreak in that they could be designed and manufactured expediently on a large scale using common fermentation technology, are thermal-stable, and may provide more rapid therapeutic benefit;
- a highly potent conventional protein-based therapeutic monoclonal antibody (mAb) product against Ebola virus infection; and
- a DNA-based vaccine against Ebola.

Our contract with DARPA covers the pre-clinical development costs for the dMAb products and protein mAb candidates, as well as GMP manufacturing costs and the Phase 1 clinical trial costs for the three product candidates described above.

In May 2015, we and our collaborators initiated a Phase 1 clinical trial of INO-4212, an Ebola DNA vaccine to evaluate its safety, tolerability and immune responses in 75 healthy subjects divided into five study arms. INO-4212 consists of two optimized SynCon® DNA plasmids coding for the Ebola glycoprotein antigen from circulating Ebola

strains from 1975-2014. The study was designed to evaluate INO-4212 and its components INO-4201 and INO-4202, alone or in combination with INO-9012, delivered into muscle or skin using our proprietary DNA delivery technology.

In March 2016, we reported initial results from the trial. Of 69 evaluated subjects, 64 (92.8%) seroconverted and mounted a strong antibody response to the Ebola glycoprotein antigen following the three dose immunization regimen; 48 subjects (69.6%) seroconverted after only two doses.

In the study arm using intradermal (skin) administration, 13 of 13 evaluable subjects (100%) generated antigen-specific antibody responses after only two doses, and all remained seropositive after three immunizations. Similarly, in the study arm receiving the vaccine with intramuscular administration in combination with plasmid IL-12, 13 of 13 evaluable subjects (100%) produced strong antibody responses after three immunizations, and 12 of 13 (92.3%) achieved strong antibody responses after only two immunizations.

The Ebola glycoprotein specific geometric mean antibody titers measured in the five cohorts ranged from over 2,000 to greater than 46,000. Significantly, a majority of vaccinated subjects in each of the five cohorts produced strong Ebola antigen specific T cell responses as measured by interferon gamma ELISpot analysis.

INO-4212 was well tolerated, with no systemic serious adverse effects observed. Side effects, such as fever, joint pain, and low white blood cell counts have previously been reported following treatment with some viral vector based Ebola vaccines currently in development. Moreover, unlike the viral vectored vaccines which must be kept frozen, the INO-4212 formulation used in the trial was kept in a solution which was refrigerated at 2-8 degrees Celsius.

In August 2016, we announced that enrollment of this study was being expanded to up to 200 subjects to further characterize and identify in humans the most optimal immunization regimen using intradermal (skin) delivery of the Ebola DNA vaccine.

In April 2017, we reported preliminary results from the expanded Phase 1 trial. Across both stages of the trial, including both intramuscular and intradermal delivery, 95% (170/179) of evaluable subjects generated an Ebola-specific antibody immune response, with the mean antibody titer comparable or superior to those reported from viral vector-based Ebola vaccines. Our Ebola vaccine was also well tolerated in the second stages of the trial, with a favorable safety profile compared to viral vector-based Ebola vaccines, some of which have been associated with serious adverse events including myalgia, arthralgia, fever, and rash.

In October 2018, we announced that INO-4212 provided 100% protection following a challenge with a lethal dose of the Ebola virus in a preclinical study. An article in the Journal of Infectious Diseases highlights that regimens of the INO-4212 vaccine delivered by intramuscular administration provided 100% protection against a lethal Ebola challenge in all preclinical subjects. In a separate study, two injections by intradermal administration generated strong immunogenicity and provided 100% protection against a lethal Ebola challenge. In the study, scientists observed that vaccination induced long-term immune responses in monkeys that were detectable for at least one year after the final vaccination.

Middle East Respiratory Syndrome (MERS)

Overview

MERS is a viral respiratory illness first reported in Saudi Arabia in 2012. MERS appears to have been transmitted from an animal reservoir to humans but human to human transmission has been confirmed. This communicable virus has not been shown to spread in a sustained way in communities, but rapid spread in the nosocomial setting, such as emergency rooms and/or hospitals without adherence to state-of-the-art infection control practices, can result in outbreaks with many cases, including superspreading events. Like the severe acute respiratory syndrome (SARS) outbreak in 2003, which made approximately 8,000 people ill and was fatal in nearly 10% of those cases, MERS is caused by a coronavirus and appears to cause a severe lung infection. However, the case-fatality rate (death rate) of MERS has typically been between 30% and 40%, which is significantly higher than that of SARS. While the SARS epidemic in 2003 killed 10% of those who became ill from the SARS virus, MERS has killed approximately 35% of people who people who became ill from the MERS virus from 2012 to December 2017. MERS differs in that it also causes rapid kidney failure. Its high death rate has caused serious concern among global health officials.

Despite the continuing threat of MERS outbreaks, there are no licensed vaccines or treatments for MERS. Since the virus was first identified in Saudi Arabia in 2012, the World Health Organization reports 2,298 laboratory-confirmed cases of MERS and 811 deaths from MERS worldwide as of January 2019. Twenty seven countries have reported

cases, including Korea where an outbreak in the summer of 2015 resulted in 186 cases and 38 deaths. The majority of MERS cases reported in the world by country have been reported from the Kingdom of Saudi Arabia, with a total of 1,915 cases, 735 associated deaths, and a case-fatality rate of 38% from 2012 through January 2019. In early 2019, a MERS outbreak occurred in the Saudi Arabian city of Wadi Aldwasir and continues. As of February 21, 2019, a total of 47 MERS cases had been reported in that outbreak.

Preclinical and Clinical Development - MERS

In November 2013, we announced that preclinical testing of our SynCon® MERS vaccine candidate, GLS-5300, had induced robust and durable immune responses in mice, demonstrating the potential for such a vaccine to prevent and treat this deadly virus. DNA vaccine constructs targeting multiple MERS antigens were designed using our SynCon® vaccine platform with the goal to universally protect against multiple strains of MERS, which has been shown to have diverse genetic variants. These SynCon® constructs were administered via our CELLECTRA® delivery technology. A consensus MERS "spike" protein vaccine construct was created based on multiple strains of the MERS virus. Our MERS DNA vaccine was immunogenic in mice and seroconversion was observed in all animals. The antibodies generated by the vaccine in 100% of mice (20 of 20) were able to neutralize or completely block actual infection of MERS virus in the cells, demonstrating the protective potential of this vaccine. In contrast, none of the 10 unvaccinated mice in the control group generated neutralizing antibodies.

The vaccinations were also highly T cell immunogenic, generating robust and broad T cell responses as extensively analyzed by the standardized T cell ELISPOT assay. The vaccine produced robust CD8+ and CD4+ T cell responses against multiple epitopes of the MERS spike protein. This increased diversity and magnitude of cellular responses may be critical for effectively mitigating MERS infection.

We believe these preclinical findings are vital given the importance of neutralizing antibodies in preventing infection and the role T cells play in clearing infection by killing cells that harbor the virus.

In August 2015, we announced that our MERS vaccine had induced 100% protection from a live virus challenge in a preclinical study in mice, camels and monkeys, or non-human primates. In all three species, the vaccine induced robust immune responses capable of preventing the virus from infecting cells. We believe the data from camels is an important finding because camels represent not only a host reservoir of the disease, but also act as a mode of transmission to humans. In monkeys, all vaccinated animals in the study were protected from symptoms of MERS disease when challenged with a live MERS virus.

The preclinical results appeared in the peer-reviewed journal Science Translational Medicine in an article entitled, "A synthetic consensus anti-spike protein DNA vaccine induces protective immunity against Middle East Respiratory Syndrome Coronavirus in non-human primates."

In February 2016, we and our collaborator GeneOne commenced a Phase 1, dose-escalation clinical trial of GLS-5300 in 75 healthy volunteers at the Walter Reed Army Institute of Research (WRAIR) in Maryland. The primary and secondary goals of this first-in-man Phase 1 trial are to obtain safety and immunogenicity data. This trial represents the first MERS vaccine to be tested in humans for this disease that has no approved vaccines or treatments.

In December 2016, we announced that the International Vaccine Institute (IVI) will provide new funding and support to further advance the clinical development of GLS-5300. IVI will add technical, laboratory and financial support for GLS-5300 clinical trials in Korea with the goal to advance clinical testing toward emergency use authorization by the Korean government as well as authorities of other countries. This collaborative funding is part of a grant from the Samsung Foundation to IVI to support the development of a MERS vaccine for emergency use in Korea and internationally.

In April 2018, we announced a collaboration with The Coalition for Epidemic Preparedness Innovations (CEPI) under which we will develop vaccine candidates against Lassa fever and Middle East Respiratory Syndrome (MERS). CEPI will fund up to $56 million of costs to support our pre-clinical and clinical advancement through Phase 2 of GLS-5300, as well as a Lassa fever vaccine. The goal of the collaboration is for the Lassa and MERS vaccines to be available as soon as possible for emergency use.

In June 2018, we announced positive results from the Phase 1 trial of GLS-5300. In the trial, treatment with GLS-5300 was well tolerated and resulted in overall high levels of antibody responses in roughly 95% of subjects, while also generating broad-based T cell responses in nearly 90% of study participants. Antibody responses were observed in 94% of subjects at week 14 (two weeks after the third dose). Additionally, there were no statistically significant dose-dependent differences in antibody response rates (91%, 95%, and 95% at doses of 0.67, 2, and 6 mg, respectively). Durable antibody responses were also maintained through 60 weeks following dosing.

In September 2018, we announced the dosing of the first subject in a Phase 1/2a study of GLS-5300 in South Korea funded by IVI. We expect to advance GLS-5300 into a Phase 2 field trial in the Middle East in 2019 with CEPI funding.

HIV (Human Immunodeficiency Virus)

Overview

Since its discovery in 1981, HIV, the virus which causes AIDS, has killed more than 35 million people. Worldwide in 2017, there were an estimated 1.8 million new HIV infections and 940,000 deaths due to HIV. That year worldwide,

an estimated approximately 37 million people were living with HIV worldwide. In 2017 in the United States, 38,739 people received an HIV diagnosis. At the end of 2015, 1.12 million people in the United States were living with HIV. Effective vaccines have been actively pursued for over 30 years, without significant success. HIV represents one of the most confounding targets in medicine. The virus's high mutagenicity (ability to mutate) has made effective vaccine development very challenging. Its outer envelope, swathed in sugar molecules, is difficult to attack, and HIV strikes the very cells that the immune system launches to thwart such an infection. Although several drugs (anti-retrovirals) are available to treat the patients once they are infected, vaccines and immunotherapies are necessary to stop the spread of disease and perhaps reduce the need for anti-retroviral treatment.

Noting that many long-term survivors have high counts of killer CD8+ T cells, the HIV vaccine and immunotherapy field has turned to stimulating the immune system to generate those cells. Recent HIV vaccine candidates used an adenovirus (a common human cold virus) genetically modified to contain code for HIV antigens to prevent viral replication. These vaccines have proven to not be effective. More recently, the RV-144 trial, which employed an ALVAC™ (canary pox) vaccine prime followed by a protein vaccine boost, demonstrated 30% efficacy in preventing acquisition of infection amongst the vaccinated population compared to the control group. Although the efficacy was relatively modest, the finding for the first time showed that an immunotherapy may be able to combat spread of HIV and has spurred the development of newer immunotherapy candidates. We believe, however, that a different approach is needed to develop an effective vaccine or immunotherapy for HIV.

PENNVAX®-GP - Preventive and Therapeutic Immunotherapies

PENNVAX®-GP is a developmental vaccine intended to prevent and treat HIV strains present in Africa, Asia, Europe, and North America. Using our SynCon® technology, it has been optimized to target two env antigens, as well as gag and pol antigens. This comprehensive targeting gives PENNVAX®-GP the potential to provide global coverage against HIV-1 subtypes. PENNVAX®-GP is delivered intramuscularly using the CELLECTRA® delivery device. The development of the PENNVAX®-GP program was funded by a seven-year, $25 million NIAID contract to us and our collaborators.

In September 2015, the first patient was dosed in a Phase 1 trial to evaluate the safety and tolerability of PENNVAX®-GP. This trial was conducted in collaboration with the HIV Vaccine Trials Network (HVTN). The trial measured immune responses following administration of the vaccine in four groups of healthy subjects receiving the vaccine with and without an immune activator (IL-12) and delivered into muscle or skin using our CELLECTRA® delivery technology.

In May 2017, we announced results from the trial, in which PENNVAX®-GP produced among the highest overall levels of immune response rates (cellular and humoral) ever observed in a human clinical trial by an HIV vaccine. Overall, 71 of 76 (93%) evaluable vaccinated participants showed a CD4+ or CD8+ T cells cellular immune response to at least one of the four vaccine antigens. Similarly, 62 of 66 (94%) evaluated participants had an env specific antibody response. None of the placebo recipients (0 of 9) had either a cellular or an antibody response in the study. Notably, amongst the participants receiving PENNVAX®-GP vaccine and IL-12 with intradermal immunization, 27 of 28 (96%) participants achieved a cellular response and 27 of 28 (96%) achieved an HIV env specific antibody response.

Amongst the evaluated participants receiving PENNVAX®-GP and IL-12 via intramuscular vaccination, 27 of 27 (100%) achieved a cellular response and 19 of 21 (90%) achieved an env specific antibody response. Similar immune responses and response rates were achieved via both intradermal and intramuscular administration of the vaccine, even though participants vaccinated via intradermal administration received 1/5th of the dose of vaccine compared to those vaccinated via intramuscular administration.

In addition to our NIAID contract that funded our Phase 1 clinical trial of PENNVAX®-GP, in 2015, we and our collaborators were awarded an additional $16 million Integrated Preclinical/Clinical AIDS Vaccine Development (IPCAVD) grant from the NIAID. We will use this additional grant to design and test new PENNVAX® envelope constructs with our DNA-based immune activator encoding novel cytokine genes in a prime-boost strategy with recombinant HIV envelope proteins. Our collaborators will assess different combinations in preclinical models with the goal of generating high levels of neutralizing antibodies mirroring the robust CD8+ T cell responses generated by our PENNVAX®-B DNA vaccine in previously published clinical studies. The overall goal of this project is to further build upon this important HIV vaccine approach as well as to gain fundamental insight into new technologies to

improve vaccination outcomes.

In March 2017, we and our collaborators received an additional multi-year $7.0 million grant from NIAID to develop a single or combination therapy using PENNVAX®-GP, with the goal of attaining long-term HIV remission in the absence of antiviral drugs. This is a two-step clinical study in HIV-positive subjects to assess PENNVAX®-GP with INO-9012 alone and with the addition of a PD-1 checkpoint inhibitor. All trials will be randomized, double-blind,

placebo-controlled assessments of PENNVAX®-GP and will be conducted at the University of California in San Francisco and Los Angeles.

In August 2018, we announced that the first participant had been dosed with PENNVAX®-GP in a Phase 1/2 clinical trial designed to evaluate its ability to drive remission of HIV infection. This Phase 1/2 HIV trial is a randomized, double-blinded, placebo-controlled study. The trial is divided into two cohorts and all vaccines are delivered via the CELLECTRA® device. In the main study (Cohort A), 45 HIV-infected adults who initiated antiretroviral therapy during chronic infection will receive either PENNVAX-GP, another vaccine formulation that contains only Gag/Pol antigens, or a placebo. Both vaccines are also co-administered with INO-9012. In the single arm and uncontrolled second study (Cohort B), individuals who initiated antiretroviral therapy during acute HIV infection will receive PENNVAX-GP together with INO-9012.

In October 2018, we announced preliminary results from the Phase 1/2 trial, in which PENNVAX®-GP delivered via intradermal route resulted in durable and robust antibody and T cell immune responses measured throughout the duration of the study. In this study, PENNVAX-GP plasmids were delivered intradermally or intramuscularly with CELLECTRA® device in healthy volunteers. PENNVAX-GP delivered intradermally (ID) with CELLECTRA® generated equivalent or superior immune responses compared to the delivery via intramuscular (IM) route using the same delivery device, with ID delivery using only one-fifth of the dose compared to IM delivery.

HIV dMAb®

In July 2016, we announced that our DNA-based monoclonal antibody technology will be deployed to develop product candidates that could be used alone and in combination with other immunotherapies in the pursuit of new ways to treat and potentially cure infection from HIV. See the section below titled "Synthetic DNA-based Monoclonal Antibodies" for more details on this technology.

Universal Influenza Immunotherapy

Conventional vaccines are strain-specific and have limited ability to protect against genetic shifts in the influenza strains they target. They are therefore modified annually in anticipation of the next flu season’s new strain(s). If a significantly different, unanticipated new strain emerges, such as the 2009 swine-origin pandemic strain, then the current vaccines provide little or no protective capability. In contrast, we believe that our design approach to characterize a broad consensus of antigens across variant strains of each influenza sub-type creates the ability to protect against new strains that have common genetic roots, even though they are not perfectly matched. By formulating a single immunotherapy with some or all of the key sub-types, protection may be achieved against seasonal as well as pandemic strains such as swine flu or pandemic-potential strains, such as avian influenza. We are focused on developing DNA-based influenza immunotherapies able to provide broad protection against known as well as newly emerging, unknown seasonal and pandemic influenza strains.

Instead of targeting a specific strain or strains, we have developed a universal vaccine strategy to deal with ever-changing flu threats. Using our SynCon® process, our scientists have designed immunotherapies targeting an optimal consensus of HA, NA, and NP proteins derived from multiple strains of each of the Type A sub-types H1N1, H2N2, H3N2 (these three influenza sub-types having been responsible for the majority of seasonal and pandemic influenza outbreaks in humans during the last century), as well as H5N1. In theory, consensus HA vaccine constructs from each sub-type, delivered using our CELLECTRA® device, could potentially protect immunized subjects from 90-95% of all human seasonal and pandemic influenza concerns. Additionally, we have also developed an optimal consensus of HA sequences derived from influenza Type B strains. Type B is one of three components of current seasonal influenza vaccinations. Using our SynCon® constructs, we have now developed immunotherapy elements that can target both pandemic-risk (H5N1, H7N9, H1N1) as well as seasonal influenza strains (H3N2, H1N1, influenza B).

Moreover, using our approach the immunotherapies might not have to be administered annually after the first few priming sessions. Rather, the same combination could be used to boost the immune system every few years.

In January 2018, we announced results from a preclinical study in which our synthetic vaccine approach, using a collection of synthetic DNA antigens, generated broad protective antibody responses against all major deadly strains of H1 influenza viruses from the last 100 years, including the virus that caused “Spanish Flu” in 1918 in multiple animal models, including mice, guinea pigs and non-human primates. The vaccine also protected 100% of immunized ferrets from a lethal virus challenge. The preclinical results were detailed in a paper published in the journal Vaccine entitled,

“Broad cross-protective anti-hemagglutination responses elicited by influenza microconsensus DNA vaccine."
We are seeking additional grant and/or collaboration funding to further advance this program.
Immunotherapies for Biodefense and Biosecurity

A number of infectious agents that are relatively rare today are poised for an upsurge in incidence by either “natural” or terrorism-related means. For example, natural threats are posed by the influenza strains H5N1 and H7N9. At the same time, an engineered influenza virus for intentional release would pose a significant human threat.

Since 2001, the United States government has spent or allocated over a billion dollars in funding to address the threat of biological weapons. United States funding for bioweapons-related activities focuses primarily on research for and acquisition of medicines for defense. Biodefense funding also goes toward stockpiling protective equipment, increased surveillance and detection of biological agents, and improving state and hospital preparedness. The increase in this type of funding is mainly due to the Project BioShield Act adopted in 2004.

There are opportunities to secure development funding and for proof-of principle immunotherapy studies for bio-warfare pathogens. We have secured funding from the U.S. government for these projects.

We continue to actively pursue grant and contract funding from the NIH, Department of Defense and other government funding agencies as a source of non-dilutive funding to support development of specific technologies that are broadly applicable across multiple product development programs in the areas of cancer, infectious diseases and biodefense. Based on various initiatives and with the support of NIH funding we are an active collaborator with the Department of Defense (U.S. Army) and continue research and development of DNA-based immunotherapies delivered via our proprietary CELLECTRA® delivery system. Specifically, our projects are focused on identifying immunotherapy candidates with the potential to provide rapid, robust immunity to protect against bio-warfare and bioterror attacks as well as development of our CELLECTRA® devices.

In October 2014, we announced that DARPA had awarded $12.2 million to our scientists and those from the Perelman School of Medicine at the University of Pennsylvania and AstraZeneca to develop and assess dMAb products for influenza and antibiotic resistant bacteria in preclinical studies. This collaboration aims to demonstrate that DNA plasmids can activate sufficient quantities of disease-specific monoclonal antibodies in the body to be protective against a pathogen challenge. See the section below titled "Synthetic DNA-based Monoclonal Antibodies" for more details on our dMAb programs.

Synthetic DNA-based Monoclonal Antibodies Program

Monoclonal antibodies (mAbs) have become one of the most valuable therapeutic technologies of recent years. In 2012, global sales of mAbs exceeded $50 billion. Among the top 10 best-selling drugs in 2012, six were monoclonal antibodies, each with annual sales exceeding $5 billion.

mAbs are designed to enhance the immune system's ability to regulate cell functions. They are designed to bind to a very specific epitope (area) of an antigen or cell surface target and can bind to almost any selected target. They have the ability to alert the immune system to attack and kill specific cancer cells (as in the case of Yervoy®) or block certain biochemical pathways (such as those leading to rheumatoid arthritis, as in the case of Humira®). However, mAb technology has limitations. As a passive immunotherapy, meaning they are manufactured outside the body, mAbs require costly large-scale laboratory development and production. Additional limitations include high cost to develop and manufacture, their limited duration of in vivo potency, and a pharmacokinetic profile that can result in toxicity. We have created DNA based monoclonal antibodies that we believe overcome many of the limitations associated with conventional mAb technology.

Using our core platform technology, we encode the DNA sequence for a specific monoclonal antibody in a DNA plasmid. We deliver the plasmid directly into cells of the body using CELLECTRA®, enabling these cells to manufacture the mAbs in vivo, - unlike conventional mAb technology that requires manufacture outside of the body. We believe this approach provides potentially significant advantages in terms of lower production costs, as well as the ability to target a pharmacokinetic profile that provides control in terms of dosing regimen, peak responses, duration of responses and toxicity.

We expect to design dMAb product candidates not only for new disease targets not currently addressable with conventional mAbs, but also targets of existing, commercially available mAb products. We have already designed and produced dMAb product candidates targeting cancer mechanisms including checkpoint inhibition, anti-cancer pathways and anti-Tregs, as well as prophylactic and therapeutic dMAb product candidates for infectious diseases including Ebola, influenza, antibiotic resistant bacteria, dengue and Chikungunya. When the mAb binds to an infectious disease receptor, the immune system then generates natural killer cells and macrophages to clear the virus or bacteria-bound mAbs.

Proof of Concept

Our first published research on a DNA-based monoclonal antibody was presented in October 2013 in Human Vaccines & Immunotherapeutics in a paper entitled, “Optimized and enhanced DNA plasmid vector based in vivo construction of a neutralizing anti-HIV-1 envelope glycoprotein Fab.” In a preclinical study, a single administration in mice of a highly optimized dMAb® HIV immunotherapy generated antibody molecules in the bloodstream that possessed

desirable functional activity, including high antigen-binding and HIV-neutralization capabilities, against diverse strains of HIV viruses. In the study, this delivery strategy resulted in an increase in Fab levels in as little as 48 hours, when compared with protein-based immunization.

A second paper was published in July 2015 in Scientific Reports, a Nature Publishing Group journal, in the paper, "Protection against dengue disease by synthetic nucleic acid antibody prophylaxis/immunotherapy." In this study, a single intramuscular injection of a DNA plasmid encoding a monoclonal antibody targeting dengue protected mice subsequently exposed to the dengue virus. The protection conferred by the monoclonal antibodies expressed by these dMAb product candidates was very rapid, with 100% survival in mice challenged with lethal enhanced dengue disease less than a week after dMAb administration. While conventional vaccine and monoclonal antibody technologies have shown limited ability to provide an effective solution to dengue to date, the unique attributes and data generated by dMAb immunotherapies show their potential to provide a needed solution. Furthermore, this short time frame to achieve full protection is significantly more rapid than vaccine-driven protection, which can take weeks to months to reach peak efficacy levels.

A paper published in March 2016 in The Journal of Infectious Diseases entitled, “Rapid and long-term immunity elicited by DNA encoded antibody prophylaxis and DNA vaccination against Chikungunya virus,” discussed the results of our preclinical study in which animals transfected with our DNA-based mAb targeting Chikungunya virus (CHIKV) exhibited the specific ability to bind to the CHIKV envelope antigen, and this serum possessed CHIKV-neutralizing activity. CHIKV is a serious mosquito-borne alpha-virus responsible for several recent epidemics in tropical Africa and Asia. In mid-2015, the CDC reported that suspected or confirmed cases of Chikungunya had reached 1.74 million in 45 countries or territories in the Americas. There is currently no vaccine or therapeutic against this virus. In the study, the treatment of the animals with anti-CHIKV mAb plasmids protected 100% of the treated animals from a lethal injection of CHIKV virus while 100% of the control animals died. The treated animals were also spared virus-related morbidity, as measured by dramatic weight loss and lethargy.

Next Steps

In October 2014, we announced that the DARPA had awarded a $12.2 million grant to our scientists and those from the Perelman School of Medicine at the University of Pennsylvania and AstraZeneca in order to develop and assess dMAb product candidates in preclinical studies.

This collaboration aims to demonstrate that DNA plasmids can activate sufficient quantities of disease-specific monoclonal antibodies in the body to be protective against a pathogen challenge. Using the capabilities and advantages of DNA plasmids delivered using CELLECTRA®, the team is constructing and evaluating multiple dMAb product candidates focused on influenza virus and antibiotic resistant bacteria, such as Pseudomonas aeruginosa and Staphylococcus aureus.

In 2016, we expanded the collaboration to include The Wistar Institute after the collaborating investigator, Dr. David Weiner, a member of our board of directors, moved to the Institute.

Depending on the outcome of the preclinical studies, we and our collaborators may seek to advance a dMAb product candidate into clinical trials, if we are able to obtain additional governmental or non-governmental funding to do so.

As described above, in April 2015, we received a grant from DARPA to lead a consortium to develop multiple treatment and prevention approaches against Ebola. The aim of the research funded by this grant is to compare combinations of a DNA vaccine with conventional or DNA-based monoclonal antibodies.

In July 2016, we announced that our DNA-based monoclonal antibody technology will be deployed to develop product candidates which could be used alone and in combination with other immunotherapies in the pursuit of new ways to treat and potentially cure infection from HIV. Funding for this research is part of a $23 million grant from the National Institutes of Health to our collaborator, The Wistar Institute.

As described above, we have also received a sub-grant through The Wistar Institute to develop a DNA-based monoclonal antibody designed to provide a fast-acting treatment against Zika infection and its debilitating effects.

In February 2019, we announced that in collaboration with The Wistar Institute and the University of Pennsylvania, the first subject was dosed as part of the first-ever human study of our dMAb technology. Funded fully by the Bill & Melinda Gates Foundation, this trial's focus is on evaluating our dMAb's ability to prevent or treat Zika virus infection. This open-label trial is a single center, dose escalation trial that will enroll up to 24 healthy volunteers who will receive up to four doses of dMAbs.

License, Collaboration and Supply Agreements

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We have entered into various arrangements with corporate, academic, and government collaborators, licensors, licensees and others. These arrangements are summarized below.

AstraZeneca

In August 2015, we entered into a strategic cancer vaccine collaboration and license agreement with AstraZeneca. Under the agreement, AstraZeneca acquired exclusive rights to our immunotherapy candidate INO-3112 (renamed MEDI0457), which targets cancers caused by human papillomavirus (HPV) types 16 and 18.

Under the terms of the agreement, AstraZeneca made an upfront payment of $27.5 million to us in the third quarter of 2015. AstraZeneca will fund all development costs. The agreement also calls for potential future payments totaling up to $700 million upon reaching specified development and commercial milestones. We are entitled to receive up to double-digit tiered royalties on MEDI0457 product sales.

AstraZeneca is studying MEDI0457 in combination with its PD-L1 checkpoint inhibitor, durvalumab, in a Phase 1/2 clinical trial in patients with recurrent or metastatic head and neck squamous cancer associated with HPV. On December 28, 2017, we received a $7.0 million milestone payment from AstraZeneca, which was triggered by the initiation of the Phase 2 portion of this ongoing clinical trial. In January 2019, we received a $2.0 million milestone payment from AstraZeneca, which was triggered by the initiation of a Phase 2 combination trial to evaluate MEDI0457 in combination with durvalumab targeting a broad array of cancers associated with HPV.

Within the broader collaboration, we and AstraZeneca are co-developing an additional DNA-based cancer vaccine product candidate (not included in our current product pipeline), and AstraZeneca will have the exclusive rights to develop and commercialize. We will receive development, regulatory and commercialization milestone payments and will be eligible to receive royalties on worldwide net sales for this cancer vaccine product.

GeneOne

In September 2014, we and GeneOne announced a collaboration in which the companies will co-develop our DNA-based Ebola vaccine through a Phase 1 clinical trial. In April 2015, the collaborators received an award from DARPA to further advance the Ebola project. The previous collaboration agreement with GeneOne for Ebola vaccine was incorporated into this consortium funded by DARPA. In May 2015, a Phase 1 study of the DNA vaccine part of the project was initiated. Enrollment of this study has been completed. Details of this project are provided under "Ebola" above.

In May 2015, we announced that we will advance a DNA vaccine for MERS into a Phase 1 clinical trial in healthy volunteers in a collaboration with GeneOne. Under the terms of the agreement, GeneOne will be responsible for funding all preclinical and clinical studies through Phase 1. In return, GeneOne will receive up to a 35% milestone-based ownership interest in the MERS immunotherapy upon achievement of the last milestone event of completion of the Phase 1 safety and immunogenicity study. In January 2016, the collaborators announced the initiation of recruitment for the Phase 1 study in partnership with the Walter Reed Army Institute of Research (WRAIR) in Maryland, where the trial was conducted. We announced results from the trial in June 2018.

In January 2016, we and GeneOne expanded the collaboration agreement to test and advance our DNA-based vaccine for preventing and treating Zika virus.

ApolloBio

In December 2017, we entered into an Amended and Restated License and Collaboration Agreement with Beijing Apollo Saturn Biological Technology Limited, a corporation organized under the laws of China, or ApolloBio. Under the terms of this License and Collaboration Agreement, which became effective in March 2018, we granted to ApolloBio the exclusive right to develop and commercialize VGX-3100, our DNA immunotherapy product candidate designed to treat pre-cancers caused by HPV, within the territories of China, Hong Kong, Macao and Taiwan. The territory may be expanded to include Korea in the event that no patent covering VGX-3100 issues in China within the first three years of the term of the agreement.

As part of the License and Collaboration Agreement, we have granted to ApolloBio an option to negotiate an exclusive license to research, develop and commercialize MEDI0457 in the event of termination of our current collaboration with AstraZeneca for the development of MEDI0457 in the territory covered by the License and Collaboration Agreement. As part of the collaboration, ApolloBio will fund all clinical development costs within the licensed territory, and the parties will discuss in good faith the inclusion of clinical trial sites in China as part of our ongoing Phase 3 clinical development program for VGX-3100.

Under the License and Collaboration Agreement, we received proceeds of $19.4 million in March 2018, which comprised an upfront payment of $23.0 million less $2.2 million in foreign income taxes and $1.4 million in certain foreign non-income taxes. The foreign income taxes were recorded as a provision for income taxes and the foreign non-

income taxes were recorded as a general and administrative expense, on the condensed consolidated statement of operations during the year ended December 31, 2018.

In addition to the upfront payment, we are entitled to receive up to an aggregate of $20.0 million, less required income, withholding or other taxes, upon the achievement of specified milestones related to the regulatory approval of VGX-3100 in the United States, China and Korea. In the event that VGX-3100 is approved for marketing in these territories, we will be entitled to receive royalty payments based on a tiered percentage of annual net sales, with such percentage being in the low- to mid-teens, subject to reduction in the event of generic competition in a particular territory. ApolloBio's obligation to pay royalties will continue for 10 years after the first commercial sale in a particular territory or, if later, until the expiration of the last-to-expire patent covering the licensed products in the specified territory. The License and Collaboration Agreement, once effective, will continue in force until ApolloBio has no remaining royalty obligations.

Agreements Focused on Advancing Immuno-Oncology

In May 2017, we entered into a supply agreement with Genentech to obtain supply of TECENTRIQ® (atezolizumab) for use in our clinical trials evaluating INO-5401 and INO-9012, an immune activator encoding IL-12, in combination with TECENTRIQ®, in approximately 80 patients with advanced bladder cancer. We will manage and fund the costs of the multi-center, open-label trial.

In May 2017, we entered into a clinical study and supply agreement with Regeneron to provide its PD-1 inhibitor, REGN2810, for use in our clinical trials evaluating INO-5401 and INO-9012, in combination with REGN2810, in patients with newly diagnosed GBM. Under the terms of the agreement, we will conduct and fund the trial based upon a mutually agreed upon study design.

In January 2018, we entered into a Clinical Collaboration Agreement with the Parker Institute for Cancer Immunotherapy to undertake clinical evaluation of novel combination regimens within the field of immuno-oncology. We expect to benefit from the Parker Institute's innovative research model, which brings together leading academic cancer institutions and companies to share resources, data and technology, accelerate research through unifying and managing clinical trial design, and conduct multi-center clinical trials. The goal of our collaboration is to design studies that have the potential to address cancers with high unmet need. The initial trial under consideration would address muscle-invasive bladder cancer with INO-5401 in combination with other immunotherapies.

Under the agreement, the Parker Institute will have responsibility for clinical study execution, working in collaboration with its established network of clinical academic and industry cancer centers. We will provide financial contributions if the product candidate studied under the collaboration reaches the initiation of a Phase 3 clinical trial.

Geneos Therapeutics

In August 2016, we incorporated a subsidiary, Geneos Therapeutics, Inc., to develop and commercialize neoantigen based personalized cancer therapies. As of December 31, 2018, we owned 100% of the outstanding equity of Geneos. In February 2019, Geneos raised capital from the issuance of equity to us and other third parties, which reduced our ownership percentage. While we leverage our SynCon® immunotherapy and CELLECTRA® delivery technologies to break tolerance and create cancer products targeting shared tumor specific antigens, Geneos is focusing exclusively on leveraging our immunotherapy technology platform to advance the field of patient-specific neoantigen therapies for cancer. We believe that our clinically validated DNA-based platform is well suited for advancing individualized therapies due to its rapid product design and manufacturing benefits, ability to combine multiple neoantigens into formulations, and generation of potent killer T cell responses that are needed to drive clinical efficacy. We have exclusively licensed our SynCon® immunotherapy and CELLECTRA® technology platform to Geneos to be used in the field of personalized, neoantigen based therapy for cancer. The license agreement provides for potential royalty payments to us in the event that Geneos commercializes any products using the licensed technology.

Core DNA Immunotherapy Technology and Product License

In March 2016, we entered into a collaborative research agreement with the Wistar Institute for preventive and therapeutic DNA-based immunotherapy applications and products for cancers and infectious diseases developed by David B. Weiner, Ph.D., and his Wistar laboratory. We will have the exclusive right to in-license new intellectual property developed in this collaboration.

We also have license agreements for intellectual property relating to DNA-based immunotherapy technology and multiple products developed at the University of Pennsylvania, or UPenn. Under the terms of the license agreement

with UPenn, we have obtained exclusive worldwide rights to develop multiple DNA plasmids and constructs with the potential to treat and/or prevent cancer therapeutic vaccines targeting WT1, prostate cancer, other undisclosed cancer antigen targets, HPV, HBV, HCV, HIV, influenza, RSV (respiratory syncytial virus), cytomegalovirus, Chikungunya, dengue fever, malaria, herpes viruses, MERS, Ebola and the family of Filovirus such as Marburg, tuberculosis, foot-and-

mouth disease, intestinal infections including Clostridium difficile, and MRSA (methicillin-resistant staphylococcus aureus). In addition, the amended agreement provides us with global rights to DNA-based monoclonal antibodies and new chemokine and cytokine molecular adjuvant technologies.

This agreement, as amended to date, provides for royalty payments, based on future sales of licensed products, to UPenn.

The Wistar Institute Collaboration for Programs against Tuberculosis and Malaria

In early 2018, we announced that we will collaborate with The Wistar Institute to advance two novel SynCon® vaccine programs against tuberculosis (TB) and malaria, fully funded by more than $4.6 million in total grants from the Bill & Melinda Gates Foundation and the National Institutes of Health (NIH). Grants from the Gates Foundation (for malaria) and from the National Institute of Allergy & Infectious Diseases (for TB) will support our efforts to develop new DNA vaccines employing our technology platform.

Competition

As we develop and seek to ultimately commercialize our product candidates, we face and will continue to encounter competition with an array of existing or development-stage drug and immunotherapy approaches targeting diseases we are pursuing. We are aware of various established enterprises, including major pharmaceutical companies, broadly engaged in vaccine/immunotherapy research and development. These include Janssen Pharmaceuticals (part of J&J), Sanofi-Aventis, GlaxoSmithKline plc (following its acquisition of Novartis Vaccines), Merck, Pfizer, and our collaborator AstraZeneca. There are also various development-stage biotechnology companies involved in different vaccine and immunotherapy technologies including Aduro Biotech, Advaxis, BioNTech, CureVac, Dynavax, Immune Design, Moderna, Novavax, and Translate Bio. If these companies are successful in developing their technologies, it could materially and adversely affect our business and our future growth prospects.

Bavarian Nordic, Merck and GlaxoSmithKline have commercialized preventive vaccines against HPV to protect against cervical cancer. Some companies are seeking to treat early HPV infections or low grade cervical dysplasias. Loop Electrosurgical Excision Procedure, commonly known as LEEP, is the current standard of care for treating high grade cervical dysplasia. Advaxis and Gilead Sciences have therapeutic cervical cancer product candidates under development. Many companies are pursuing different approaches to prostate, breast, lung and other cancers we are targeting.

We also compete more specifically with companies seeking to utilize antigen-encoding DNA delivered with electroporation or other DNA delivery technologies such as viral vectors or lipid vectors to induce in vivo generated antigen production and immune responses to prevent or treat various diseases. These competitive technologies have shown promise, but they each also have their unique obstacles to overcome.

Viral DNA Delivery

This technology utilizes a virus as a carrier to deliver genetic material into target cells. The method is efficient for delivering immunotherapy antigens and has the advantage of mimicking real viral infection so that the recipient will mount a broad immune response against the immunotherapy. The greatest limitation of the technology stems from problems with unwanted immune responses against the viral vector, limiting its use to patients who have not been previously exposed to the viral vector and making repeated administration difficult. In addition, complexity and safety concerns increase their cost and complicate regulatory approval.

Lipid DNA Delivery

A number of lipid formulations have been developed that increase the effect of DNA/RNA immunotherapies. These work by either increasing uptake of the DNA/RNA into cells or by acting as an adjuvant, alerting the immune system. While there has been progress in this field, lipid delivery tends to be less efficient than viral vectors and is hampered by concerns regarding toxicity and increased complexity.

DNA Immunotherapy Delivery With Electroporation

There are other companies with electroporation intellectual property and devices. We believe we have significant competitive advantages over other companies focused on electroporation for multiple reasons:

- We have an extensive history and experience in developing the methods and devices that optimize the use of electroporation in conjunction with DNA-based agents. This experience has been validated with multiple sets of interim data from multiple clinical studies assessing DNA-based immunotherapies and vaccines against cancers and infectious disease.

- We have a broad product line of electroporation instruments designed to enable DNA delivery in tumors, muscle, and skin.

- We have been proactive in filing for patents, as well as acquiring and licensing additional patents, to expand our global patent estate.

If any of our competitors develop products with efficacy or safety profiles significantly better than our product candidates, we may not be able to commercialize our products, and sales of any of our commercialized products could be harmed. Some of our competitors and potential competitors have substantially greater product development capabilities and financial, scientific, marketing and human resources than we do. Competitors may develop products earlier, obtain FDA approvals for products more rapidly, or develop products that are more effective than those under development by us. We will seek to expand our technological capabilities to remain competitive; however, research and development by others may render our technologies or products obsolete or noncompetitive, or result in treatments or cures superior to ours.

Our competitive position will be affected by the disease indications addressed by our product candidates and those of our competitors, the timing of market introduction for these products and the stage of development of other technologies to address these disease indications. For us and our competitors, proprietary technologies, the ability to complete clinical trials on a timely basis and with the desired results, and the ability to obtain timely regulatory approvals to market these product candidates are likely to be significant competitive factors. Other important competitive factors will include the efficacy, safety, ease of use, reliability, availability and price of products and the ability to fund operations during the period between technological conception and commercial sales.

The FDA and other regulatory agencies may expand current requirements for public disclosure of DNA-based product development data, which may harm our competitive position with foreign and United States companies developing DNA-based products for similar indications.

Government Regulation

Government authorities in the United States at the federal, state and local level and in other countries extensively 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 biological products, or biologics, and medical devices, such as our product candidates. Generally, before a new biologic or medical device can be marketed, considerable data demonstrating its quality, safety and efficacy must be obtained, organized into a format specific to each regulatory authority, submitted for review and approved by the regulatory authority.

Review and Approval of Combination Products in the United States

Certain products may be comprised of components that would normally be regulated under different types of regulatory authorities, and frequently by different centers at the FDA. These products are known as combination products. Specifically, under regulations issued by the FDA, a combination product may be:

- a product comprised of two or more regulated components that are physically, chemically, or otherwise combined or mixed and produced as a single entity;
- two or more separate products packaged together in a single package or as a unit and comprised of drug and device products;
- a drug, device, or biological product packaged separately that according to its investigational plan or proposed labeling is intended for use only with an approved individually specified drug, device or biological where both are required to achieve the intended use, indication, or effect and where upon approval of the proposed product the labeling of the approved product would need to be changed, e.g., to reflect a change in intended use, dosage form, strength, route of administration, or significant change in dose; or
- any investigational drug, device, or biological packaged separately that according to its proposed labeling is for use only with another individually specified investigational drug, device, or biological product where both are required to achieve the intended use, indication, or effect.

Our product candidates are combination products comprising an electroporation device for delivery of a biologic. Under the Federal Food, Drug, and Cosmetic Act, or FDCA, the FDA is charged with assigning a center with primary jurisdiction, or a lead center, for review of a combination product. That determination is based on the “primary mode of action” of the combination product, which means the mode of action expected to make the greatest contribution to the overall intended therapeutic effects. Thus, if the primary mode of action of a device-biologic combination product is attributable to the biologic product, that is, if it acts by means of a virus, therapeutic serum, toxin, antitoxin, vaccine,

blood, blood component or derivative, allergenic product, or analogous product, the FDA center responsible for premarket review of the biologic product would have primary jurisdiction for the combination product. We believe that

all of our product candidates will have a biologic primary mode of action, with the device component reviewed under a Device Master File.

U.S. Biological Product Development

In the United States, the FDA regulates biologics under FDCA, and the Public Health Service Act, or PHSA, and their implementing regulations. Biologics are also subject to other federal, state and local statutes and regulations. The process of obtaining regulatory approvals and the subsequent compliance with appropriate federal, state, local and foreign statutes and regulations require 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 after 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, a clinical hold, untitled or warning letters, product recalls or withdrawals from the market, product seizures, total or partial suspension of production or distribution injunctions, fines, refusals of government contracts, restitution, disgorgement, or civil or criminal penalties. Any agency or judicial enforcement action could have a material adverse effect on us.

Our product candidates must be approved by the FDA through the Biologics License Application, or BLA, process before they may be legally marketed in the United States. The process required by the FDA before a biologic may be marketed in the United States generally involves the following:

- completion of extensive nonclinical, sometimes referred to as pre-clinical laboratory tests, pre-clinical animal studies and formulation studies in accordance with applicable regulations, including the FDA's Good Laboratory Practice, or GLP, regulations;
- submission to the FDA of an IND, which must become effective before human clinical trials may begin;
- performance of adequate and well-controlled human clinical trials in accordance with applicable IND and other clinical trial-related regulations, sometimes referred to as good clinical practices, or GCPs, to establish the safety and efficacy of the proposed product candidate for its proposed indication;
- submission to the FDA of a BLA;
- satisfactory completion of an FDA pre-approval inspection of the manufacturing facility or facilities where the product is produced to assess compliance with the FDA's current good manufacturing practice, or cGMP, requirements to assure that the facilities, methods and controls are adequate to preserve the product's identity, strength, quality, purity and potency;
- potential FDA audit of the pre-clinical and/or clinical trial sites that generated the data in support of the BLA; and
- FDA review and approval of the BLA prior to any commercial marketing or sale of the product in the United States.

The data required to support a BLA is generated in two distinct development stages: pre-clinical and clinical. The pre-clinical development stage generally involves laboratory evaluations of drug chemistry, formulation and stability, as well as studies to evaluate toxicity in animals, which support subsequent clinical testing. The conduct of the pre-clinical studies must comply with federal regulations, including GLPs. The sponsor must submit the results of the pre-clinical studies, together with manufacturing information, analytical data, any available clinical data or literature and a proposed clinical protocol, to the FDA as part of the IND. An IND is a request for authorization from the FDA to administer an investigational drug product to humans. The central focus of an IND submission is on the general investigational plan and the protocol(s) for human trials. The IND automatically becomes effective 30 days after receipt by the FDA, unless the FDA raises concerns or questions regarding the proposed clinical trials and places the IND on clinical hold within that 30-day time period. In such a case, the IND sponsor and the FDA must resolve any outstanding concerns before the clinical trial can begin. The FDA may also impose clinical holds on a product candidate at any time before or during clinical trials due to safety concerns or non-compliance. Accordingly, we cannot be sure that submission of an IND will result in the FDA allowing clinical trials to begin, or that, once begun, issues will not arise that could cause the trial to be suspended or terminated.

The clinical stage of development involves the administration of the product candidate 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 GCPs, which include the requirement that all research subjects 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. Further, each clinical trial must be reviewed and approved by an independent institutional review board, or IRB, at or servicing each institution at which the clinical trial

will be conducted. An IRB is charged with protecting the welfare and rights of trial participants and considers such items as whether 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 are also requirements governing the reporting of ongoing clinical trials and completed clinical trial results to public registries. Sponsors of certain clinical trials of FDA-regulated products, including biologics, are required to register and disclose specified clinical trial information, which is publicly available at www.clinicaltrials.gov. Information related to the product, patient population, phase of investigation, study sites and investigators, and other aspects of the clinical trial is then made public as part of the registration. Sponsors are also obligated to disclose the results of their clinical trials after completion.

Clinical trials are generally conducted in three sequential phases that may overlap, known as Phase 1, Phase 2 and Phase 3 clinical trials. Phase 1 clinical trials generally involve a small number of healthy volunteers who are initially exposed to a product candidate. The primary purpose of these clinical trials is to assess the action, side effect tolerability and safety of the product candidate and, if possible, to gain early evidence on effectiveness. Phase 2 clinical trials typically involve studies in patients to determine the dose required to produce the desired benefits. At the same time, safety and preliminary evaluation of efficacy is assessed. Phase 3 clinical trials generally involve large numbers of patients at multiple sites, in multiple countries (from several hundred to several thousand subjects) and are designed to provide the data necessary to demonstrate the efficacy 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 approval. Phase 3 clinical trials may include comparisons with placebo and/or other comparator treatments. The duration of treatment is often extended to mimic the actual use of a product during marketing. Generally, two adequate and well-controlled Phase 3 clinical trials are required by the FDA for approval of a BLA.

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. In certain instances, FDA may condition approval of a BLA on the sponsor’s agreement to conduct additional clinical trials to further assess the biologic’s safety and effectiveness after BLA approval.

Progress reports detailing the results of the clinical trials must be submitted at least annually to the FDA and written IND safety reports must be submitted to the FDA and the investigators for serious and unexpected suspected adverse, findings from other studies suggesting a significant risk to humans exposed to the drug, findings from animal or in vitro testing suggesting a significant risk to humans, and any clinically important rate increase of a serious suspected adverse reaction over that listed in the protocol or investigator brochure. Phase 1, Phase 2 and Phase 3 clinical trials may not be completed successfully within any specified period, if at all. The FDA, the IRB, or the sponsor may suspend or terminate a clinical trial at any time on various grounds, including a finding that the research subjects or 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 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 or not a trial may move forward at designated intervals based on access to certain data from the trial. We may also suspend or terminate a clinical trial based on evolving business objectives and/or competitive climate. Concurrent with clinical trials, companies usually complete additional animal studies and must also develop additional information about the chemistry and physical characteristics of the product candidate 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 candidate and, among other things, 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 product candidate does not undergo unacceptable deterioration over its shelf life.

BLA and FDA Review Process

Following trial completion, trial data is analyzed to assess safety and efficacy. The results of pre-clinical studies and clinical trials are then submitted to the FDA as part of a BLA, along with proposed labeling for the product and

information about the manufacturing process and facilities that will be used to ensure product quality, results of analytical testing conducted on the chemistry of the product candidate, and other relevant information. The BLA is a request for approval to market the biologic for one or more specified indications and must contain proof of safety, purity, potency and efficacy, which is demonstrated by extensive pre-clinical and clinical testing. The application includes positive findings from pre-clinical and clinical trials as well as ambiguous or negative results. Data may come from company-sponsored clinical trials intended to test the safety and efficacy of a use of a product, 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.

Under the Prescription Drug User Fee Act, or PDUFA, as amended, each BLA must be accompanied by a significant user fee, which is adjusted on an annual basis. PDUFA also imposes an annual program fee for approved products. 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.

Once a BLA has been accepted for filing, which occurs, if at all, sixty days after the BLA's submission, the FDA's goal is to review BLAs within ten months of the filing date for standard review or six months of the filing date for priority review, if the application is for a product intended for a serious or life-threatening condition and the product, if approved, would provide a significant improvement in safety or effectiveness. The review process is often significantly extended by FDA requests for additional information or clarification. If not accepted for filing, the sponsor must resubmit the BLA and begin the FDA's review process again, including the initial sixty day review to determine if the application is sufficiently complete to permit substantive review.

After the BLA submission is accepted for filing, the FDA reviews the BLA to determine, among other things, whether the proposed product candidate is safe and effective for its intended use, and whether the product candidate is being manufactured in accordance with cGMP to assure and preserve the product candidate's identity, strength, quality, purity and potency. The FDA may refer applications for novel drug product candidates or drug product candidates 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. The FDA is not bound by the recommendations of an advisory committee, but it considers such recommendations carefully when making decisions. The FDA will likely re-analyze the clinical trial data, which could result in extensive discussions between the FDA and us during the review process. The review and evaluation of a BLA by the FDA is extensive and time consuming and may take longer than originally planned to complete, and we may not receive a timely approval, if at all.

Before approving a BLA, the FDA will conduct a pre-approval inspection of the manufacturing facilities for the new product to determine whether they comply with cGMPs. 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. In addition, before approving a BLA, the FDA may also audit data from clinical trials to ensure compliance with GCP requirements. After the FDA evaluates the application, manufacturing process and manufacturing facilities, it may issue an approval letter or a Complete Response Letter. An approval letter authorizes commercial marketing of the product 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 identified by the FDA. The Complete Response Letter may require additional clinical data and/or an additional pivotal Phase 3 clinical trial(s), and/or other significant and time-consuming requirements related to clinical trials, pre-clinical studies or manufacturing. If a Complete Response Letter is issued, the applicant may either resubmit the BLA, addressing all of the deficiencies identified in the letter, or withdraw the application. Even if such data and information is submitted, the FDA may ultimately decide that the BLA 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.

There is no assurance that the FDA will ultimately approve a product for marketing in the United States and we may encounter significant difficulties or costs during the review process. If a product receives marketing approval, the approval may be significantly limited to specific populations, severities of allergies, and dosages or the indications for use may otherwise be limited, which could restrict the commercial value of the product. Further, the FDA may require that certain contraindications, warnings or precautions be included in the product labeling or may condition the approval of the BLA on other changes to the proposed labeling, development of adequate controls and specifications, or a commitment to conduct post-market testing or clinical trials and surveillance to monitor the effects of approved products. For example, the FDA may require Phase 4 testing which involves clinical trials designed to further assess the product's safety and effectiveness and may require testing and surveillance programs to monitor the safety of approved products that have been commercialized. 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 must submit a proposed REMS. The FDA will not approve the BLA 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.

Post-Marketing Requirements

Following approval of a new product, a manufacturer and the approved product are subject to continuing regulation by the FDA, including, among other things, monitoring and recordkeeping activities, reporting to the applicable regulatory authorities of adverse experiences with the product, providing the regulatory authorities with updated safety and efficacy information, product sampling and distribution requirements, and complying with promotion and advertising requirements, which include, among others, standards for direct-to-consumer advertising, restrictions on promoting products for uses or in patient populations that are not described in the product's approved labeling, also known as off-label use, limitations on industry-sponsored scientific and educational activities, and requirements for promotional activities involving the internet. Although physicians may prescribe legally available drugs and biologics for off-label uses, manufacturers may not market or promote such off-label uses. Modifications or enhancements to the product or its labeling or changes of the site of manufacture are often subject to the approval of the FDA and other regulators, which may or may not be received or may result in a lengthy review process. Prescription drug promotional materials must be submitted to the FDA in conjunction with their first use. Any distribution of prescription drug products and pharmaceutical samples must comply with the U.S. Prescription Drug Marketing Act, or the PDMA, a part of the FDCA.

In the United States, once a product is approved, its manufacture is subject to comprehensive and continuing regulation by the FDA. The FDA regulations require that products be manufactured in specific approved facilities and in accordance with cGMP. Moreover, the constituent parts of a combination product retain their regulatory status, for example, as a biologic or device, and as such, we may be subject to additional requirements in the Quality System Regulation, or QSR, applicable to medical devices, such as design controls, purchasing controls, and corrective and preventive action. We rely, and expect to continue to rely, on third parties for the production of clinical and commercial quantities of our products in accordance with cGMP regulations. cGMP regulations require, among other things, quality control and quality assurance as well as the corresponding 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 products 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 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. These regulations also impose certain organizational, procedural and documentation requirements with respect to manufacturing and quality assurance activities. BLA holders using contract manufacturers, laboratories or packagers are responsible for the selection and monitoring of qualified firms, and, in certain circumstances, qualified suppliers to these firms. These firms and, where applicable, their suppliers are subject to inspections by the FDA at any time, and the discovery of violative conditions, including failure to conform to cGMP, could result in enforcement actions that interrupt the operation of any such facilities or the ability to distribute products manufactured, processed or tested by them. Discovery of problems with a product after approval may result in restrictions on a product, manufacturer, or holder of an approved BLA, including, among other things, recall or withdrawal of the product from the market.

The FDA also may require post-approval testing, sometimes referred to as Phase 4 testing, REMS and post-marketing surveillance to monitor the effects of an approved product or place conditions on an approval that could restrict the distribution or use of the product. Discovery of previously unknown problems with a product or the failure to comply with applicable FDA requirements can have negative consequences, including adverse publicity, judicial or administrative enforcement, warning letters from the FDA, mandated corrective advertising or communications with doctors, and civil or criminal penalties, among others. Newly discovered or developed safety or effectiveness data may require changes to a product's approved labeling, including the addition of new warnings and contraindications, and also may require the implementation of other risk management measures. Also, new government requirements, including those resulting from new legislation, may be established, or the FDA's policies may change, which could delay or prevent regulatory approval of our products under development.

Coverage and Reimbursement

Patients in the United States and elsewhere generally rely on third-party payors to reimburse part or all of the costs associated with their prescription drugs. Accordingly, a pharmaceutical company's ability to commercialize its products successfully depends in part on the extent to which private health insurers, other third-party payors, and

governmental authorities, including Medicare and Medicaid, establish appropriate coverage and reimbursement levels for its product candidates and related treatments. As a threshold for coverage and reimbursement, third-party payors generally require that products be approved for marketing by the FDA.

Coverage decisions may not favor new products when more established or lower cost therapeutic alternatives are available. The process for obtaining coverage for a product or service is separate from the process to obtain the associated reimbursement. Reimbursement levels can affect the adoption of products and services by physicians and

patients. Additionally, products used in connection with medical procedures may not be reimbursed separately, but their cost may instead be bundled as part of the payment received by the provider for the procedure only. Separate reimbursement for a product or the treatment or procedure in which the product is used may not be available. Coverage and reimbursement policies for drug products can differ significantly from payor to payor as there is no uniform policy of coverage and reimbursement for drug products among third-party payors in the United States. There may be significant delays in obtaining coverage and reimbursement as the process of determining coverage and reimbursement is often time consuming and costly which may require the provision of scientific and clinical support for the use of the product to each payor separately, with no assurance that coverage or adequate reimbursement will be obtained.

A significant trend in the U.S. healthcare industry and elsewhere is cost containment. Third-party payors have attempted to control costs by limiting coverage and the amount of reimbursement for particular products and services. Third-party payors are increasingly challenging the effectiveness of and prices charged for medical products and services. Moreover, the U.S. government, state legislatures and foreign governmental entities have shown significant interest in implementing cost containment programs to limit the growth of government paid healthcare costs, including price controls, restrictions on reimbursement and coverage and requirements for substitution of generic products for branded prescription drugs.

Healthcare Reform

In both the United States and certain foreign jurisdictions there have been, and continue to be, a number of legislative and regulatory changes to the healthcare system that impact the ability to sell pharmaceutical products profitably. In the United States, the federal government enacted the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act, or collectively, the ACA. Among the ACA's provisions of importance to the pharmaceutical industry are that it:

- created an annual, nondeductible fee on any entity that manufactures or imports certain specified branded prescription drugs and biologic agents apportioned among these entities according to their market share in some government healthcare programs;
- increased the statutory minimum rebates a manufacturer must pay under the Medicaid Drug Rebate Program, to 23.1% and 13% of the average manufacturer price for most branded and generic drugs, respectively and capped the total rebate amount for innovator drugs at 100% of the Average Manufacturer Price, or AMP;
- created new methodology by which rebates owed by manufacturers under the Medicaid Drug Rebate Program are calculated for certain drugs and biologics that are inhaled, infused, instilled, implanted or injected;
- expanded eligibility criteria for Medicaid programs by, among other things, allowing states to offer Medicaid coverage to additional individuals and by adding new mandatory eligibility categories for individuals with income at or below 133% of the federal poverty level, thereby potentially increasing manufacturers' Medicaid rebate liability;
- expanded the entities eligible for discounts under the Public Health program;
- created a new Patient-Centered Outcomes Research Institute to oversee, identify priorities in, and conduct comparative clinical effectiveness research, along with funding for such research;
- established a Center for Medicare & Medicaid Innovation at the Centers for Medicare & Medicaid Services, or CMS, to test innovative payment and service delivery models to lower Medicare and Medicaid spending, potentially including prescription drug spending that began on January 1, 2011; and
- created a licensure framework for follow on biologic products.

Some of the provisions of the ACA have yet to be implemented, and there have been judicial and Congressional challenges to certain aspects of the ACA, as well as recent efforts by the Trump administration to repeal or replace certain aspects of the ACA. Since January 2017, President Trump has signed two Executive Orders and other directives designed to delay the implementation of certain provisions of the ACA. Concurrently, Congress has considered legislation that would repeal or repeal and replace all or part of the ACA. While Congress has not passed comprehensive repeal legislation, it has enacted laws that modify certain provisions of the ACA such as removing penalties, starting January 1, 2019, for not complying with the ACA's individual mandate to carry health insurance and delaying the implementation of certain ACA-mandated fees. On December 14, 2018, a Texas U.S. District Court Judge ruled that the ACA is unconstitutional in its entirety because the "individual mandate" was repealed by Congress as part of the Tax Cuts and Jobs Act of 2017. While the Texas U.S. District Court Judge, as well as the Trump

administration and CMS, have stated that the ruling will have no immediate effect pending appeal of the decision, it is unclear how this decision, subsequent appeals, and other efforts to repeal and replace the ACA will impact the ACA.

Further there has been heightened governmental scrutiny in the United States of pharmaceutical pricing practices in light of the rising cost of prescription drugs and biologics. Such scrutiny has resulted in several recent congressional inquiries and proposed and enacted federal and state legislation 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. For example, the Trump administration released a "Blueprint" to lower drug prices and reduce out of pocket costs of drugs that contains additional proposals to increase drug manufacturer competition, increase the negotiating power of certain federal healthcare programs, incentivize manufacturers to lower the list price of their products, and reduce the out of pocket costs of drug products paid by consumers. On January 31, 2019, the U.S. Department of Health and Human Services, Office of Inspector General, proposed modifications to the federal healthcare program Anti-Kickback Statute discount safe harbor for the purpose of reducing the cost of drug products to consumers which, among other things, if finalized, will affect discounts paid by manufacturers to Medicare Part D plans, Medicaid managed care organizations and pharmacy benefit managers working with these organizations. While some of these and other proposed measures may require additional authorization to become effective, Congress and the Trump administration have each indicated that it will continue to seek new legislative and/or administrative measures to control drug costs.

Moreover, on May 30, 2018, the Trickett Wendler, Frank Mongiello, Jordan McLinn, and Matthew Bellina Right to Try Act of 2017, or the Right to Try Act, was signed into law. The law, among other things, provides a federal framework for certain patients to access certain investigational new drug products that have completed a Phase I clinical trial and that are undergoing investigation for FDA approval. Under certain circumstances, eligible patients can seek treatment without enrolling in clinical trials and without obtaining FDA permission under the FDA expanded access program. There is no obligation for a drug manufacturer to make its drug products available to eligible patients as a result of the Right to Try Act.

Healthcare Laws

Certain federal, state, local and foreign healthcare laws and regulations pertaining to fraud and abuse, transparency, patients' rights, and privacy are applicable to the business of a pharmaceutical company. The laws that may affect a pharmaceutical company's ability to operate include:

- the federal healthcare program Anti-Kickback Statute, which prohibits, among other things, people from soliciting, receiving or providing remuneration, directly or indirectly, to induce or reward either the referral of an individual, or the purchasing, ordering, or leasing of an item, good, facility or service, for which payment may be made by a federal healthcare program such as Medicare or Medicaid;
- federal civil and criminal false claims laws, including the civil False Claims Act, which prohibit, among other things, individuals or entities from knowingly presenting, or causing to be presented, claims for payment from Medicare, Medicaid, or other third-party payors that are false or fraudulent;
- the federal Health Insurance Portability and Accountability Act of 1996, or HIPAA, which prohibits, among other things, executing a scheme to defraud any healthcare benefit program or making false statements relating to healthcare matters;
- HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act, and their implementing regulations, which imposes certain requirements relating to the privacy, security and transmission of individually identifiable health information on certain individuals and entities;
- the Physician Payments Sunshine Act, created under the ACA, which requires pharmaceutical companies to record any transfers of value made to doctors and teaching hospitals, as well as ownership and investment interests held by physicians and their immediate family members, and to annually report such data to CMS;
- the Federal Food, Drug, and Cosmetic Act, which among other things, strictly regulates drug product marketing, prohibits manufacturers from marketing drug products for off-label use and regulates the distribution of drug samples;
- the U.S. Foreign Corrupt Practices Act, which, among other things, prohibits companies issuing stock in the U.S. from bribing foreign officials for government contracts and other business; and
- state law equivalents of each of the above federal laws, such as anti-kickback and false claims laws which may apply to items or services reimbursed by any third-party payor, including commercial insurers, state and local laws requiring the registration of pharmaceutical sales and medical representatives, and state laws governing the privacy and security of health information in certain circumstances, many of which differ from each other in significant ways and often are

not preempted by HIPAA, thus complicating compliance efforts; and

- additional state and local laws such as laws in California and Massachusetts, which mandate implementation of compliance programs, compliance with industry ethics codes, and spending limits, and other state and local laws, such as laws in Vermont, Maine, and Minnesota which require reporting to state governments of gifts, compensation, and other remuneration to physicians.

A pharmaceutical company will need to spend substantial time and money to ensure that its business arrangements with third parties comply with applicable healthcare laws and regulations. Because of the breadth of these laws and the narrowness of the statutory exceptions and regulatory safe harbors available, which require strict compliance in order to offer protection, it is possible that governmental authorities may conclude that its business practices do not comply with current or future statutes, regulations, agency guidance or case law involving applicable healthcare laws. If a pharmaceutical company's operations are found to be in violation of any of the laws described above or any other governmental regulations that apply to it, it may be subject to significant penalties, including administrative, civil and criminal penalties, damages, fines, disgorgement, possible exclusion from participation in Medicare, Medicaid and other federal healthcare programs, imprisonment, integrity and/or other oversight obligations, contractual damages, reputational harm and the curtailment or restructuring of operations.

Other Regulations

We also are subject to various federal, state and local laws, regulations, and recommendations relating to safe working conditions, laboratory and manufacturing practices, the experimental use of animals, and the use and disposal of hazardous or potentially hazardous substances, including radioactive compounds and infectious disease agents, used in connection with our research. The extent of government regulation that might result from any future legislation or administrative action cannot be accurately predicted.

Commercialization and Manufacturing

Because of the broad potential applications of our technologies, we intend to develop and commercialize products both on our own and through our collaborators and licensees. We intend to develop and commercialize products in well-defined specialty markets, such as infectious diseases and cancer. Where appropriate, we intend to rely on strategic marketing and distribution alliances.

We believe our plasmids can be produced in commercial quantities through uniform methods of fermentation and processing that are applicable to all plasmids. We believe we will be able to obtain sufficient supplies of plasmids for all foreseeable clinical investigations.

Relationship with GeneOne

We acquired an equity interest in GeneOne in 2005. As of December 31, 2018, we owned 7.8% of the outstanding capital stock of GeneOne and GeneOne owned 73,590 shares of our common stock. To our knowledge, none of our current officers, directors, or key employees beneficially owns, directly or indirectly, any securities of GeneOne.

In 2008, we sold our manufacturing operations (including patent rights to certain manufacturing technology) to VGXI, Inc., a wholly-owned United States subsidiary of GeneOne. In connection with this transfer we entered into a Supply Agreement pursuant to which VGXI, Inc., a cGMP contract manufacturer, produces and supplies the DNA plasmids for all of our research and early clinical trials. The price of the plasmids we purchase from VGXI, Inc. is determined by us and GeneOne at the time of order placement or, with respect to product supplied in connection with a grant contract, based on the contracted bid provided by the applicable agency. We agreed to treat GeneOne and its subsidiary as our most favored supplier for DNA plasmids and GeneOne and its subsidiary agreed to treat us as their most favored customer. Before we can manufacture DNA plasmids on our own behalf or engage a third party other than GeneOne or its subsidiary to manufacture DNA plasmids for us, we must first offer such manufacturing work to GeneOne or its subsidiary.

In 2014, we entered into a Collaborative Development Agreement with GeneOne to co-develop an Ebola vaccine through Phase 1 clinical trials. In 2015, we amended the agreement to provide that we would have control over the development program, in return for the payment of certain development fees.

In 2015, we entered into a Collaborative Development Agreement with GeneOne to co-develop a DNA vaccine for MERS through Phase 1 clinical trials. Under the terms of the agreement, GeneOne will be responsible for funding all preclinical and clinical studies through Phase 1. In return, GeneOne will receive up to 35% milestone-based ownership interest in the MERS immunotherapy upon achievement of the last milestone event of completion of the

Phase 1 safety and immunogenicity study. The collaborative research program will terminate upon the completion of activities under the development plan, unless sooner terminated.

In January 2016, we and GeneOne expanded the collaboration agreement to test and advance our DNA-based vaccine for preventing and treating Zika virus. GeneOne will be responsible for funding all preclinical and clinical studies through Phase 1. In return, GeneOne will receive up to a 35% milestone-based ownership interest in the Zika immunotherapy upon achievement of the last milestone event of the completion of the Phase 1 safety and immunogenicity study.

In December 2017, we completed the sale of certain assets related to our compound VGX-1027 to GeneOne for $1.0 million.

Revenue recognized from GeneOne consists of licensing and other fees from the influenza and Zika collaborations. For the years ended December 31, 2018 and 2017, we recognized revenue from GeneOne of $342,000 and $551,000, respectively. Operating expenses recorded from transactions with GeneOne relate primarily to biologics manufacturing. These operating expenses for the years ended December 31, 2018 and 2017 were $7.0 million and $2.3 million, respectively. At December 31, 2018 and 2017, we had an accounts payable and accrued liability balance of $372,000 and $107,000, respectively, related to GeneOne and its subsidiaries. At December 31, 2018 and 2017, $381,000 and $331,000, respectively, of prepayments made to GeneOne were classified as long-term other assets on our consolidated balance sheet.

Intellectual Property

Patents and other proprietary rights are essential to our business. We file patent applications to protect our technologies, inventions and improvements to our inventions that we consider important to the development of our business. We file for patent registration extensively in the United States and in key foreign markets. Although our patent filings include claims covering various features of our products and product candidates, including composition, methods of manufacture and use, our patents do not provide us with complete protection, or guarantee, against the development of competing products. In addition, some of our know-how and technology are not patentable. We thus also rely upon trade secrets, know-how, continuing technological innovations and licensing opportunities to develop and maintain our competitive position. We also require employees, consultants, advisors and collaborators to enter into confidentiality agreements, but such agreements may provide limited protection for our trade secrets, know-how or other proprietary information.

Our intellectual property portfolio covers our proprietary technologies, including CELLECTRA® delivery and vaccine related technologies. As of December 31, 2018, our patent portfolio included over 113 issued United States patents and 593 issued foreign counterpart patents.

If we fail to protect our intellectual property rights adequately our competitors might gain access to our technology and our business would thus be harmed. In addition, defending our intellectual property rights might entail significant expense. Any of our intellectual property rights may be challenged by others or invalidated through administrative processes or litigation through the courts. In addition, our patents, or any other patents that may be issued to us in the future, may not provide us with any competitive advantages, or may be challenged by third parties. Furthermore, legal standards relating to the validity, enforceability and scope of protection of intellectual property rights are uncertain. Effective patent, trademark, copyright and trade secret protection may not be available to us in each country where we operate. The laws of some foreign countries may not be as protective of intellectual property rights as those in the United States, and domestic and international mechanisms for enforcement of intellectual property rights in those countries may be inadequate. Accordingly, despite our efforts, we may be unable to prevent third parties from infringing upon or misappropriating our intellectual property or otherwise gaining access to our technology. We may be required to expend significant resources to monitor and protect our intellectual property rights. We may initiate claims or litigation against third parties for infringement of our proprietary rights or to establish the validity of our proprietary rights. Any such litigation, whether or not it is ultimately resolved in our favor, would result in significant expense to us and divert the efforts of our technical and management personnel.

There may be rights we are not aware of, including applications that have been filed but not published that, when issued, could be asserted against us. These third-parties could bring claims against us, and that would cause us to incur substantial expenses and, if successful against us, could cause us to pay substantial damages. Further, if a patent infringement suit were brought against us, we could be forced to stop or delay research, development, manufacturing or sales of the product or biologic drug candidate that is the subject of the suit. As a result of patent infringement

claims, or in order to avoid potential claims, we may choose or be required to seek a license from the third-party. These licenses may not be available on acceptable terms, or at all. Even if we are able to obtain a license, the license would likely obligate us to pay license fees or royalties or both, and the rights granted to us might be non-exclusive, which could result in our competitors gaining access to the same intellectual property. Ultimately, we could be prevented from commercializing a product, or be forced to cease some aspect of our business operations, if, as a result of actual or threatened patent infringement claims, we are unable to enter into licenses on acceptable terms. All of the issues

described above could also impact our collaborators, which would also impact the success of the collaboration and therefore us.

Important legal issues remain to be resolved as to the extent and scope of available patent protection for biologic products, including vaccines, and processes in the United States and other important markets outside the United States, such as Europe and Japan. Foreign markets may not provide the same level of patent protection as provided under the United States patent system. We recognize that litigation or administrative proceedings may be necessary to determine the validity and scope of certain of our and others' proprietary rights. Any such litigation or proceeding may result in a significant commitment of resources in the future and could force us to interrupt our operations, redesign our products or processes, or negotiate a license agreement, all of which would adversely affect our revenue. Furthermore, changes in, or different interpretations of, patent laws in the United States and other countries may result in patent laws that allow others to use our discoveries or develop and commercialize our products.

We cannot guarantee that the patents we obtain or the unpatented technology we hold will afford us significant commercial protection.

Significant Customers and Research and Development

During the year ended December 31, 2018, we derived 75% of our revenue from ApolloBio and 23% of our revenue from AstraZeneca. During the years ended December 31, 2017 and 2016, we derived 53% and 4% of our revenue from AstraZeneca, 24% and 75% of our revenue from DARPA, and 14% and 14% of our revenue from Roche, respectively. Since our inception, virtually all of our activities have consisted of research and development efforts related to developing our electroporation technologies and immunotherapies. Research and development expense consists of expenses incurred in performing research and development activities including salaries and benefits, facilities and other overhead expenses, clinical trials, contract services and other outside expenses. Our research and development expense was $95.3 million in 2018, $98.6 million in 2017 and $88.7 million in 2016.

Geographic Information

All of our revenue for the years ended December 31, 2018, 2017 and 2016 was earned in the United States. All of our long-lived assets are located in the United States.

Corporate History and Headquarters

We have been a leader in advancing the capabilities of DNA-based immunotherapies to treat infectious diseases and cancers going back to the original incorporation of Viral Genomix, Inc. under the laws of Delaware on April 17, 2000. We were renamed VGX Pharmaceuticals, Inc. on May 31, 2006. On February 21, 2007, VGX Pharmaceuticals acquired Advisys, Inc., a company possessing DNA and electroporation technology, through an asset purchase agreement. On April 14, 2007, VGX Pharmaceuticals entered into an exclusive license agreement with the Trustees of the University of Pennsylvania related to therapeutic and prophylactic DNA vaccines developed by Professor David B. Weiner at the University of Pennsylvania School of Medicine.

Recognizing the value of electroporation delivery technology, devices, and patents in advancing DNA-based immunotherapy products, on June 1, 2009, VGX Pharmaceuticals completed a merger with Inovio Biomedical Corporation, a publicly listed company focused on electroporation delivery technology.

Inovio Biomedical Corporation started as Biotechnologies & Experimental Research, Inc. and was incorporated on June 29, 1983 in California to create products for the research marketplace. The company changed its corporate name to BTX, Inc. on December 10, 1991, and to Genetronics, Inc. on February 8, 1994. On April 14, 1994, Genetronics, Inc. became a public company through a share exchange agreement with Consolidated United Safety Technologies, Inc., a company listed on the Vancouver Stock Exchange under the laws of British Columbia, Canada. The company changed its name to Genetronics Biomedical Ltd. on September 29, 1994. Genetronics, Inc. remained as a wholly owned operating subsidiary. On September 2, 1997, the company listed on the Toronto Stock Exchange. On December 8, 1998, the company listed on the American Stock Exchange (now NYSE MKT) and voluntarily de-listed from the Toronto Stock Exchange on January 17, 2003. On June 15, 2001, Genetronics Biomedical Ltd. completed a change in jurisdiction of incorporation from British Columbia, Canada, to the state of Delaware and became Genetronics Biomedical Corporation. On January 25, 2005, Genetronics Biomedical Corporation acquired Inovio AS, a gene delivery technology company located in Norway. On March 31, 2005, Genetronics Biomedical Corporation was renamed Inovio Biomedical Corporation.

The merger between VGX Pharmaceuticals and Inovio Biomedical Corporation was effected pursuant to the terms of an Amended and Restated Agreement and Plan of Merger dated December 5, 2008, as further amended on March 31, 2009. On May 14, 2010, the combined entity changed its corporate name to Inovio Pharmaceuticals, Inc. We conduct our business through our United States wholly-owned subsidiaries, VGX Pharmaceuticals, LLC and Genetronics, Inc.

Our corporate headquarters are located at 660 W. Germantown Pike, Suite 110, Plymouth Meeting, Pennsylvania 19462, and our telephone number is (267) 440-4200.

Available Information

Our Internet website address is www.inovio.com. In addition to the information contained in this Annual Report, information about us can be found on our website. Our website and information included in or linked to our website are not part of this Annual Report.

We make our annual report on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K and amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Securities Exchange Act of 1934, or the Exchange Act, available free of charge on our website as soon as reasonably practicable after we electronically file such material with, or furnish it to, the Securities and Exchange Commission, or the SEC. The SEC maintains an Internet site (www.sec.gov) that contains reports, proxy and information statements, and other information regarding issuers that file electronically with the SEC, including us.

Information regarding our corporate governance, including the charters of our audit committee, our nomination and corporate governance committee and our compensation committee, our Code of Business Conduct and Ethics, our Corporate Governance Guidelines, our Corporate Governance Policy and information for contacting our board of directors is available on our website.

Our Code of Business Conduct and Ethics includes our Code of Ethics applicable to our Chief Executive Officer and Chief Financial Officer, who also serves as our principal accounting officer. Any amendments to or waivers of the Code of Ethics will be promptly posted on our website or in a report on Form 8-K, as required by applicable law.

Employees

As of February 28, 2019, we employed 281 people on a full-time basis and 7 people under consulting and project employment agreements. Of the combined total, 231 were in product research, which includes research and development, quality assurance, clinical, engineering, and manufacturing, and 57 were in general and administrative functions, which includes corporate development, information technology, legal, investor relations, finance and corporate administration. None of our employees are subject to collective bargaining agreements.

ITEM 1A. RISK FACTORS

You should carefully consider the following factors regarding information included in this Annual Report. The risks and uncertainties described below are not the only ones we face. Additional risks and uncertainties not presently known to us or that we currently deem immaterial also may impair our business operations. If any of the following risks actually occur, our business, financial condition and operating results could be materially adversely affected.

Risks Related to Our Business and Industry

We have incurred losses since inception, expect to incur significant net losses in the foreseeable future and may never become profitable.

We have experienced significant operating losses to date. As of December 31, 2018 our accumulated deficit was approximately $620.4 million. We have generated limited revenues, primarily consisting of license revenue, grant funding and interest income. We expect to continue to incur substantial additional operating losses for at least the next several years as we advance our clinical trials and research and development activities. We may never successfully commercialize our vaccine product candidates or electroporation-based synthetic vaccine delivery technology and thus may never have any significant future revenues or achieve and sustain profitability.

We have limited sources of revenue and our success is dependent on our ability to develop our vaccine and immunotherapies and other product candidates and electroporation equipment.

We do not sell any products and may not have any other products commercially available for several years, if at all. Our ability to generate future revenues depends heavily on our success in:

- developing and securing United States and/or foreign regulatory approvals for our product candidates, including securing regulatory approval for conducting clinical trials with product candidates;
- developing our electroporation-based DNA delivery technology; and
- commercializing any products for which we receive approval from the FDA and foreign regulatory authorities.

Our electroporation equipment and product candidates will require extensive additional clinical study and evaluation, regulatory approval in multiple jurisdictions, substantial investment and significant marketing efforts before we generate any revenues from product sales. We are not permitted to market or promote our electroporation equipment and product candidates before we receive regulatory approval from the FDA or comparable foreign regulatory authorities. If we do not receive regulatory approval for and successfully commercialize any products, we will not generate any revenues from sales of electroporation equipment and products, and we may not be able to continue our operations.

None of our human vaccine and immunotherapy product candidates have been approved for sale, and we may not develop commercially successful vaccine products.

Our human vaccine and immunotherapy programs are in the early stages of research and development, and currently include product candidates in discovery, preclinical studies and Phase 1, 2 and 3 clinical trials. There are limited data regarding the efficacy of synthetic vaccine and immunotherapy candidates compared with conventional vaccines, and we must conduct a substantial amount of additional research and development before any regulatory authority will approve any of our vaccine product candidates. The success of our efforts to develop and commercialize our product candidates could fail for a number of reasons. For example, we could experience delays in product development and clinical trials. Our product candidates could be found to be ineffective or unsafe, or otherwise fail to receive necessary regulatory clearances. The products, if safe and effective, could be difficult to manufacture on a large scale or uneconomical to market, or our competitors could develop superior products more quickly and efficiently or more effectively market their competing products.

In addition, adverse events, or the perception of adverse events, relating to vaccine and immunotherapy candidates and delivery technologies may negatively impact our ability to develop commercially successful products. For example, pharmaceutical companies have been subject to claims that the use of some pediatric vaccines has caused personal injuries, including brain damage, central nervous system damage and autism. These and other claims may influence public perception of the use of vaccine and immunotherapy products and could result in greater governmental regulation, stricter labeling requirements and potential regulatory delays in the testing or approval of our potential products.

Our indebtedness and liabilities could limit the cash flow available for our operations, expose us to risks that could adversely affect our business, financial condition and results of operations.

To date, we have sold $70.0 million aggregate principal amount of 6.50% convertible senior notes due 2024 (the "Notes"). We may also incur additional indebtedness to meet future financing needs. Our indebtedness could have significant

negative consequences for our security holders and our business, results of operations and financial condition by, among other things:

- increasing our vulnerability to adverse economic and industry conditions;
- limiting our ability to obtain additional financing;
- requiring the dedication of a substantial portion of our cash flow from operations to service our indebtedness, which will reduce the amount of cash available for other purposes;
- limiting our flexibility to plan for, or react to, changes in our business;
- diluting the interests of our existing stockholders as a result of issuing shares of our common stock upon conversion of the Notes; and
- placing us at a possible competitive disadvantage with competitors that are less leveraged than us or have better access to capital.

Our business may not generate sufficient funds, and we may otherwise be unable to maintain sufficient cash reserves, to pay amounts due under the Notes and any additional indebtedness that we may incur. In addition, our cash needs may increase in the future. In addition, any future indebtedness that we may incur may contain financial and other restrictive covenants that limit our ability to operate our business, raise capital or make payments under our other indebtedness. If we fail to comply with these covenants or to make payments under our indebtedness when due, then we would be in default under that indebtedness, which could, in turn, result in that and our other indebtedness becoming immediately payable in full.

The conditional conversion feature of the Notes, if triggered, may adversely affect our financial condition, operating results, or liquidity.

In the event the conditional conversion feature of the Notes is triggered, holders of Notes will be entitled to convert their Notes at any time during specified periods at their option. If one or more of the holders of the Notes elects to convert their notes, unless we satisfy our conversion obligation by delivering only shares of our common stock, we would be required to settle all or a portion of our conversion obligation through the payment of cash, which could adversely affect our liquidity. The conditional convertibility of the Notes will be monitored at each quarterly reporting date and analyzed dependent upon market prices of our common stock during the prescribed measurement periods.

We will need substantial additional capital to develop our synthetic vaccine and immunotherapy programs and electroporation delivery technology.

Conducting the costly and time-consuming research, pre-clinical and clinical testing necessary to obtain regulatory approvals and bring our product candidates and delivery technology to market will require a commitment of substantial funds in excess of our current capital. Our future capital requirements will depend on many factors, including, among others:

- the progress of our current and new product development programs;
- the progress, scope and results of our pre-clinical and clinical testing;
- the time and cost involved in obtaining regulatory approvals;
- the cost of manufacturing our products and product candidates;
- the cost of prosecuting, enforcing and defending against patent infringement claims and other intellectual property rights;
- debt service obligations on the Notes;
- competing technological and market developments; and
- our ability and costs to establish and maintain collaborative and other arrangements with third parties to assist in potentially bringing our products to market.

Additional financing may not be available on acceptable terms, or at all. Domestic and international capital markets have from time to time experienced heightened volatility and turmoil, making it more difficult to raise capital through the issuance of equity securities. Volatility in the capital markets can also negatively impact the cost and availability of credit, creating illiquid credit markets and wider credit spreads. Concern about the stability of the markets generally and the strength of counterparties specifically has led many lenders and institutional investors to reduce, and in some cases cease to provide, funding to borrowers. To the extent we are able to raise additional capital through the sale of equity securities or we issue securities in connection with another transaction, the ownership position of existing stockholders could be substantially diluted. If additional funds are raised through the issuance of preferred stock or

debt securities, these securities are likely to have rights, preferences and privileges senior to our common stock and may involve significant fees, interest expense, restrictive covenants and the

granting of security interests in our assets. Fluctuating interest rates could also increase the costs of any debt financing we may obtain. Raising capital through a licensing or other transaction involving our intellectual property could require us to relinquish valuable intellectual property rights and thereby sacrifice long-term value for short-term liquidity.

Our failure to successfully address ongoing liquidity requirements would have a substantially negative impact on our business. If we are unable to obtain additional capital on acceptable terms when needed, we may need to take actions that adversely affect our business, our stock price and our ability to achieve cash flow in the future, including possibly surrendering our rights to some technologies or product opportunities, delaying our clinical trials or curtailing or ceasing operations.

We depend upon key personnel who may terminate their employment with us at any time and we may need to hire additional qualified personnel in order to obtain financing, pursue collaborations or develop or market our product candidates.

The success of our business strategy will depend to a significant degree upon the continued services of key management, technical and scientific personnel and our ability to attract and retain additional qualified personnel and managers, including personnel with expertise in clinical trials, government regulation, manufacturing, marketing and other areas. Competition for qualified personnel is intense among companies, academic institutions and other organizations. If we are unable to attract and retain key personnel and advisors, it may negatively affect our ability to successfully develop, test, commercialize and market our products and product candidates.

We face intense and increasing competition and many of our competitors have significantly greater resources and experience.

If any of our competitors develop products with efficacy or safety profiles significantly better than our products, we may not be able to commercialize our products, and sales of any of our commercialized products could be harmed. Some of our competitors and potential competitors have substantially greater product development capabilities and financial, scientific, marketing and human resources than we do. Competitors may develop products earlier, obtain FDA approvals for products more rapidly, or develop products that are more effective than those under development by us. We will seek to expand our technological capabilities to remain competitive; however, research and development by others may render our technologies or products obsolete or noncompetitive, or result in treatments or cures superior to ours.

Many other companies are pursuing other forms of treatment or prevention for diseases that we target. For example, many of our competitors are working on developing and testing cancer vaccines and immunotherapies and several products such as the CAR-Ts developed by our competitors have been approved for human use. Our competitors and potential competitors include large pharmaceutical and more established biotechnology companies. These companies have significantly greater financial and other resources and greater expertise than us in research and development, securing government contracts and grants to support research and development efforts, manufacturing, pre-clinical and clinical testing, obtaining regulatory approvals and marketing. This may make it easier for them to respond more quickly than us to new or changing opportunities, technologies or market needs. Many of these competitors operate large, well-funded research and development programs and have significant products approved or in development. Small companies may also prove to be significant competitors, particularly through collaborative arrangements with large pharmaceutical companies or through acquisition or development of intellectual property rights. Our potential competitors also include academic institutions, governmental agencies and other public and private research organizations that conduct research, seek patent protection and establish collaborative arrangements for product and clinical development and marketing. Research and development by others may seek to render our technologies or products obsolete or noncompetitive.

If we lose or are unable to secure collaborators or partners, or if our collaborators or partners do not apply adequate resources to their relationships with us, our product development and potential for profitability will suffer.

We have entered into, or may enter into, distribution, co-promotion, partnership, sponsored research and other arrangements for development, manufacturing, sales, marketing and other commercialization activities relating to our products. For example, in the past we have entered into license and collaboration agreements. The amount and timing of resources applied by our collaborators are largely outside of our control.

If any of our current or future collaborators breaches or terminates our agreements, or fails to conduct our collaborative activities in a timely manner, our commercialization of products could be diminished or blocked completely. We may not receive any event-based payments, milestone payments or royalty payments under our collaborative agreements if our collaborative partners fail to develop products in a timely manner or at all. It is possible that collaborators will change their strategic focus, pursue alternative technologies or develop alternative products, either on their own or in collaboration with others. Further, we may be forced to fund programs that were previously funded by our collaborators, and we may not have, or be able to access, the necessary funding. The effectiveness of our partners, if any, in marketing our products will also affect our revenues and earnings.

We desire to enter into new collaborative agreements. However, we may not be able to successfully negotiate any additional collaborative arrangements and, if established, these relationships may not be scientifically or commercially successful. Our success in the future depends in part on our ability to enter into agreements with other highly-regarded organizations. This can be difficult due to internal and external constraints placed on these organizations. Some organizations may have insufficient administrative and related infrastructure to enable collaborations with many companies at once, which can extend the time it takes to develop, negotiate and implement a collaboration. Once news of discussions regarding possible collaborations are known in the medical community, regardless of whether the news is accurate, failure to announce a collaborative agreement or the entity's announcement of a collaboration with another entity may result in adverse speculation about us, resulting in harm to our reputation and our business.

Disputes could also arise between us and our existing or future collaborators, as to a variety of matters, including financial and intellectual property matters or other obligations under our agreements. These disputes could be both expensive and time-consuming and may result in delays in the development and commercialization of our products or could damage our relationship with a collaborator.

A small number of licensing partners and government contracts account for a substantial portion of our revenue.

We currently derive, and in the past we have derived, a significant portion of our revenue from a limited number of licensing partners and government grants and contracts. Revenue can fluctuate significantly depending on the timing of upfront and event-based payments and work performed. If we fail to sign additional future contracts with major licensing partners and the government, if a contract is delayed or deferred, or if an existing contract expires or is canceled and we fail to replace the contract with new business, our revenue would be adversely affected.

We have agreements with government agencies, which are subject to termination and uncertain future funding.

We have entered into agreements with government agencies, such as the NIAID and DARPA, and we intend to continue entering into these agreements in the future. Our business is partially dependent on the continued performance by these government agencies of their responsibilities under these agreements, including adequate continued funding of the agencies and their programs. We have no control over the resources and funding that government agencies may devote to these agreements, which may be subject to annual renewal and which generally may be terminated by the government agencies at any time.

Government agencies may fail to perform their responsibilities under these agreements, which may cause them to be terminated by the government agencies. In addition, we may fail to perform our responsibilities under these agreements. Many of our government agreements are subject to audits, which may occur several years after the period to which the audit relates. If an audit identifies significant unallowable costs, we could incur a material charge to our earnings or reduction in our cash position. As a result, we may be unsuccessful entering, or ineligible to enter, into future government agreements.

Our quarterly operating results may fluctuate significantly.

We expect our operating results to be subject to quarterly fluctuations. Our net loss and other operating results will be affected by numerous factors, including:

- variations in the level of expenses related to our electroporation equipment, product candidates or future development programs;
- expenses related to corporate transactions, including ones not fully completed;
- addition or termination of clinical trials or funding support;
- any intellectual property infringement lawsuit in which we may become involved;
- any legal claims that may be asserted against us or any of our officers;
- regulatory developments affecting our electroporation equipment and product candidates or those of our competitors;
- debt service obligations on the Notes;
- our execution of any collaborative, licensing or similar arrangements, and the timing of payments we may make or receive under these arrangements; and
- if any of our products receives regulatory approval, the levels of underlying demand for our products.

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

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If we are unable to obtain FDA approval of our products, we will not be able to commercialize them in the United States.

We need FDA approval prior to marketing our electroporation equipment and products in the United States. If we fail to obtain FDA approval to market our electroporation equipment and product candidates, we will be unable to sell our products in the United States, which will significantly impair our ability to generate any revenues.

This regulatory review and approval process, which includes evaluation of pre-clinical studies and clinical trials of our products as well as the evaluation of our manufacturing processes and our third-party contract manufacturers' facilities, is lengthy, expensive and uncertain. To receive approval, we must, among other things, demonstrate with substantial evidence from well-controlled clinical trials that our electroporation equipment and product candidates are both safe and effective for each indication for which approval is sought. Satisfaction of the approval requirements typically takes several years and the time needed to satisfy them may vary substantially, based on the type, complexity and novelty of the product. We do not know if or when we might receive regulatory approvals for our electroporation equipment and any of our product candidates currently under development. Moreover, any approvals that we obtain may not cover all of the clinical indications for which we are seeking approval, or could contain significant limitations in the form of narrow indications, warnings, precautions or contra-indications with respect to conditions of use. In such event, our ability to generate revenues from such products would be greatly reduced and our business would be harmed.

The FDA has substantial discretion in the approval process and may either refuse to consider our application for substantive review or may form the opinion after review of our data that our application is insufficient to allow approval of our electroporation equipment and product candidates. If the FDA does not consider or approve our application, it may require that we conduct additional clinical, pre-clinical or manufacturing validation studies and submit that data before it will reconsider our application. Depending on the extent of these or any other studies, approval of any applications that we submit may be delayed by several years, or may require us to expend more resources than we have available. It is also possible that additional studies, if performed and completed, may not be successful or considered sufficient by the FDA for approval or even to make our applications approvable. If any of these outcomes occur, we may be forced to abandon one or more of our applications for approval, which might significantly harm our business and prospects.

It is possible that none of our products or any product we may seek to develop in the future will ever obtain the appropriate regulatory approvals necessary for us or our collaborators to commence product sales. Any delay in obtaining, or an inability to obtain, applicable regulatory approvals would prevent us from commercializing our products, generating revenues and achieving and sustaining profitability.

Clinical trials involve a lengthy and expensive process with an uncertain outcome, and results of earlier studies and trials may not be predictive of future trial results.

Clinical testing is expensive and can take many years to complete, and its outcome is uncertain. Failure can occur at any time during the clinical trial process. The results of pre-clinical studies and early clinical trials of our products may not be predictive of the results of later-stage clinical trials. Results from one study may not be reflected or supported by the results of similar studies. Results of an animal study may not be indicative of results achievable in human studies. Human-use equipment and product candidates in later stages of clinical trials may fail to show the desired safety and efficacy traits despite having progressed through pre-clinical studies and initial clinical testing. The time required to obtain approval by the FDA and similar foreign authorities is unpredictable but typically takes many years following the commencement of clinical trials, depending upon numerous factors. In addition, approval policies, regulations, or the type and amount of clinical data necessary to gain approval may change. We have not obtained regulatory approval for any human-use products.

Our products could fail to complete the clinical trial process for many reasons, including the following:

- we may be unable to demonstrate to the satisfaction of the FDA or comparable foreign regulatory authorities that our electroporation equipment and a product candidate are safe and effective for any indication;
- the results of clinical trials may not meet the level of statistical significance required by the FDA or comparable foreign regulatory authorities for approval;
-

the FDA or comparable foreign regulatory authorities may disagree with the design or implementation of our clinical trials;

- we may not be successful in enrolling a sufficient number of participants in clinical trials;
- we may be unable to demonstrate that our electroporation equipment and a product candidate's clinical and other benefits outweigh its safety risks;
- we may be unable to demonstrate that our electroporation equipment and a product candidate presents an advantage over existing therapies, or over placebo in any indications for which the FDA requires a placebo-controlled trial;

- the FDA or comparable foreign regulatory authorities may disagree with our interpretation of data from pre-clinical studies or clinical trials;
- the data collected from clinical trials of our product candidates may not be sufficient to support the submission of a new drug application or other submission or to obtain regulatory approval in the United States or elsewhere;
- the FDA or comparable foreign regulatory authorities may fail to approve the manufacturing processes or facilities of us or third-party manufacturers with which we or our collaborators contract for clinical and commercial supplies; and
- the approval policies or regulations of the FDA or comparable foreign regulatory authorities may significantly change in a manner rendering our clinical data insufficient for approval.

Our product candidates are combination products regulated under both the biologic and device regulations of the Public Health Service Act and Federal Food, Drug, and Cosmetic Act. Third-party manufacturers may not be able to comply with current good manufacturing practices, or cGMP, regulations, regulations applicable to biologic/device combination products, including applicable provisions of the FDA's drug cGMP regulations, device cGMP requirements embodied in the Quality System Regulation, or QSR, or similar regulatory requirements outside the United States. 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 product candidates, operating restrictions and criminal prosecutions, any of which could significantly affect supplies of our product candidates.

Delays in the commencement or completion of clinical testing could result in increased costs to us and delay or limit our ability to generate revenues.

Delays in the commencement or completion of clinical testing could significantly affect our product development costs. We do not know whether planned clinical trials will begin on time or be completed on schedule, if at all. In addition, ongoing clinical trials may not be completed on schedule, or at all, and could be placed on a hold by the regulators for various reasons. The commencement and completion of clinical trials can be delayed for a number of reasons, including delays related to:

- obtaining regulatory approval to commence a clinical trial;
- adverse results from third party clinical trials involving gene based therapies and the regulatory response thereto;
- reaching agreement on acceptable terms with prospective CROs and trial sites, the terms of which can be subject to extensive negotiation and may vary significantly among different CROs and trial sites;
- future bans or stricter standards imposed on gene based therapy clinical trials;
- manufacturing sufficient quantities of our electroporation equipment and product candidates for use in clinical trials;
- obtaining institutional review board, or IRB, approval to conduct a clinical trial at a prospective site;
- slower than expected recruitment and enrollment of patients to participate in clinical trials for a variety of reasons, including competition from other clinical trial programs for similar indications;
- conducting clinical trials with sites internationally due to regulatory approvals and meeting international standards;
- retaining patients who have initiated a clinical trial but may be prone to withdraw due to side effects from the therapy, lack of efficacy or personal issues, or who are lost to further follow-up;
- collecting, reviewing and analyzing our clinical trial data; and
- global unrest, terrorist activities, and economic and other external factors.

Clinical trials may also be delayed as a result of ambiguous or negative interim results. In addition, a clinical trial may be suspended or terminated by us, the FDA, the IRB overseeing the clinical trial at issue, any of our clinical trial sites with respect to that site, or other regulatory authorities 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 sites by the FDA or other regulatory authorities resulting in the imposition of a clinical hold;
- unforeseen safety issues; and
- lack of adequate funding to continue the clinical trial.

If we experience delays in completion of, or if we terminate, any of our clinical trials, the commercial prospects for our electroporation equipment and our product candidates may be harmed and our ability to generate product revenues will be delayed. In addition, 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 a product candidate. Further, delays in the commencement or completion of clinical trials may adversely affect the trading price of our common stock.

We and our collaborators rely on third parties to conduct our clinical trials. If these third parties do not successfully carry out their contractual duties or meet expected deadlines, we and our collaborators may not be able to obtain regulatory approval for or commercialize our product candidates.

We and our collaborators have entered into agreements with CROs to provide monitors for and to manage data for our on-going clinical programs. We and the CROs conducting clinical trials for our electroporation equipment and product candidates are required to comply with current good clinical practices, or GCPs, regulations and guidelines enforced by the FDA for all of our products in clinical development. The FDA enforces GCPs through periodic inspections of trial sponsors, principal investigators and trial sites. If we or the CROs conducting clinical trials of our product candidates fail to comply with applicable GCPs, the clinical data generated in the clinical trials may be deemed unreliable and the FDA may require additional clinical trials before approving any marketing applications.

If any relationships with CROs terminate, we or our collaborators may not be able to enter into arrangements with alternative CROs. In addition, these third-party CROs are not our employees, and we cannot control whether or not they devote sufficient time and resources to our on-going clinical programs or perform trials efficiently. These CROs may also have relationships with other commercial entities, including our competitors, for whom they may also be conducting clinical studies or other drug development activities, which could harm our competitive position. If CROs do not successfully carry out their contractual duties or obligations or meet expected deadlines, if they need to be replaced, or if the quality or accuracy of the clinical data they obtain is compromised due to the failure to adhere to our clinical protocols, regulatory requirements, or for other reasons, our clinical trials may be extended, delayed or terminated, and we may not be able to obtain regulatory approval for or successfully commercialize our product candidates. As a result, our financial results and the commercial prospects for our product candidates would be harmed, our costs could increase and our ability to generate revenues could be delayed. Cost overruns by or disputes with our CROs may significantly increase our expenses.

Even if our products receive regulatory approval, they may still face future development and regulatory difficulties.

Even if United States regulatory approval is obtained, the FDA may still impose significant restrictions on a product's indicated uses or marketing or impose ongoing requirements for potentially costly post-approval studies. This governmental oversight may be particularly strict with respect to gene based therapies. Our products will also be subject to ongoing FDA requirements governing the labeling, packaging, storage, advertising, promotion, record keeping and submission of safety and other post-market information. For example, the FDA strictly regulates the promotional claims that may be made about medical products. In particular, a product may not be promoted for uses that are not approved by the FDA as reflected in the product’s approved labeling. However, companies may in certain circumstances share truthful and not misleading information that is otherwise consistent with the product’s FDA approved labeling. In addition, manufacturers of drug products and their facilities are subject to continual review and periodic inspections by the FDA and other regulatory authorities for compliance with current good manufacturing practices, or cGMP, regulations. If we or a regulatory agency discover 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 on that product, the manufacturer or us, including requiring withdrawal of the product from the market or suspension of manufacturing. If we, our product candidates or the manufacturing facilities for our product candidates fail to comply with applicable regulatory requirements, a regulatory agency may:

- issue Warning Letters or untitled letters;
- impose civil or criminal penalties;
- suspend regulatory approval;
- suspend any ongoing clinical trials;
- refuse to approve pending applications or supplements to applications filed by us;
- impose restrictions on operations, including costly new manufacturing requirements; or

- seize or detain products or require us to initiate a product recall.

Even if our products receive regulatory approval in the United States, we may never receive approval or commercialize our products outside of the United States.

In order to market any electroporation equipment and product candidates outside of the United States, we must establish and comply with numerous and varying regulatory requirements of other countries regarding safety and efficacy. Approval procedures vary among countries and can involve additional product testing and additional administrative review periods. The time required to obtain approval in other countries might differ from that required to obtain FDA approval. The regulatory approval process in other countries may include all of the risks detailed above regarding FDA approval in the United States as well as other risks. Regulatory approval in one country does not ensure regulatory approval in another, but a failure or delay in obtaining regulatory approval in one country may have a negative effect on the regulatory process in others. Failure to obtain regulatory approval in other countries or any delay or setback in obtaining such approval could have the same adverse effects detailed above regarding FDA approval in the United States. Such effects include the risks that our product candidates may not be approved for all indications requested, which could limit the uses of our product candidates and have an adverse effect on their commercial potential or require costly, post-marketing follow-up studies.

We face potential product liability exposure and, if successful claims are brought against us, we may incur substantial liability.

The use of our electroporation equipment and synthetic vaccine candidates in clinical trials and the sale of any products for which we obtain marketing approval expose us to the risk of product liability claims. Product liability claims might be brought against us by consumers, healthcare providers, pharmaceutical companies or others selling or otherwise coming into contact with our products. For example, pharmaceutical companies have been subject to claims that the use of some pediatric vaccines has caused personal injuries, including brain damage, central nervous system damage and autism, and these companies have incurred material costs to defend these claims. If we cannot successfully defend ourselves against product liability claims, we could incur substantial liabilities. In addition, regardless of merit or eventual outcome, product liability claims may result in:

- decreased demand for our product candidates;
- impairment of our business reputation;
- withdrawal of clinical trial participants;
- costs of related litigation;
- distraction of management's attention from our primary business;
- substantial monetary awards to patients or other claimants;
- loss of revenues; and
- inability to commercialize our products.

We have obtained product liability insurance coverage for our clinical trials, but our insurance coverage may not be sufficient to reimburse us for any expenses or losses we may suffer. Moreover, insurance coverage is becoming increasingly expensive, and, in the future, 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. On occasion, large judgments have been awarded in class action lawsuits based on products that had unanticipated side 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 business.

We currently have no marketing and sales organization. If we are unable to establish marketing and sales capabilities or enter into agreements with third parties to market and sell our products, we may not be able to generate product revenues.

We currently do not have a sales organization for the marketing, sales and distribution of our electroporation equipment and product candidates. In order to commercialize any products, we must build our marketing, sales, distribution, managerial and other non-technical capabilities or make arrangements with third parties to perform these services. We contemplate establishing our own sales force or seeking third-party partners to sell our products. The establishment and development of our own sales force to market any products we may develop will be expensive and time consuming and could delay any product launch, and we may not be able to successfully develop this capability. We will also have to compete with other pharmaceutical and biotechnology companies to recruit, hire, train and retain marketing and sales personnel. To the extent we rely on third parties to commercialize our approved products, if any, we will receive lower revenues than if we commercialized these products ourselves. In addition, we may have little or

no control over the sales efforts of third parties involved in our commercialization efforts. In the event we are unable to develop our own marketing and sales force or collaborate with a third-party marketing and sales organization, we would not be able to commercialize our product candidates which would negatively impact our ability to generate product revenues.

If any of our products for which we receive regulatory approval does not achieve broad market acceptance, the revenues that we generate from their sales will be limited.

The commercial success of our electroporation equipment and product candidates for which we obtain marketing approval from the FDA or other regulatory authorities will depend upon the acceptance of these products by both the medical community and patient population. Coverage and reimbursement of our product candidates by third-party payors, including government payors, generally is also necessary for optimal commercial success. The degree of market acceptance of any of our approved products will depend on a number of factors, including:

- our ability to provide acceptable evidence of safety and efficacy;
- the relative convenience and ease of administration;
- the prevalence and severity of any actual or perceived adverse side effects;
- limitations or warnings contained in a product's FDA-approved labeling, including, for example, potential “black box” warnings
- availability of alternative treatments;
- pricing and cost effectiveness;
- the effectiveness of our or any future collaborators' sales and marketing strategies;
- our ability to obtain sufficient third-party coverage and adequate reimbursement; and
- the willingness of patients to pay out of pocket in the absence of third-party coverage.

If our electroporation equipment and product candidates are approved but do not achieve an adequate level of acceptance by physicians, healthcare payors and patients, we may not generate sufficient revenue from these products, and we may not become or remain profitable. In addition, our efforts to educate the medical community and third-party payors on the benefits of our product candidates may require significant resources and may never be successful.

We are subject to uncertainty relating to coverage and reimbursement policies which, if not favorable to our product candidates, could hinder or prevent our products' commercial success.

Patients in the United States and elsewhere generally rely on third-party payors to reimburse part or all of the costs associated with their prescription drugs and medical treatments. Accordingly, our ability to commercialize our electroporation equipment and product candidates successfully will depend in part on the extent to which governmental authorities, including Medicare and Medicaid, private health insurers and other third-party payors establish appropriate coverage and reimbursement levels for our product candidates and related treatments. As a threshold for coverage and reimbursement, third-party payors generally require that drug products have been approved for marketing by the FDA.

Significant uncertainty exists as to the coverage and reimbursement status of any products for which we may obtain regulatory approval. Coverage decisions may not favor new products when more established or lower cost therapeutic alternatives are already available. Even if we obtain coverage for a given product, the associated reimbursement rate may not be adequate to cover our costs, including research, development, intellectual property, manufacture, sale and distribution expenses, or may require co-payments that patients find unacceptably high. Patients are unlikely to use our products unless reimbursement is adequate to cover all or a significant portion of the cost of our drug products. Additionally, some of our products, if approved, will be provided under the supervision of a physician. When used in connection with medical procedures, our product candidates may not be reimbursed separately but their cost may instead be bundled as part of the payment received by the provider for the procedure only. Separate reimbursement for the product itself or the treatment or procedure in which our product is used may not be available. A decision by a third-party payor not to cover or separately reimburse for our product candidates or procedures using our product candidates, could reduce physician utilization of our products once approved.

Coverage and reimbursement policies for drug products can differ significantly from payor to payor as there is no uniform policy of coverage and reimbursement for drug products among third-party payors in the United States. There may be significant delays in obtaining coverage and reimbursement as the process of determining coverage and reimbursement is often time consuming and costly which will require us to provide scientific and clinical support for the use of our products to each payor separately, with no assurance that coverage or adequate reimbursement will be obtained. It is difficult to predict at this time what government authorities and third-party payors will decide with respect to coverage and reimbursement for our products.

A significant trend in the U.S. healthcare industry and elsewhere is cost containment. Third-party payors have attempted to control costs by limiting coverage and the amount of reimbursement for particular products and services.

Third-party payors are increasingly challenging the effectiveness of and prices charged for medical products and services. Moreover, the U.S. government, state legislatures and foreign governmental entities have shown significant interest in implementing cost containment programs to limit the growth of government paid healthcare costs, including price controls, restrictions on

reimbursement and coverage and requirements for substitution of generic products for branded prescription drugs. We may not be able to obtain third-party payor coverage or reimbursement for our products in whole or in part.

Healthcare reform measures could hinder or prevent our products' commercial success.

In both the United States and certain foreign jurisdictions there have been, and we anticipate there will continue to be, a number of legislative and regulatory changes to the healthcare system that could impact our ability to sell any of our products profitably. In the United States, the federal government enacted healthcare reform legislation, the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act, or collectively, the ACA. Among the ACA's provisions of importance to the pharmaceutical industry are that it:

- imposed an annual excise tax of 2.3% on any entity that manufactures or imports medical devices offered for sale in the United States, with limited exceptions, although the effective rate paid may be lower. Under the Consolidated Appropriations Act of 2016, the excise tax was suspended through December 31, 2017, and under the continuing resolution on appropriations for fiscal year 2018, or 2018 Appropriations Resolution, signed by President Trump on January 22, 2018, was further suspended through December 31, 2019;
- created an annual, nondeductible fee on any entity that manufactures or imports certain specified branded prescription drugs and biologic agents apportioned among these entities according to their market share in some government healthcare programs;
- increased the statutory minimum rebates a manufacturer must pay under the Medicaid Drug Rebate Program, to 23.1% and 13% of the average manufacturer price for most branded and generic drugs, respectively and capped the total rebate amount for innovator drugs at 100% of the Average Manufacturer Price, or AMP;
- created new methodology by which rebates owed by manufacturers under the Medicaid Drug Rebate Program are calculated for certain drugs and biologics that are inhaled, infused, instilled, implanted or injected;
- expanded eligibility criteria for Medicaid programs by, among other things, allowing states to offer Medicaid coverage to additional individuals and by adding new mandatory eligibility categories for individuals with income at or below 133% of the federal poverty level, thereby potentially increasing manufacturers' Medicaid rebate liability;
- expanded the entities eligible for discounts under the Public Health program;
- created a new Patient-Centered Outcomes Research Institute to oversee, identify priorities in, and conduct comparative clinical effectiveness research, along with funding for such research;
- established a Center for Medicare & Medicaid Innovation at the Centers for Medicare & Medicaid Services, or CMS, to test innovative payment and service delivery models to lower Medicare and Medicaid spending, potentially including prescription drug spending that began on January 1, 2011; and
- created a licensure framework for follow on biologic products.

Some of the provisions of the ACA have yet to be implemented, and there have been judicial and Congressional challenges to certain aspects of the ACA, as well as recent efforts by the Trump administration to repeal or replace certain aspects of the ACA. Since January 2017, President Trump has signed two Executive Orders and other directives designed to delay the implementation of certain provisions of the ACA. Concurrently, Congress has considered legislation that would repeal or repeal and replace all or part of the ACA. While Congress has not passed comprehensive repeal legislation, it has enacted laws that modify certain provisions of the ACA such as removing penalties, starting January 1, 2019, for not complying with the ACA's individual mandate to carry health insurance and delaying the implementation of certain ACA-mandated fees. On December 14, 2018, a Texas U.S. District Court Judge ruled that the ACA is unconstitutional in its entirety because the "individual mandate" was repealed by Congress as part of the Tax Cuts and Jobs Act of 2017. While the Texas U.S. District Court Judge, as well as the Trump administration and CMS, have stated that the ruling will have no immediate effect pending appeal of the decision, it is unclear how this decision, subsequent appeals, and other efforts to repeal and replace the ACA will impact the ACA and our business.

In addition, other legislative changes have been proposed and adopted since the ACA was enacted. On August 2, 2011, the Budget Control Act of 2011 was signed into law, which, among other things, included reductions to Medicare payments to providers of 2% per fiscal year, which went into effect on April 1, 2013 and, due to subsequent legislative amendments to the statute will remain in effect through 2027 unless additional Congressional action is taken. On January 2, 2013, the American Taxpayer Relief Act of 2012 was signed into law, which, among other things, reduced Medicare payments to several providers, including hospitals, and increased the statute of limitations

period for the government to recover overpayments to providers from three to five years.

Further there has been heightened governmental scrutiny in the United States of pharmaceutical pricing practices in light of the rising cost of prescription drugs and biologics. Such scrutiny has resulted in several recent congressional inquiries and proposed and enacted federal and state legislation 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. For example, the Trump administration released a "Blueprint" to lower drug prices and reduce out of pocket costs of drugs that contains additional proposals to increase drug manufacturer competition, increase the negotiating power of certain federal healthcare programs, incentivize manufacturers to lower the list price of their products, and reduce the out of pocket costs of drug products paid by consumers. On January 31, 2019, the U.S. Department of Health and Human Services, Office of Inspector General, proposed modifications to the federal healthcare program Anti-Kickback Statute discount safe harbor for the purpose of reducing the cost of drug products to consumers which, among other things, if finalized, will affect discounts paid by manufacturers to Medicare Part D plans, Medicaid managed care organizations and pharmacy benefit managers working with these organizations. While some of these and other proposed measures may require additional authorization to become effective, Congress and the Trump administration have each indicated that it will continue to seek new legislative and/or administrative measures to control drug costs.

The continuing efforts of the government, insurance companies, managed care organizations and other payors of healthcare services to make and implement healthcare reforms may adversely affect:

- our ability to set a price we believe is fair for our products;
- our ability to generate revenues and achieve or maintain profitability;
- the availability of capital; and
- our ability to obtain timely approval of our products.

If we fail to comply with applicable healthcare regulations, we could face substantial penalties and our business, operations and financial condition could be adversely affected.

Certain federal, state, local and foreign healthcare laws and regulations pertaining to fraud and abuse, transparency, patients' rights, and privacy are applicable to our business. The laws that may affect our ability to operate include:

- the federal healthcare program Anti-Kickback Statute, which prohibits, among other things, people from soliciting, receiving or providing remuneration, directly or indirectly, to induce or reward either the referral of an individual, or ordering, or leasing of an item, good, facility or service, for which payment may be made by a federal healthcare program such as Medicare or Medicaid. The intent standard under the federal healthcare program Anti-Kickback Statute was amended by the ACA to a stricter standard such that a person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation. Further, the ACA codified case law that a claim including items or services resulting from a violation of the federal healthcare program Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the civil False Claims Act;
- federal civil and criminal false claims laws, including the civil False Claims Act, which prohibit, among other things, individuals or entities from knowingly presenting, or causing to be presented, claims for payment from Medicare, Medicaid, or other third-party payors that are false or fraudulent;
- the federal Health Insurance Portability and Accountability Act of 1996, or HIPAA, which prohibits, among other things, executing a scheme to defraud any healthcare benefit program or making false statements relating to healthcare matters. Similar to the federal healthcare program Anti-Kickback Statute, a person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation;
- HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act, and their implementing regulations, which imposes certain requirements relating to the privacy, security and transmission of individually identifiable health information on certain individuals and entities;
- the Physician Payments Sunshine Act, created under the ACA, which requires pharmaceutical companies to record any transfers of value made to doctors and teaching hospitals, as well as ownership and investment interests held by physicians and their immediate family members, and to annually report such data to CMS;
- the Federal Food, Drug, and Cosmetic Act, which among other things, strictly regulates drug product marketing, prohibits manufacturers from marketing drug products for off-label use and regulates the distribution of drug samples;
- the U.S. Foreign Corrupt Practices Act, which, among other things, prohibits companies issuing stock in the U.S. from bribing foreign officials for government contracts and other business;
- state law equivalents of each of the above federal laws, such as anti-kickback and false claims laws which may apply to items or services reimbursed by any third-party payor, including commercial insurers, state and local laws requiring the registration of pharmaceutical sales and medical representatives, and state laws governing the privacy

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and security of health information in certain circumstances, many of which differ from each other in significant ways and often are not preempted by HIPAA, thus complicating compliance efforts; and

- additional state and local laws such as laws in California and Massachusetts, which mandate implementation of compliance programs, compliance with industry ethics codes, and spending limits, and other state and local laws, such as laws in Vermont, Maine, and Minnesota which require reporting to state governments of gifts, compensation, and other remuneration to physicians.

The shifting regulatory environment, along with the requirement to comply with multiple jurisdictions with different compliance and/or reporting requirements, increases the possibility that a company may run afoul of one or more laws.

We will be required to spend substantial time and money to ensure that our business arrangements with third parties comply with applicable healthcare laws and regulations. Because of the breadth of these laws and the narrowness of the statutory exceptions and regulatory safe harbors available, which require strict compliance in order to offer protection, it is possible that governmental authorities may conclude that our business practices do not comply with current or future statutes, regulations, agency guidance or case law involving applicable healthcare laws. If our operations are found to be in violation of any of the laws described above or any other governmental regulations that apply to us, we may be subject to significant penalties, including administrative, civil and criminal penalties, damages, fines, disgorgement, possible exclusion from participation in Medicare, Medicaid and other federal healthcare programs, imprisonment, integrity and/or other oversight obligations, contractual damages, reputational harm, and the curtailment or restructuring of our operations. Any such penalties could adversely affect our ability to operate our business and our financial results. 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.

If we and the contract manufacturers upon whom we rely fail to produce our systems and product candidates in the volumes that we require on a timely basis, or fail to comply with stringent regulations, we may face delays in the development and commercialization of our electroporation equipment and product candidates.

We manufacture some components of our electroporation systems and utilize the services of contract manufacturers to manufacture the remaining components of these systems and our product supplies for clinical trials. The manufacture of our systems and product supplies requires significant expertise and capital investment, including the development of advanced manufacturing techniques and process controls. Manufacturers often encounter difficulties in production, particularly in scaling up for commercial production. These problems include difficulties with production costs and yields, quality control, including stability of the equipment and product candidates and quality assurance testing, shortages of qualified personnel, as well as compliance with strictly enforced federal, state and foreign regulations. If we or our manufacturers were to encounter any of these difficulties or our manufacturers otherwise fail to comply with their obligations to us, our ability to provide our electroporation equipment to our partners and products to patients in our clinical trials or to commercially launch a product would be jeopardized. Any delay or interruption in the supply of clinical trial supplies could delay the completion of our clinical trials, increase the costs associated with maintaining our clinical trial program and, depending upon the period of delay, require us to commence new trials at significant additional expense or terminate the trials completely.

In addition, all manufacturers of our products must comply with cGMP requirements enforced by the FDA through its facilities inspection program. These requirements include, among other things, quality control, quality assurance and the generation and maintenance of records and documentation. Manufacturers of our products may be unable to comply with these cGMP requirements and with other FDA, state and foreign regulatory requirements. We have little control over our manufacturers' compliance with these regulations and standards. A failure to comply with these requirements may result in fines and civil penalties, suspension of production, suspension or delay in product approval, product seizure or recall, or withdrawal of product approval. If the safety of any product is compromised due to our or our manufacturers' failure to adhere to applicable laws or for other reasons, we may not be able to obtain regulatory approval for or successfully commercialize our products, and we may be held liable for any injuries sustained as a result. Any of these factors could cause a delay of clinical trials, regulatory submissions, approvals or commercialization of our products, entail higher costs or result in our being unable to effectively commercialize our products. Furthermore, if our manufacturers fail to deliver the required commercial quantities on a timely basis,

pursuant to provided specifications and at commercially reasonable prices, we may be unable to meet demand for our products and would lose potential revenues.

Our failure to successfully acquire, develop and market additional product candidates or approved products would impair our ability to grow.

We may acquire, in-license, develop and/or market additional products and product candidates. The success of these actions depends partly upon our ability to identify, select and acquire promising product candidates and products.

The process of proposing, negotiating and implementing a license or acquisition of a product candidate or approved product is lengthy and complex. Other companies, including some with substantially greater financial, marketing and sales resources, may compete with us for the license or acquisition of product candidates and approved products. We have limited resources to identify and execute the acquisition or in-licensing of third-party products, businesses and technologies and integrate them into our current infrastructure. Moreover, we may devote resources to potential acquisitions or in-licensing opportunities that are never completed, or we may fail to realize the anticipated benefits of such efforts. We may not be able to acquire the rights to additional product candidates on terms that we find acceptable, or at all.

In addition, future acquisitions may entail numerous operational and financial risks, including:

- exposure to unknown liabilities;
- disruption of our business and diversion of our management's time and attention to develop acquired products or technologies;
- incurrence of substantial debt or dilutive issuances of securities to pay for acquisitions;
- higher than expected acquisition and integration costs;
- increased amortization expenses;
- difficulty and cost in combining the operations and personnel of any acquired businesses with our operations and personnel;
- impairment of relationships with key suppliers or customers of any acquired businesses due to changes in management and ownership; and
- inability to retain key employees of any acquired businesses.

Further, any product candidate that we acquire may require additional development efforts prior to commercial sale, including extensive clinical testing and approval by the FDA and applicable foreign regulatory authorities. All product candidates are prone to risks of failure typical of product development, including the possibility that a product candidate will not be shown to be sufficiently safe and effective for approval by regulatory authorities.

Our business involves the use of hazardous materials and we and our third-party manufacturers must comply with environmental laws and regulations, which can be expensive and restrict how we do business.

Our and our third-party manufacturers' activities involve the controlled storage, use and disposal of hazardous materials, including the components of our product candidates and other hazardous compounds. We and our manufacturers are subject to federal, state and local laws and regulations governing the use, manufacture, storage, handling and disposal of these hazardous materials. In the event of an accident, state or federal authorities may curtail the use of these materials and interrupt our business operations. If we are subject to any liability as a result of our or our third-party manufacturers' activities involving hazardous materials, our business and financial condition may be adversely affected.

We may be subject to stockholder litigation, which would harm our business and financial condition.

We may have actions brought against us by stockholders relating to past transactions, changes in our stock price or other matters. Any such actions could give rise to substantial damages, and thereby have a material adverse effect on our consolidated financial position, liquidity, or results of operations. Even if an action is not resolved against us, the uncertainty and expense associated with stockholder actions could harm our business, financial condition and reputation. Litigation can be costly, time-consuming and disruptive to business operations. The defense of lawsuits could also result in diversion of our management's time and attention away from business operations, which could harm our business.

Our results of operations and liquidity needs could be materially affected by market fluctuations and general economic conditions.

Our results of operations could be materially affected by economic conditions generally, both in the United States and elsewhere around the world. Concerns over inflation, energy costs, geopolitical issues and the availability and cost of credit have in the past and may continue to contribute to increased volatility and diminished expectations for the economy and the markets going forward. Market upheavals may have an adverse effect on us. In the event of a market downturn, our results of operations could be adversely affected. Our future cost of equity or debt capital and access to the capital markets could be adversely affected, and our stock price could decline. There may be disruption in or delay in the performance of our third-party contractors and suppliers. If our contractors, suppliers and partners are unable to

satisfy their contractual commitments, our business could suffer. In addition, we maintain significant amounts of cash and cash equivalents at one or more financial institutions that are in excess of federally insured limits, and we may experience losses on these deposits.

We are dependent on information technology and our systems and infrastructure face certain risks, including from cybersecurity breaches and data leakage.

We rely to a large extent upon sophisticated information technology systems to operate our businesses, some of which are managed, hosted provided and/or used for third-parties or their vendors. We collect, store and transmit large amounts of confidential information, and we deploy and operate an array of technical and procedural controls to maintain the confidentiality and integrity of such confidential information. A significant breakdown, invasion, corruption, destruction or interruption of critical information technology systems or infrastructure, by our workforce, others with authorized access to our systems or unauthorized persons could negatively impact operations. The ever-increasing use and evolution of technology, including cloud-based computing, creates opportunities for the unintentional dissemination or intentional destruction of confidential information stored in our or our third-party providers' systems, portable media or storage devices. We could also experience a business interruption, theft of confidential information or reputational damage from industrial espionage attacks, malware or other cyber-attacks, which may compromise our system infrastructure or lead to data leakage, either internally or at our third-party providers. While we have invested in the protection of data and information technology, there can be no assurance that our efforts will prevent service interruptions or security breaches. Any such interruption or breach of our systems could adversely affect our business operations and/or result in the loss of critical or sensitive confidential information or intellectual property, and could result in financial, legal, business and reputational harm to us.

Changes in tax laws could adversely affect our business and financial condition.

On December 22, 2017, President Trump signed into law new legislation, known as the Tax Cuts and Jobs Act of 2017, that significantly revises the Internal Revenue Code of 1986, as amended, or the Code. The newly enacted federal income tax law, among other things, contains significant changes to corporate taxation, including reduction of the corporate tax rate from a top marginal rate of 35 percent to a flat rate of 21 percent, limitation of the tax deduction for interest expense to 30 percent of adjusted earnings (except for certain small businesses), limitation of the deduction for net operating losses to 80 percent 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, immediate deductions for certain new investments instead of deductions for depreciation expense over time, 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). Notwithstanding the reduction in the corporate income tax rate, the overall impact of the federal tax law is uncertain and our business and financial condition could be adversely affected. In addition, it is uncertain if and to what extent various states will conform to the federal tax law.

Changes in funding for the FDA and other government agencies could hinder our ability to hire and retain key leadership and other personnel, or otherwise prevent new products from being developed or commercialized in a timely manner, which could negatively impact our business.

The ability of the FDA to review and approve new products can be affected by a variety of factors, including government budget and funding levels, ability to hire and retain key personnel and accept the payment of user fees, and statutory, regulatory, and policy changes. Average review times at the agency have fluctuated in recent years as a result. In addition, government funding of other government agencies that fund research and development activities is subject to the political process, which is inherently fluid and unpredictable.

Disruptions at the FDA and other agencies may also slow the time necessary for new drugs to be reviewed and/or approved by necessary government agencies, which would adversely affect our business. For example, over the last several years, including for 35 days beginning on December 22, 2018, the U.S. government has shut down several times and certain regulatory agencies, such as the FDA, have had to furlough critical FDA employees and stop critical activities. If a prolonged government shutdown occurs, it could significantly impact the ability of the FDA to timely review and process our regulatory submissions, which could have a material adverse effect on our business.

Risks Related to Our Intellectual Property

It is difficult and costly to generate and protect our intellectual property and our proprietary technologies, and we may not be able to ensure their protection.

Our commercial success will depend in part on obtaining and maintaining patent, trademark, trade secret, and other intellectual property protection relating to our electroporation equipment and product candidates, as well as

successfully defending these intellectual property rights against third-party challenges.

The patent positions of pharmaceutical and biotechnology companies can be highly uncertain and involve complex legal and factual questions for which important legal principles remain unresolved. The laws and regulations regarding the breadth of claims allowed in biotechnology patents have evolved over recent years and continues to undergo review and revision, both in the United States and abroad. The biotechnology patent situation outside the United States can be even more uncertain

depending on the country. Changes in either the patent laws or in interpretations of patent laws in the United States and other countries may diminish the value of our intellectual property. Accordingly, we cannot predict the breadth of claims that may be allowed or enforced in our licensed patents, our patents or in third-party patents, nor can we predict the likelihood of our patents surviving a patent validity challenge.

The degree of future protection for our intellectual property rights is uncertain, because legal decision-making can be unpredictable, thereby often times resulting in limited protection, which may not adequately protect our rights or permit us to gain or keep our competitive advantage, or resulting in an invalid or unenforceable patent. For example:

- we, or the parties from whom we have acquired or licensed patent rights, may not have been the first to file the underlying patent applications or the first to make the inventions covered by such patents;
- the named inventors or co-inventors of patents or patent applications that we have licensed or acquired may be incorrect, which may give rise to inventorship and ownership challenges;
- others may develop similar or alternative technologies, or duplicate any of our products or technologies that may not be covered by our patents, including design-arounds;
- pending patent applications may not result in issued patents;
- the issued patents covering our products and technologies may not provide us with any competitive advantages or have any commercial value;
- the issued patents may be challenged and invalidated, or rendered unenforceable;
- the issued patents may be subject to reexamination, which could result in a narrowing of the scope of claims or cancellation of claims found unpatentable;
- we may not develop or acquire additional proprietary technologies that are patentable;
- our trademarks may be invalid or subject to a third party's prior use; or
- our ability to enforce our patent rights will depend on our ability to detect infringement, and litigation to enforce patent rights may not be pursued due to significant financial costs, diversion of resources, and unpredictability of a favorable result or ruling.

We depend, in part, on our licensors and collaborators to protect a portion of our intellectual property rights. In such cases, our licensors and collaborators may be primarily or wholly responsible for the maintenance of patents and prosecution of patent applications relating to important areas of our business. If any of these parties fail to adequately protect these products with issued patents, our business and prospects would be harmed significantly.

We also may rely on trade secrets to protect our technology, especially where we do not believe patent protection is appropriate or obtainable. However, trade secrets are difficult to protect. Although we use reasonable efforts to protect our trade secrets, our employees, consultants, contractors, outside scientific collaborators and other advisors may unintentionally or willfully disclose our trade secrets to competitors. Enforcing a claim that a third-party entity illegally obtained and is using any of our trade secrets is expensive and time consuming, and the outcome is unpredictable. In addition, courts outside the United States are sometimes less willing to protect trade secrets. Moreover, our competitors may independently develop equivalent knowledge, methods and know-how.

If we or our licensors fail to obtain or maintain patent protection or trade secret protection for our product candidates or our technologies, third parties could use our proprietary information, which could impair our ability to compete in the market and adversely affect our ability to generate revenues and attain profitability.

From time to time, U.S. and other policymakers have proposed reforming the patent laws and regulations of their countries. In September 2011 the America Invents Act (the Act) was signed into law. The Act changed the current “first-to-invent” system to a system that awards a patent to the “first-inventor-to-file” for an application for a patentable invention. The Act also created a procedure to challenge newly issued patents in the patent office via post-grant proceedings and new inter parties reexamination proceedings. These changes may make it easier for competitors to challenge our patents, which could result in increased competition and have a material adverse effect on our product sales, business and results of operations. The changes may also make it harder to challenge third-party patents and place greater importance on being the first inventor to file a patent application on an invention.

If we are sued for infringing intellectual property rights of third parties, it will be costly and time consuming, and an unfavorable outcome in that litigation would have a material adverse effect on our business.

Other companies may have or may acquire intellectual property rights that could be enforced against us. If they do so, we may be required to alter our technologies, pay licensing fees or cease activities. If our products or technologies

infringe the

intellectual property rights of others, they could bring legal action against us or our licensors or collaborators claiming damages and seeking to enjoin any activities that they believe infringe their intellectual property rights.

Because patent applications can take many years to issue, and there is a period when the application remains undisclosed to the public, there may be currently pending applications unknown to us or reissue applications that may later result in issued patents upon which our products or technologies may infringe. There could also be existing patents of which we are unaware that our products or technologies may infringe. In addition, if third parties file patent applications or obtain patents claiming products or technologies also claimed by us in pending applications or issued patents, we may have to participate in interference or derivation proceedings in the United States Patent and Trademark Office to determine priority or derivation of the invention. If third parties file oppositions in foreign countries, we may also have to participate in opposition proceedings in foreign tribunals to defend the patentability of our filed foreign patent applications.

If a third party claims that we infringe its intellectual property rights, it could cause our business to suffer in a number of ways, including:

- we may become involved in time-consuming and expensive litigation, even if the claim is without merit, the third party's patent is invalid or we have not infringed;
- we may become liable for substantial damages for past infringement if a court decides that our technologies infringe upon a third party's patent;
- we may be enjoined by a court to stop making, selling or licensing our products or technologies without a license from a patent holder, which may not be available on commercially acceptable terms, if at all, or which may require us to pay substantial royalties or grant cross-licenses to our patents; and
- we may have to redesign our products so that they do not infringe upon others' patent rights, which may not be possible or could require substantial investment or time.

If any of these events occur, our business could suffer and the market price of our common stock may decline.

Risks Related to Our Common Stock

The price of our common stock may be volatile, and an investment in our common stock could decline substantially in value.

In light of our small size and limited resources, as well as the uncertainties and risks that can affect our business and industry, our stock price may be highly volatile and can be subject to substantial drops, with or even in the absence of news affecting our business. Period to period comparisons are not indicative of future performance. The following factors, in addition to the other risk factors described in this annual report, and the potentially low volume of trades in our common stock, may have a significant impact on the market price of our common stock, some of which are beyond our control:

- developments concerning any research and development, clinical trials, manufacturing, and marketing efforts or collaborations;
- fluctuating public or scientific interest in the potential for influenza pandemic or other applications for our vaccine or other product candidates;
- our announcement of significant acquisitions, strategic collaborations, joint ventures or capital commitments;
- fluctuations in our operating results;
- announcements of technological innovations;
- new products or services that we or our competitors offer;
- changes in the structure of healthcare payment systems;
- the initiation, conduct and/or outcome of intellectual property and/or litigation matters;
- changes in financial or other estimates by securities analysts or other reviewers or evaluators of our business;
- conditions or trends in bio-pharmaceutical or other healthcare industries;
- regulatory developments in the United States and other countries;
- negative perception of gene based therapy;
- changes in the economic performance and/or market valuations of other biotechnology and medical device companies;
- additions or departures of key personnel;

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- sales or other transactions involving our common stock;
- changes in our capital structure;
- sales or other transactions by executive officers or directors involving our common stock;
- changes in accounting principles;
- global unrest, terrorist activities, and economic and other external factors; and
- catastrophic weather and/or global disease pandemics.

The stock market in general has recently experienced relatively large price and volume fluctuations. In particular, the market prices of securities of smaller biotechnology and medical device companies have experienced dramatic fluctuations that often have been unrelated or disproportionate to the operating results of these companies. Continued market fluctuations could result in extreme volatility in the price of the common stock, which could cause a decline in the value of the common stock. In addition, price volatility may increase if the trading volume of our common stock remains limited or declines.

Anti-takeover provisions under our charter documents and Delaware law could delay or prevent a change of control which could limit the market price of our common stock.

Our amended and restated certificate of incorporation contains provisions that could delay or prevent a change of control of our company or changes in our board of directors that our stockholders might consider favorable. Some of these provisions include:

- the authority of our board of directors to issue shares of undesignated preferred stock and to determine the rights, preferences and privileges of these shares, without stockholder approval;
- all stockholder actions must be effected at a duly called meeting of stockholders and not by written consent; and
- the elimination of cumulative voting.

In addition, we are governed by the provisions of Section 203 of the Delaware General Corporate Law, which may prohibit certain business combinations with stockholders owning 15% or more of our outstanding voting stock. These and other provisions in our amended and restated certificate of incorporation, amended and restated bylaws and Delaware law could make it more difficult for stockholders or potential acquirers to obtain control of our board of directors or initiate actions that are opposed by the then-current board of directors, including to delay or impede a merger, tender offer or proxy contest involving our company. Any delay or prevention of a change of control transaction or changes in our board of directors could cause the market price of our common stock to decline.

We have never paid cash dividends on our common stock and we do not anticipate paying dividends in the foreseeable future.

We have paid no cash dividends on our common stock to date, and we currently intend to retain our future earnings, if any, to fund the development and growth of our business. In addition, the terms of any future debt or credit facility may preclude or limit our ability to pay any dividends. As a result, capital appreciation, if any, of our common stock will be the sole source of potential gain for the foreseeable future.

ITEM 1B. UNRESOLVED STAFF COMMENTS

None.

ITEM 2. PROPERTIES

We own no real property and have no plans to acquire any real property in the future.

San Diego Leases

In April 2013, we entered into a lease, or the San Diego Lease, for office space in San Diego, California. The term of the San Diego Lease commenced on December 1, 2013. The initial term of the San Diego Lease is ten years, with a right to terminate on December 1, 2019 and an option to extend the term by five years, subject to specified conditions. In June 2015, we amended the San Diego Lease to increase the total leased space to 31,207 square feet and occupy the entire building. The commencement of the amended San Diego Lease was in January 2016. As of December 31, 2018, rent payments under the San Diego Lease include base rent with an annual increase of approximately 3 percent, and additional monthly fees to cover our share of certain facility expenses, including utilities, property taxes, insurance and maintenance.

In October 2016, we entered into an office lease, or the new Lease, for a second property in San Diego, California. The total space under the new Lease is approximately 51,000 square feet. We are using the facility for office, manufacturing and

research and development purposes. The term of the new Lease commenced on June 1, 2017. The initial term of the new Lease is ten years, with a right to terminate on November 30, 2023, subject to specified conditions.
The base rent adjusts periodically throughout the term of the new Lease. As of December 31, 2018, rent payments under the San Diego Lease include base rent with an annual increase of approximately 3 percent, and additional monthly fees to cover our share of certain facility expenses, including utilities, property taxes, insurance and maintenance. In addition, we have paid a security deposit of $95,000.

Plymouth Meeting Lease
In March 2014, we entered into a lease, or the Lease, for our corporate headquarters in Plymouth Meeting, Pennsylvania. We occupied the space in June 2014. The initial term of the Lease was 11.5 years, with a right to extend the term by five years, subject to specified conditions. We use the space for office purposes.
The base rent adjusts periodically throughout the term of the Lease. As of December 31, 2018, rent payments under the Lease include base rent with an annual increase of approximately 2 percent, and additional monthly fees to cover our share of certain facility expenses, including utilities, property taxes, insurance and maintenance. In addition, we have paid a security deposit of $49,000. In July 2015, we amended the Lease to increase the total leased space to 27,583 square feet.
In June 2017, we entered into another amendment to the Lease to increase the total leased space to 57,361 square feet and extend the lease term through December 31, 2029. In connection with this amendment, we have paid the landlord an additional security deposit of $75,000.
We believe our current and future planned facilities will be adequate to meet our operating needs for the foreseeable future. Should we need additional space, we believe we will be able to secure additional space at commercially reasonable rates.

ITEM 3. LEGAL PROCEEDINGS
From time to time, we are subject to litigation and claims arising in the ordinary course of business. We are not currently a party to any material legal proceedings and we are not aware of any pending or threatened legal proceeding against us that we believe could have a material adverse effect on our business, operating results, cash flows or financial condition.

ITEM 4. MINE SAFETY DISCLOSURES
Not applicable.

PART II

ITEM 5. MARKET FOR REGISTRANT'S COMMON EQUITY, RELATED STOCKHOLDER MATTERS AND ISSUER PURCHASES OF EQUITY SECURITIES

Market Information

Our common stock, par value $0.001 per share, began trading on the Nasdaq Global Select Market on September 15, 2014 under the symbol "INO," having previously traded on the NYSE MKT exchange.

As of March 7, 2019, we had approximately 480 common stockholders of record. The actual number of stockholders is greater than this number of record holders and includes stockholders who are beneficial owners but whose shares are held in street name by brokers and other nominees. This number of holders of record also does not include stockholders whose shares may be held in trust by other entities.

The closing price per share of our common stock on March 11, 2019 was $3.52, as reported on the Nasdaq Global Select Market.

Dividends

The payment of any dividends on our common stock is within the discretion of our board of directors. We have never paid cash dividends on our common stock and the board of directors does not expect to declare cash dividends on the common stock in the foreseeable future.

Performance Graph

The graph below compares the performance of our common stock with the performance of the NYSE American Index, the S&P SuperCap Biotechnology index and the Nasdaq Composite Index for the five years ended December 31, 2018. The graph assumes a $100 investment on December 31, 2013 in our common stock and in each index, with the reinvestment of all dividends, if any.

	12/13	12/14	12/15	12/16	12/17	12/18
Inovio Pharmaceuticals, Inc.	100.00	79.14	57.93	59.83	35.60	34.48
NYSE American	100.00	101.45	72.08	86.50	85.89	75.60
Nasdaq Composite	100.00	114.62	122.81	133.19	172.11	165.84
S&P SuperCap Biotechnology	100.00	132.22	139.26	120.00	144.50	136.07

The stock price performance included in this graph is not necessarily indicative of future stock price performance. The performance graph is furnished solely to accompany this Form 10-K annual report and shall not be deemed to be incorporated by reference by means of any general statement incorporating by reference this Form 10-K into any filing under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended, except to the extent that we specifically incorporate such information by reference, and shall not otherwise be deemed filed under such acts.

Recent Sales of Unregistered Securities

In 2018, in connection with a settlement agreement, we issued 38,000 shares of our common stock to a third party. The shares were issued pursuant to the exemption from registration provided by Section 4(a)(2) of the Securities Act of 1933, as amended, as a transaction not involving a public offering.

Purchases of Equity Securities by the Issuer and Affiliated Parties
None.

ITEM 6. SELECTED FINANCIAL DATA

The following selected consolidated financial data should be read together with “Management’s Discussion and Analysis of Financial Condition and Results of Operations” and our consolidated financial statements and related notes included elsewhere in this report. The selected consolidated balance sheet data at December 31, 2018 and 2017 and the selected consolidated statements of operations data for the years ended December 31, 2018, 2017 and 2016 have been derived from our audited consolidated financial statements that are included elsewhere in this report. The selected consolidated balance sheet data at December 31, 2016, 2015, and 2014 and the selected consolidated statements of operations data for the years ended December 31, 2015 and 2014 have been derived from our audited consolidated financial statements not included in this report. Historical results are not necessarily indicative of the results to be expected in the future.

	Year Ended December 31, 2018	Year Ended December 31, 2017	Year Ended December 31, 2016	Year Ended December 31, 2015	Year Ended December 31, 2014
Statement of Operations Data:					
Revenue under collaborative research and development arrangements, including from affiliated entity	$30,310,309	$29,173,216	$7,891,341	$27,655,700	$7,896,032
Grants and miscellaneous revenue, including from affiliated entity	171,588	13,046,870	27,477,020	12,916,411	2,560,734
Total revenues	30,481,897	42,220,086	35,368,361	40,572,111	10,456,766
Loss from operations	(94,091,138)	(83,642,901)	(76,235,937)	(34,283,702)	(39,495,961)
Interest and other income, net	920,891	1,612,974	1,257,257	305,071	331,461
Change in fair value of common stock warrants	360,795	806,819	127,554	177,561	348,143
Gain (loss) on investment in affiliated entity	(1,988,567)	(6,982,664)	1,110,787	2,600,467	2,676,224
(Provision for) benefit from income taxes	(2,169,811)	—	—	2,097,766	—
Net loss	(96,967,830)	(88,205,772)	(73,740,339)	(29,102,837)	(36,140,133)
Net (income) loss attributable to non-controlling interest	—	—	—	(84,769)	18,420
Net loss attributable to Inovio Pharmaceuticals, Inc.	$(96,967,830)	$(88,205,772)	$(73,740,339)	$(29,187,606)	$(36,121,713)
Net loss per common share attributable to common stockholders					
Basic	$(1.05)	$(1.08)	$(1.01)	$(0.43)	$(0.61)
Diluted	$(1.05)	$(1.09)	$(1.01)	$(0.44)	$(0.64)

	December 31, 2018	December 31, 2017	December 31, 2016	December 31, 2015	December 31, 2014
Balance Sheet Data:					
Cash and cash equivalents	$23,693,633	$23,786,579	$19,136,472	$57,632,693	$40,543,982
Short-term investments	57,538,852	103,638,844	85,629,412	105,357,277	53,075,974
Total assets	131,113,265	187,239,270	173,707,166	213,840,859	131,785,097
Current liabilities	35,299,759	35,405,426	43,823,027	31,466,406	14,085,294
Noncurrent liabilities	8,781,099	9,345,035	6,505,719	6,441,400	6,162,209
Accumulated deficit	(620,426,436)	(523,356,317)	(434,838,235)	(361,097,896)	(331,910,290)
Total stockholders' equity	87,032,407	142,488,809	123,378,420	175,933,053	111,537,594

ITEM 7. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

This report contains forward-looking statements, as defined in Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended. These statements relate to future events or our future financial performance. In some cases, you can identify forward-looking statements by terminology such as "may," "will," "should," "expect," "plan," "anticipate," "believe," "estimate," "predict," "potential" or "continue," the negative or other comparable terminology. These statements are only predictions. Actual events or results may differ materially.

Although we believe that the expectations reflected in the forward-looking statements are reasonable based on our current expectations and projections, we cannot guarantee future results, levels of activity, performance or achievements. Moreover, neither we, nor any other person, assume responsibility for the accuracy and completeness of the forward-looking statements. We are under no obligation to update any of the forward-looking statements after the filing of this Annual Report to conform such statements to actual results or to changes in our expectations.

The following discussion of our financial condition and results of operations should be read in conjunction with our consolidated financial statements and the related notes and other financial information appearing elsewhere in this Annual Report. Readers are also urged to carefully review and consider the various disclosures made by us which attempt to advise interested parties of the factors which affect our business, including without limitation the disclosures made in Item 1A of Part I of this Annual Report under the Caption "Risk Factors."

Risk factors that could cause actual results to differ from those contained in the forward-looking statements include but are not limited to: our history of losses; our lack of products that have received regulatory approval; uncertainties inherent in clinical trials and product development programs, including but not limited to the fact that pre-clinical and clinical results may not be indicative of results achievable in other trials or for other indications, that the studies or trials may not be successful or achieve desired results, that preclinical studies and clinical trials may not commence, have sufficient enrollment or be completed in the time periods anticipated, that results from one study may not necessarily be reflected or supported by the results of other similar studies, that results from an animal study may not be indicative of results achievable in human studies, that clinical testing is expensive and can take many years to complete, that the outcome of any clinical trial is uncertain and failure can occur at any time during the clinical trial process, and that our electroporation technology and DNA vaccines may fail to show the desired safety and efficacy traits in clinical trials; the availability of funding; the ability to manufacture vaccine candidates; the availability or potential availability of alternative therapies or treatments for the conditions targeted by us or our collaborators, including alternatives that may be more efficacious or cost-effective than any therapy or treatment that we and our collaborators hope to develop; our ability to receive development, regulatory and commercialization event-based payments under our collaborative agreements; whether our proprietary rights are enforceable or defensible or infringe or allegedly infringe on rights of others or can withstand claims of invalidity; and the impact of government healthcare laws and proposals.

Overview

We are a late-stage biotechnology company focused on the discovery, development, and commercialization of DNA-based immunotherapies and vaccines that transform the treatment and prevention of cancers and infectious diseases. Our DNA-based immunotherapies and vaccines, in combination with our proprietary, efficacy-enabling delivery devices, are intended to generate robust immune responses, in particular functional CD8+ killer T cells and antibodies, to fight targeted diseases.

Our novel SynCon® immunotherapy design has shown the ability to help break the immune system's tolerance of cancerous cells. Our SynCon® product design approach is also intended to facilitate cross-strain protection against known and new unmatched strains of pathogens, such as influenza. Our CELLECTRA® delivery system facilitates optimized cellular uptake of the SynCon® immunotherapies, overcoming a key limitation of other DNA-based immunotherapies. Human data to date have shown a favorable safety profile of our SynCon® immunotherapies delivered using CELLECTRA® in over 6,000 administrations across almost 2,000 patients.

We or our collaborators are currently conducting or planning clinical studies of our proprietary SynCon® immunotherapies for HPV-caused pre-cancers, including cervical, vulvar, and anal dysplasia; HPV-caused cancers,

including head & neck, cervical, anal, penile, vulvar, and vaginal; bladder cancer; glioblastoma multiforme, or GBM; hepatitis B virus; hepatitis C virus; HIV; Ebola; Middle East Respiratory Syndrome, or MERS; Lassa fever; and Zika virus.

Our corporate strategy is to advance, protect and exploit our differentiated immunotherapy platform. Through the use of our unique capabilities on both design and development, we continue to progress and validate an array of cancer and infectious disease immunotherapy and vaccine products. We aim to advance products through to commercialization and continue to leverage third-party resources through collaborations and partnerships, including product license agreements. Our partners and collaborators include AstraZeneca, Regeneron Pharmaceuticals, Inc., F. Hoffmann-La Roche AG/Genentech, Inc., ApolloBio

Corporation, The Bill and Melinda Gates Foundation, The Wistar Institute, the University of Pennsylvania, The Parker Institute for Cancer Immunotherapy, Coalition for Epidemic Preparedness Innovations (CEPI), Defense Advanced Research Projects Agency (DARPA), GeneOne Life Science, Inc., Plumbline Life Sciences, Inc., National Institutes of Health (NIH), HIV Vaccines Trial Network (HVTN), National Cancer Institute (NCI), United States Military HIV Research Program, Drexel University, and Laval University.

All of our product candidates are in the research and development phase. We have not generated any revenues from the sale of any products, and we do not expect to generate any such revenues for at least the next several years. We earn revenue from license fees and milestone revenue and collaborative research and development agreements. Our product candidates will require significant additional research and development efforts, including extensive preclinical and clinical testing. All product candidates that we advance to clinical testing will require regulatory approval prior to commercial use, and will require significant costs for commercialization. We may not be successful in our research and development efforts, and we may never generate sufficient product revenue to be profitable.

As of December 31, 2018, we had an accumulated deficit of $620.4 million. We expect to continue to incur substantial operating losses in the future due to our commitment to our research and development programs, the funding of preclinical studies, clinical trials and regulatory activities and the costs of general and administrative activities.

Critical Accounting Policies

The SEC defines critical accounting policies as those that are, in management's view, important to the portrayal of our financial condition and results of operations and require management's judgment. Our discussion and analysis of our financial condition and results of operations are based on our audited consolidated financial statements, which have been prepared in accordance with U.S. GAAP. The preparation of these financial statements requires us to make estimates and judgments that affect the reported amounts of assets, liabilities, revenue and expenses. We base our estimates on experience and on various assumptions that we believe are 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 those estimates. Our critical accounting policies include:

Revenue Recognition

Effective January 1, 2018, we adopted Accounting Standards Update ("ASU") 2014-09, Revenue from Contracts with Customers ("Topic 606") using the modified retrospective method which consisted of applying and recognizing the cumulative effect of Topic 606 at the date of initial application. Topic 606 supersedes the revenue recognition requirements in Accounting Standards Codification ("ASC") Topic 605, Revenue Recognition ("Topic 605"), including most industry-specific revenue recognition guidance throughout the Industry Topics of the ASC. All periods prior to the adoption date of Topic 606 have not been restated to reflect the impact of the adoption of Topic 606, but continue to be accounted for and presented under Topic 605.

The following paragraphs in this section describe our revenue recognition accounting policies under Topic 606 upon adoption on January 1, 2018. Refer to Note 2 to the consolidated financial statements included in our Annual Report on Form 10-K for the year ended December 31, 2017 for revenue recognition accounting policies under Topic 605.

We recognize revenue when promised goods or services are transferred to customers in an amount that reflects the consideration to which it expects to be entitled in exchange for those goods or services. To determine revenue recognition for contracts with customers, we perform 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) we satisfy our performance obligations. At contract inception, we assess the goods or services agreed upon within each contract and assess whether each good or service is distinct and determine those that are performance obligations. We then recognize as revenue the amount of the transaction price that is allocated to the respective performance obligation when (or as) the performance obligation is satisfied.

Collaborative Arrangements

We enter into collaborative arrangements with partners that typically include payment of one or more of the following: (i) license fees; (ii) milestone payments related to the achievement of developmental, regulatory, or commercial goals; and (iii) royalties on net sales of licensed products. Where a portion of non-refundable, upfront fees

or other payments received are allocated to continuing performance obligations under the terms of a collaborative arrangement, they are recorded as deferred revenue and recognized as revenue when (or as) the underlying performance obligation is satisfied.

As part of the accounting for these arrangements, we must develop estimates and assumptions that require judgment of management to determine the underlying stand-alone selling price for each performance obligation which determines how the transaction price is allocated among the performance obligations. The standalone selling price may include items such as forecasted revenues, development timelines, discount rates and probabilities of technical and regulatory success. We evaluate each performance obligation to determine if it can be satisfied at a point in time or over time. In addition, variable consideration must be evaluated to determine if it is constrained and, therefore, excluded from the transaction price.

License Fees

If a license to intellectual property is determined to be distinct from the other performance obligations identified in the arrangement, we will recognize revenue from non-refundable, up-front fees allocated to the license when the license is transferred to the licensee and the licensee is able to use and benefit from the license. For licenses that are bundled with other promises, we utilize judgment to assess the nature of the combined performance obligation to determine whether the combined performance obligation is satisfied over time or at a point in time and, if over time, the appropriate method of measuring progress for purposes of recognizing revenue. We will evaluate the measure of progress each reporting period and, if necessary, adjust the measure of performance and related revenue recognition.

Milestone Payments

At the inception of each arrangement that includes milestone payments (variable consideration), we evaluate whether the milestones are considered probable of being reached and estimate the amount to be included in the transaction price using the most likely amount method. If it is probable that a significant revenue reversal would not occur, the associated milestone value is included in the transaction price. Milestone payments that are not within our or our collaboration partner’s control, such as regulatory approvals, are generally not considered probable of being achieved until those approvals are received. The transaction price is then allocated to each performance obligation on a relative stand-alone selling price basis, for which we recognize revenue as or when the performance obligations under the contract are satisfied. At the end of each subsequent reporting period, we re-evaluate the probability of achieving such milestones and any related constraint, and if necessary, adjust our estimate of the overall transaction price. Any such adjustments are recorded on a cumulative catch-up basis, which would affect license, collaboration or other revenues and earnings in the period of adjustment.

Royalties

For arrangements that include sales-based royalties, including milestone payments based on the level of sales, and for which the license is deemed to be the predominant item to which the royalties relate, we recognize revenue at the later of (i) when the related sales occur, or (ii) when the performance obligation to which some or all of the royalty has been allocated has been satisfied (or partially satisfied). To date, we have not recognized any royalty revenue resulting from any of our collaborative arrangements.

Under certain collaborative arrangements, we have been reimbursed for a portion of our research and development ("R&D") expenses, including costs of drug supplies. When these R&D services are performed under a reimbursement or cost sharing model with our collaboration partners, we record these reimbursements as a reduction of R&D expense in our consolidated statements of operations.

Grant revenue

We have determined that as of January 1, 2018, accounting for our various grant agreements falls under the contributions guidance under Subtopic 958-605, Not-for-Profit Entities-Revenue Recognition, which is outside the scope of Topic 606, as the government agencies granting us the funds are not receiving reciprocal value for their contributions. Beginning on January 1, 2018, all contributions received from current grant agreements are recorded as a contra-expense as opposed to revenue on the consolidated statement of operations.

Valuation of Intangible Assets and Goodwill

Intangible assets are amortized over their estimated useful lives ranging from 2 to 18 years. Acquired intangible assets are continuously being developed for the future economic viability contemplated at the time of acquisition. We are concurrently conducting preclinical studies and clinical trials using the acquired intangibles and have entered into licensing agreements for the use of these acquired intangibles.

Historically, we have recorded patents at cost and amortized these costs using the straight-line method over the expected useful lives of the patents or 17 years, whichever is less. Patent cost consists of the consideration paid for

patents and related legal costs. Effective as of the acquisition of VGX in 2009, all new patent costs are expensed as incurred, with patent costs capitalized as of that date continuing to be amortized over the expected life of the patent. License costs are recorded based on the fair value of consideration paid and are amortized using the straight-line method over the shorter of the expected useful life of the underlying patents or the term of the related license agreement to the extent the license has an alternative future use. As of December 31, 2018 and 2017, our intangible assets resulting from the acquisition of VGX, Inovio AS and Bioject, and

additional intangibles including previously capitalized patent costs and license costs, net of accumulated amortization, totaled $4.8 million and $6.0 million, respectively.

The determination of the value of intangible assets requires management to make estimates and assumptions that affect our consolidated financial statements. We assess potential impairments to intangible assets when there is evidence that events or changes in circumstances indicate that the carrying amount of an asset may not be recovered. Our judgments regarding the existence of impairment indicators and future cash flows related to intangible assets are based on operational performance of our acquired businesses, market conditions and other factors. If impairment is indicated, we will reduce the carrying value of the intangible asset to fair value. While current and historical operating and cash flow losses are potential indicators of impairment, we believe the future cash flows to be received from our intangible assets will exceed the intangible assets' carrying value, and accordingly, we have not recognized any impairment losses through December 31, 2018.

Goodwill represents the excess of acquisition cost over the fair value of the net assets of acquired businesses. Goodwill is reviewed for impairment at least annually at November 30, or more frequently if an event occurs indicating the potential for impairment. During our goodwill impairment review, we may assess qualitative factors to determine whether it is more likely than not that the fair value of our reporting unit is less than its carrying amount, including goodwill. The qualitative factors include, but are not limited to, macroeconomic conditions, industry and market considerations, and our overall financial performance. If, after assessing the totality of these qualitative factors, we determine that it is not more likely than not that the fair value of our reporting unit is less than its carrying amount, then no additional assessment is deemed necessary. Otherwise, we will proceed to perform the two-step test for goodwill impairment. The first step involves comparing the estimated fair value of the reporting unit with its carrying value, including goodwill. If the carrying amount of the reporting unit exceeds its fair value, we will perform the second step of the goodwill impairment test to determine the amount of loss, which involves comparing the implied fair value of the goodwill to the carrying value of the goodwill. We may also elect to bypass the qualitative assessment in a period and elect to proceed to perform the first step of the goodwill impairment test. We performed our annual assessment for goodwill impairment as of November 30, 2018, identifying no impairment.

Although there are inherent uncertainties in this assessment process, the estimates and assumptions we are using are consistent with our internal planning. If these estimates or their related assumptions change in the future, we may be required to record an impairment charge on all or a portion of its goodwill and intangible assets. Furthermore, we cannot predict the occurrence of future impairment triggering events nor the impact such events might have on its reported asset values. Future events could cause us to conclude that impairment indicators exist and that goodwill or other intangible assets associated with our acquired businesses are impaired. Any resulting impairment loss could have an adverse impact on our results of operations. See Note 9 to the Consolidated Financial Statements included in this report for further discussion of our goodwill and intangible assets.

Research and Development Expenses

Our activities have largely consisted of research and development efforts related to developing electroporation delivery technologies and DNA immunotherapies and vaccines. Research and development expenses consist of expenses incurred in performing research and development activities including salaries and benefits, facilities and other overhead expenses, clinical trials, contract services and other outside expenses. Research and development expenses are charged to operations as they are incurred. These expenses result from our independent research and development efforts as well as efforts associated with collaborations and licensing arrangements. We review and accrue clinical trial expense based on work performed, relying on estimates of total costs incurred based on patient enrollment, completion of studies and other events. We follow this method since reasonably dependable estimates of the costs applicable to various stages of a research agreement or clinical trial can be made. Accrued clinical trial costs are subject to revisions as trials progress. Revisions are charged to expense in the period in which the facts that give rise to the revision become known. Historically, revisions have not resulted in material changes to research and development expense; however a modification in the protocol of a clinical trial or cancellation of a trial could result in a charge to our results of operations.

Recent Accounting Pronouncements

Information regarding recent accounting pronouncements is contained in Note 2 to the Consolidated Financial Statements, included elsewhere in this report.

Results of Operations

The consolidated financial data for the years ended December 31, 2018, 2017 and 2016 is presented in the following table and the results of these periods are used in the discussion thereafter.

	Year Ended December 31,			Increase/(Decrease) 2018 vs. 2017		Increase/(Decrease) 2017 vs. 2016	
	2018	2017	2016	$	%	$	%
Revenues:							
Revenue under collaborative research and development arrangements, including from affiliated entity	$30,310,309	$29,173,216	$7,891,341	$1,137,093	4 %	$21,281,875	270 %
Grants and miscellaneous revenue, including from affiliated entity	171,588	13,046,870	27,477,020	(12,875,282)	(99)	(14,430,150)	(53)
Total revenues	30,481,897	42,220,086	35,368,361	(11,738,189)	(28)	6,851,725	19
Operating expenses:							
Research and development	95,257,876	98,572,618	88,712,035	(3,314,742)	(3)	9,860,583	11
General and administrative	29,315,159	28,290,369	23,892,263	1,024,790	4	4,398,106	18
Gain on sale of assets	—	(1,000,000)	(1,000,000)	1,000,000	(100)	—	—
Total operating expenses	124,573,035	125,862,987	111,604,298	(1,289,952)	(1)	14,258,689	13
Loss from operations	(94,091,138)	(83,642,901)	(76,235,937)	(10,448,237)	(12)	(7,406,964)	(10)
Interest and other income, net	920,891	1,612,974	1,257,257	(692,083)	(43)	355,717	28
Change in fair value of common stock warrants	360,795	806,819	127,554	(446,024)	(55)	679,265	533
Gain (loss) on investment in affiliated entity	(1,988,567)	(6,982,664)	1,110,787	4,994,097	72	(8,093,451)	(729)
Net loss before provision for income tax	(94,798,019)	(88,205,772)	(73,740,339)	(6,592,247)	(7)	(14,465,433)	(20)
Provision for income taxes	(2,169,811)	—	—	(2,169,811)	(100)	—	—
Net loss	$(96,967,830)	$(88,205,772)	$(73,740,339)	$(8,762,058)	(10)%	$(14,465,433)	(20)%

Comparison of Years Ended December 31, 2018 and 2017

Revenue

Revenue primarily consisted of revenue under collaborative research and development arrangements for the year ended December 31, 2018, and revenue under collaborative research and development arrangements, grants and government contracts for the year ended December 31, 2017. Our year over year total revenue decreased $11.7 million, or 28%.

As of January 1, 2018, accounting for our various grant agreements falls under the contributions guidance under Subtopic 958-605, Not-for-Profit Entities-Revenue Recognition, which is outside the scope of Topic 606, as the government agencies granting us funds are not receiving reciprocal value for their contributions. Beginning on January 1, 2018, after adopting Topic 606 using the modified retrospective transition method, all contributions received from current grant agreements are being recorded as a contra-expense as opposed to revenue on the consolidated statement of operations. For the year ended December 31, 2018, $9.5 million would have been recorded as grant revenue but under the new guidance was instead recorded as a reduction to research and development expense. See Note 2, Summary of Significant Accounting Policies: Recent Accounting Pronouncements, to the

Consolidated Financial Statements included in this report for further discussion.

The $1.1 million increase in revenue under collaborative research and development arrangements for the year ended December 31, 2018 as compared to 2017 was primarily due to the recognition of the gross upfront payment of $23.0 million from ApolloBio during the second quarter of 2018. This increase was offset by an overall decrease in revenue from the AstraZeneca collaboration of $15.4 million, primarily related to previously deferred revenue recognized during the second quarter of 2017, upon selection of the first cancer research collaboration product candidate by AstraZeneca, among other variances. There was also no revenue recognized in 2018 from Roche compared to $6.1 million for 2017, due to the termination of the agreement in 2017.

For the year ended December 31, 2018, grant funding received and recorded as contra-research and development expense was $9.5 million, as compared to $13.0 million recorded as grant and miscellaneous revenue, including arrangements with affiliated entities, for the year ended December 31, 2017. The decrease in grant funding recorded for the year over year was primarily due to a decrease from our DARPA Ebola grant of $8.8 million, partially offset by an increase from our CEPI grant of $4.3 million.

Research and Development Expenses

The $3.3 million decrease in research and development expenses for the year ended December 31, 2018 as compared to 2017 was primarily due to the $9.5 million contra-research and development expense recorded from grant agreements as discussed above, as well as a decrease of $8.9 million in expenses related to the DARPA Ebola grant and a decrease of $2.0 million in expenses related to our Hepatitis B program. These decreases were partially offset by an increase of $4.0 million related to increased employee headcount to support clinical trials and partnerships, an increase of $3.1 million for drug manufacturing related to our collaboration with AstraZeneca, an increase in expenses related to our GBM clinical trial of $2.8 million, an increase in expenses of $2.6 million related to our VGX-3100 Phase 3 clinical trial, an increase in expenses of $2.6 million related to our CEPI grant and an increase in deprecation expense of $2.3 million, among other variances.

General and Administrative Expenses

The $1.0 million increase in general and administrative expenses for the year ended December 31, 2018 as compared to 2017 was primarily related to the $1.4 million of foreign non-income taxes withheld from the ApolloBio upfront payment we received in March 2018 and the advisory fee of $960,000 incurred in connection with receiving the upfront payment. There were also increases in legal expense and personnel costs from increases in employee headcount of $1.3 million and $1.2 million, respectively, partially offset by a decrease in non-cash stock-based compensation expense of $2.8 million and depreciation expense of $1.4 million, among other variances.

Stock-based Compensation

Employee stock-based compensation cost is measured at the grant date, based on the fair value of the award, and is recognized as expense over the employee's requisite service period. Total employee stock-based compensation cost for the years ended December 31, 2018 and 2017 was $10.2 million and $12.9 million, of which $5.9 million and $5.8 million was included in research and development expenses and $4.3 million and $7.1 million was included in general and administrative expenses, respectively. The year over year decrease was primarily due to a lower weighted average grant date fair value for the awards granted in 2018, as well as higher expenses recorded for certain stock option modifications which occurred in 2017. At December 31, 2018, there was $5.2 million of total unrecognized compensation cost related to unvested stock options, which we expect to recognize over a weighted-average period of 1.7 years, as compared to $5.9 million for the year ended December 31, 2017 expected to be recognized over a weighted-average period of 1.8 years. At December 31, 2018, there was $5.1 million of total unrecognized compensation cost related to unvested restricted stock units, which is expected to be recognized over a weighted-average period of 1.7 years, as compared to $5.3 million for the year ended December 31, 2017 expected to be recognized over a weighted-average period of 1.8 years. Total stock-based compensation for options granted to non-employees for the years ended December 31, 2018 and 2017 was $302,000 and $201,000, respectively.

Gain on sale of assets

The gain on sale of assets for the year ended December 31, 2017 related to the sale of our compound VGX-1027 to GeneOne for a purchase price of $1.0 million. These assets had a carrying value of zero, resulting in the full proceeds being recognized as a gain on sale.

Interest and Other Income, net

Interest and other income, net, decreased by $692,000 for the year ended December 31, 2018 as compared to 2017 primarily due to an increase in net realized loss recorded on short-term investments, partially offset by higher interest earned on short-term investments during the year.

Change in fair value of common stock warrants

The change in fair value of common stock warrants for the years ended December 31, 2018 and 2017 was $361,000 and $807,000, respectively. The variance is due to the revaluation of the warrants to their fair value at each balance sheet date; in addition, the warrants were exercised during the quarter ended September 30, 2018, eliminating the associated warrant liability.

Loss on investment in affiliated entity

The loss on investment in affiliated entity for the years ended December 31, 2018 and 2017 was $2.0 million and $7.0 million, respectively, resulting from the change in the fair market value of the investments in GeneOne and Plumbline Life Sciences, or PLS. After the adoption of ASU No. 2016-01 on January 1, 2018, unrealized gains and losses on PLS are recorded on the consolidated statement of operations as a gain (loss) on investment in affiliated entity rather than the consolidated statement of comprehensive income (loss).

Provision for income taxes

The provision for income taxes of $2.2 million for the year ended December 31, 2018 was related to foreign income taxes on the upfront payment received from ApolloBio in March 2018.

Income Taxes

Since inception, we have incurred operating losses and accordingly have not recorded a provision for income taxes for any of the periods presented. Utilization of net operating losses and tax credits are subject to a substantial annual limitation due to ownership change limitations provided by the Internal Revenue Code of 1986, as amended, or IRC. As of December 31, 2018, we had net operating loss carry forwards for U.S. federal, California and Pennsylvania income tax purposes of approximately $383.3 million, $68.6 million and $75.6 million, respectively, net of the net operating losses that will expire due to IRC Section 382 limitations. We also had U.S. federal and state research and development tax credits of approximately $13.8 million and $2.7 million, respectively, net of the federal research and development credits that will expire due to IRC Section 383 limitations. If not utilized, the net operating losses and credits will begin to expire in 2019.

Comparison of Years Ended December 31, 2017 and 2016

Revenue

Revenue primarily consisted of revenue under collaborative research and development arrangements and grants and government contracts for the years ended December 31, 2017 and 2016. Our year over year total revenue increased $6.9 million, or 19%.

The $21.3 million increase in revenue under collaborative research and development arrangements for the year ended December 31, 2017 as compared to 2016 was primarily due to an increase in revenue recognized from AstraZeneca, as the up-front payment received in September 2015 and other deferred amounts totaling $13.8 million were recognized in June 2017 upon AstraZeneca’s selection of the first cancer research collaboration product candidate, as well as a $7.0 milestone payment recognized in December 2017 for the initiation of the Phase 2 portion on an ongoing clinical trial. The increase was also due to an increase in revenue recognized from Roche of $1.2 million, as all remaining revenue was recognized upon termination of that collaboration agreement in 2017.

The $14.4 million decrease in grants and miscellaneous revenue for the year ended December 31, 2017 as compared to 2016 was primarily due to a decrease in revenue recognized from our nearly completed DARPA Ebola grant and completed DARPA sub-contract for the treatment of infectious diseases of $12.6 million and $4.1 million, respectively, partially offset by an increase in revenue recognized from our two sub-contracts with Wistar totaling $2.2 million. Beginning in 2018, contributions received from grant agreements are recorded as a contra-expense as opposed to revenue on the consolidated statement of operations. For additional information on the new accounting standard for revenues from contracts with customers please read Note 2, Summary of Significant Accounting Policies: Recent Accounting Pronouncements, to the Consolidated Financial Statements included in this report for further discussion.

Research and Development Expenses

The $9.9 million increase in research and development expenses for the year ended December 31, 2017 as compared to 2016 was primarily due to an increase of $9.1 million in employee headcount to support clinical trials and partnerships and an increase of $1.0 million in non-cash stock-based compensation. These increases were offset by a decrease of $3.9 million in expenses related to our DARPA Ebola grant, among other variances.

General and Administrative Expenses

The $4.4 million increase in general and administrative expenses for the year ended December 31, 2017 as compared to 2016 was primarily due to increases in employee headcount, non-cash stock based compensation, rent expense and depreciation expense of $1.9 million, $1.7 million, $769,000 and $661,000 respectively. These increases were partially offset by a decrease in employee recruitment and training expenses of $623,000, among other variances.

Stock-based Compensation

Employee stock-based compensation cost is measured at the grant date, based on the fair value of the award, and is recognized as expense over the employee’s requisite service period. Total employee stock-based compensation cost for the years ended December 31, 2017 and 2016 was $12.9 million and $10.2 million, of which $5.8 million and $4.8 million was included in research and development expenses and $7.1 million and $5.4 million was included in general and administrative expenses, respectively. A portion of the year over year increase resulted from a change in accounting policy as of January 1, 2017 to recognize forfeitures as they occur rather than estimating forfeitures at the time of grant. The increase was also due to increased headcount, which resulted in an increase in the number of

employee stock options and restricted stock units granted. At December 31, 2017, there was $5.9 million of total unrecognized compensation cost related to unvested stock options, which we expect to recognize over a weighted-average period of 1.8 years, as compared to $5.8 million for the year ended December 31, 2016 expected to be recognized over a weighted-average period of 1.9 years. At December 31, 2017, there was $5.3 million of total unrecognized compensation cost related to unvested restricted stock units, which is expected to be recognized over a weighted-average period of 1.8 years, as compared to $4.0 million for the year ended December 31, 2016

expected to be recognized over a weighted-average period of 2.0 years. Total stock-based compensation for options granted to non-employees for the years ended December 31, 2017 and 2016 was $201,000 and $321,000, respectively.

Gain on sale of assets

In December 2017, we sold assets related to our compound VGX-1027 to GeneOne for a purchase price of $1.0 million. These assets had a carrying value of zero, resulting in the full proceeds being recognized as a gain on sale. The gain on sale of assets for the year ended December 31, 2016 related to our May 2014 sale of animal health assets to PLS, for which we received proceeds of $1.0 million in 2015 and $1.0 million in 2016.

Interest and Other Income, net

Interest and other income, net, increased by $356,000 for the year ended December 31, 2017 as compared to 2016 primarily due to higher interest earned on short-term investments during the year.

Change in fair value of common stock warrants

The change in fair value of common stock warrants for the years ended December 31, 2017 and 2016 was $807,000 and $128,000, respectively. The variance was due to the revaluation of the warrants to their fair value at each balance sheet date. All of these warrants were exercised during the quarter ended September 30, 2018, eliminating the associated warrant liability.

Gain (loss) on investment in affiliated entity

We held 1,644,155 common shares, representing a 7.8% and 10.2% ownership interest in GeneOne, as of December 31, 2017 and 2016, respectively. Our investment in GeneOne is measured at fair value on a recurring basis, with changes in the fair value of the investment reflected as other income (expense) in the consolidated statements of operations. The fair market value of our interest in GeneOne is determined using the closing price of GeneOne's shares of common stock as listed on the Korean Stock Exchange.

Liquidity and Capital Resources

Historically, our primary uses of cash have been to finance research and development activities including clinical trial activities in the oncology, DNA vaccines and other immunotherapy areas of our business. Since inception, we have satisfied our cash requirements principally from proceeds from the sale of equity securities and grants and government contracts.

Working Capital and Liquidity

As of December 31, 2018, we had cash and short-term investments of $81.2 million and working capital of $52.5 million, as compared to $127.4 million and $103.0 million as of December 31, 2017, respectively. The decrease in cash and short-term investments during the year ended December 31, 2018 was primarily due to our operating expenses and capital expenditures, partially offset by the sales of our common stock under our ATM sales agreements during the period as well as the net proceeds received from ApolloBio.

Net cash used in operating activities for the year ended December 31, 2018 of $73.6 million consisted of net loss of $(97.0) million less changes in net operating assets and liabilities of $4.7 million, partially offset by net non-cash adjustments of $18.7 million. The primary non-cash expenses were stock-based compensation of $10.7 million, depreciation and amortization of $5.0 million and loss on investment in affiliated entities and short-term investments of $2.0 million and $1.3 million, respectively.

Net cash used in operating activities for the year ended December 31, 2017 of $63.2 million consisted of net loss of $(88.2) million less changes in net operating assets and liabilities of $2.9 million, partially offset by net non-cash adjustments of $22.1 million. The primary non-cash income (expenses) added back to net loss included gain on sale of intangible assets of $1.0 million, offset by stock-based compensation of $13.1 million, depreciation and amortization of $3.5 million and loss on investment in affiliated entity of $7.0 million.

Net cash provided by (used in) investing activities was $42.4 million and $(27.8) million for the years ended December 31, 2018 and 2017, respectively. The variance was primarily the result of timing differences in short-term investment purchases, sales and maturities and a decrease in capital expenditures for facilities in 2018.

Net cash provided by financing activities was $31.0 million and $95.7 million for the years ended December 31, 2018 and 2017, respectively. The decrease in cash provided from financing activities was primarily due to proceeds from

the July 2017 financing (described below), offset by an increase in proceeds from the sale of common stock under our ATM sales agreements during the year.

In the first quarter of 2019, we completed a private placement of $78.5 million aggregate principal amount of our 6.50% convertible senior notes due 2024, or the “Notes”. The Notes were sold in a private offering to qualified institutional buyers

pursuant to Rule 144A under the Securities Act of 1933, as amended. Net proceeds from the offering were approximately $75.8 million, after deducting the initial purchasers' discount and estimated offering expenses payable by us. See Note 18 to the Consolidated Financial Statements included in this report for further discussion.

In May 2018, we entered into an At-the-Market Equity Offering Sales Agreement, or the Sales Agreement, with an outside placement agent, or the Placement Agent, to sell shares of our common stock with aggregate gross proceeds of up to $100.0 million, from time to time, through an “at-the-market” equity offering program under which the Placement Agent will act as sales agent. During the year ended December 31, 2018, we sold 5,354,075 shares of common stock under the Sales Agreement for aggregate net proceeds of $27.7 million.

In July 2017, we closed an underwritten public offering of 12,500,000 shares of our common stock at a public offering price of $6.00 per share. The net proceeds, after deducting the underwriters' discounts and commissions and other offering expenses, were $70.1 million.

In June 2016, we entered into an At-the-Market Equity Offering Sales Agreement, or the “Prior Sales Agreement”, with the same placement agent as for the Sales Agreement. The registration statement that registered with the SEC the shares sold under the Prior Sales Agreement expired on June 5, 2018, and no further sales will be made under the Prior Sales Agreement. During the year ended December 31, 2018, we sold a total of 314,950 shares of common stock under the Prior Sales Agreement for aggregate net proceeds of $1.6 million. During the year ended December 31, 2017, we sold a total of 2,937,406 shares of common stock under the Prior Sales Agreement for aggregate net proceeds of $24.2 million.

During the year ended December 31, 2018, stock options and warrants to purchase 756,853 shares of common stock were exercised for aggregate net proceeds of $2.4 million. During the year ended December 31, 2017, stock options to purchase 452,973 shares of common stock were exercised for aggregate net proceeds of $2.3 million.

As of December 31, 2018, we had an accumulated deficit of $620.4 million and we expect to continue to operate at a loss for some time. The amount of the accumulated deficit will continue to increase, as it will be expensive to continue research and development efforts. These activities will require additional financing. If these activities are successful and if we receive approval from the FDA to market our DNA vaccine products, then we will need to raise additional funding to market and sell the approved vaccine products and equipment. We cannot predict the outcome of the above matters at this time. We are evaluating potential collaborations as an additional way to fund operations. We believe that current cash and short-term investments are sufficient to meet planned working capital requirements for at least the next twelve months.

Off-Balance Sheet Arrangements

We did not have during the periods presented, and we do not currently have, any off-balance sheet arrangements, as defined in the rules and regulations of the SEC.

Contractual Obligations

As of December 31, 2018, we did not have any other material long-term debt or other known contractual obligations, except for the operating leases for our facilities, which expire from 2023 to 2029, and operating leases for copiers, which expire in 2021 and 2022.

We are contractually obligated to make the following operating lease payments as of December 31, 2018:

	Total	Less than 1 year	1 – 3 years	3 – 5 years	More than 5 years
Operating lease obligations	$35,653,000	$3,756,000	$7,870,000	$8,075,000	$15,952,000

In the normal course of business, we are a party to a variety of agreements pursuant to which we may be obligated to indemnify the other party. It is not possible to predict the maximum potential amount of future payments under these types of agreements due to the conditional nature of our obligations and the unique facts and circumstances involved in each particular agreement. Historically, payments made by us under these types of agreements have not had a material effect on our business, consolidated results of operations or financial condition.

ITEM 7A. QUALITATIVE AND QUANTITATIVE DISCLOSURES ABOUT MARKET RISK

Interest Rate Risk

Market risk represents the risk of loss that may impact our consolidated financial position, results of operations or cash flows due to adverse changes in financial and commodity market prices and rates. We are exposed to market risk primarily in

the area of changes in United States interest rates and conditions in the credit markets, and the recent fluctuations in interest rates and availability of funding in the credit markets primarily impact the performance of our investments. We do not have any material foreign currency or other derivative financial instruments. Under our current policies, we do not use interest rate derivative instruments to manage exposure to interest rate changes. We attempt to increase the safety and preservation of our invested principal funds by limiting default risk, market risk and reinvestment risk. We mitigate default risk by investing in investment grade securities. Due to the short-term maturities of our cash equivalents and the low risk profile of our investments at December 31, 2018, an immediate 100 basis point change in interest rates would not have a material effect on the fair market value of our cash equivalents.

Fair Value Measurements

The investment in affiliated entities represents our ownership interest in the Korean-based companies, GeneOne and PLS. We report these investments at fair value on the consolidated balance sheet using the closing price of GeneOne and PLS shares of common stock as reported on the date of determination on the Korean Stock Exchange and Korea New Exchange Market, respectively.

Foreign Currency Risk

We have operated primarily in the United States and most transactions during the year ended December 31, 2018 were made in United States dollars. Accordingly, we have not had any material exposure to foreign currency rate fluctuations, with the exception of the valuation of our equity investments in GeneOne and PLS which are denominated in South Korean Won and then translated into United States dollars. We do not have any foreign currency hedging instruments in place.

Certain transactions related to us are denominated primarily in foreign currencies, including Euros, British Pounds, Canadian Dollars and South Korean Won. As a result, our financial results could be affected by factors such as changes in foreign currency exchange rates or weak economic conditions in foreign markets where we conduct business.

We do not use derivative financial instruments for speculative purposes. We do not engage in exchange rate hedging or hold or issue foreign exchange contracts for trading purposes. Currently, we do not expect the impact of fluctuations in the relative fair value of other currencies to be material in 2019.

ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

The information required by this Item 8 is incorporated by reference to our Consolidated Financial Statements and the Report of Independent Registered Public Accounting Firm beginning at page F-1 of this report.

ITEM 9. CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE

None.

ITEM 9A. CONTROLS AND PROCEDURES

Evaluation of Disclosure Controls and Procedures

We maintain disclosure controls and procedures, which are designed to ensure that information required to be disclosed in the reports we file or submit under the Securities Exchange Act of 1934, as amended, is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms, and that such information is accumulated and communicated to our management, including our Chief Executive Officer, or CEO, and Chief Financial Officer, or CFO, as appropriate to allow timely decisions regarding required disclosures.

In designing and evaluating our disclosure controls and procedures, management recognizes that disclosure controls and procedures, no matter how well conceived and operated, can provide only reasonable, not absolute, assurance that the objectives of the disclosure controls and procedures are met. Additionally, in designing disclosure controls and procedures, our management necessarily was required to apply its judgment in evaluating the cost-benefit relationship of possible disclosure controls and procedures. The design of any system of controls also is based in part upon certain assumptions about the likelihood of future events, and there can be no assurance that any design will succeed in achieving its stated goals under all potential future conditions; over time, controls may become inadequate because of changes in conditions, or the degree of compliance with policies or procedures may deteriorate. Because of the

inherent limitations in a control system, misstatements due to error or fraud may occur and not be detected.
Based on an evaluation carried out as of the end of the period covered by this Annual Report, under the supervision and with the participation of our management, including our CEO and CFO, our CEO and CFO have concluded that, as of the end of such period, our disclosure controls and procedures (as defined in Rule 13a-15(e) and 15d-15(e) under the Securities Exchange Act of 1934) were effective as of December 31, 2018 at the reasonable assurance level.

Internal Control Over Financial Reporting

Management's Report on Internal Control Over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting, as defined in Rules 13a-15(f) and 15d-15(f) under the Securities Exchange Act of 1934. Our internal control over financial reporting is a process designed under the supervision of our Chief Executive Officer and Chief Financial Officer to provide reasonable assurance regarding the reliability of financial reporting and the preparation of our financial statements for external purposes in accordance with United States generally accepted accounting principles. As of December 31, 2018, management, with the participation of the Chief Executive Officer and Chief Financial Officer, assessed the effectiveness of our internal control over financial reporting based on the criteria for effective internal control over financial reporting established in "Internal Control—Integrated Framework," issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework). Based on the assessment, management determined that we maintained effective internal control over financial reporting as of December 31, 2018.

Changes in Internal Control over Financial Reporting

There have not been any changes in our internal control over financial reporting that occurred during the fourth quarter of our fiscal year ended December 31, 2018, that materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Attestation Report of Independent Registered Public Accounting Firm

The independent registered public accounting firm that audited the consolidated financial statements that are included in this Annual Report on Form 10-K has issued an audit report on the effectiveness of our internal control over financial reporting as of December 31, 2018. The report appears below.

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

The Board of Directors and Stockholders of Inovio Pharmaceuticals, Inc.

Opinion on Internal Control over Financial Reporting

We have audited Inovio Pharmaceuticals, Inc.'s internal control over financial reporting as of December 31, 2018, based on criteria established in Internal Control-Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission 2013 framework (the COSO criteria). In our opinion, Inovio Pharmaceuticals, Inc. (the Company) maintained, in all material respects, effective internal control over financial reporting as of December 31, 2018, based on the COSO criteria.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the consolidated balance sheets of the Company as of December 31, 2018 and 2017, the related consolidated statements of operations, comprehensive loss, stockholders' equity, and cash flows, for each of the three years in the period ended December 31, 2018 and related notes and our report dated March 12, 2019 expressed an unqualified opinion thereon.

Basis for Opinion

The Company's management is responsible for maintaining effective internal control over financial reporting and for its assessment of the effectiveness of internal control over financial reporting included in the accompanying Management's Report on Internal Control over Financial Reporting. Our responsibility is to express an opinion on the Company's internal control over financial reporting based on our audit. We are a public accounting firm registered with the 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 audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects.

Our audit included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, testing and evaluating the design and operating effectiveness of internal control based on the assessed risk, and performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

Definition and Limitations of Internal Control Over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

/s/ Ernst & Young LLP

San Diego, California
March 12, 2019

PART III

ITEM 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

The information required by this Item 10 is hereby incorporated by reference from our definitive proxy statement, to be filed pursuant to Regulation 14A within 120 days after the end of our 2018 fiscal year, under the captions “Election of Directors,” “Executive Compensation and Other Information” and “Section 16(a) Beneficial Ownership Reporting Compliance.”

ITEM 11. EXECUTIVE COMPENSATION

The information required by this Item 11 is hereby incorporated by reference from our definitive proxy statement, to be filed pursuant to Regulation 14A within 120 days after the end of our 2018 fiscal year, under the captions “Compensation Discussion and Analysis,” “Executive Compensation,” “Compensation of Directors” and “Director Compensation Table.”.

ITEM 12. SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS

The information required by this Item 12 is hereby incorporated by reference from our definitive proxy statement, to be filed pursuant to Regulation 14A within 120 days after the end of our 2018 fiscal year, under the captions “Security Ownership of Certain Beneficial Owners and Management” and “Equity Compensation Plan Information.”

ITEM 13. CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS, AND DIRECTOR INDEPENDENCE

Director independence and other information required by this Item 13 is hereby incorporated by reference from our definitive proxy statement, to be filed pursuant to Regulation 14A within 120 days after the end of our 2018 fiscal year, under the captions “Certain Relationships and Related Party Transactions” and “Election of Directors.”

ITEM 14. PRINCIPAL ACCOUNTING FEES AND SERVICES

The information required by this Item 14 is hereby incorporated by reference from our definitive proxy statement, to be filed pursuant to Regulation 14A within 120 days after the end of our 2018 fiscal year, under the caption “Ratification of Appointment of Registered Public Accounting Firm.”

PART IV

ITEM 15. EXHIBITS, FINANCIAL STATEMENT SCHEDULES

1. Financial Statements

Consolidated financial statements required to be filed hereunder are indexed on Page F-1 hereof.

2. Financial Statement Schedules

Schedules not listed herein have been omitted because the information required to be set forth therein is not applicable or is included in the Financial Statements or notes thereto.

3. Exhibits

The following exhibits are filed as part of this annual report on Form 10-K:

Exhibit Number	Description of Document
3.1	Certificate of Incorporation with all amendments (incorporated by reference to Exhibit 3.1 of the registrant's Form S-3 registration statement, filed on July 23, 2014).
3.2	Amended and Restated Bylaws of Inovio Pharmaceuticals, Inc. dated August 10, 2011 (incorporated by reference to Exhibit 3.2 to the registrant's Form 8-K current report filed on August 12, 2011).
10.1†	R&D Alliance Agreement dated December 19, 2005 by and between Ganial Immunotherapeutics, Inc. and VGX Pharmaceuticals, Inc., as amended by Novation and Amendment Agreement by and between VGX Pharmaceuticals, Inc., Ganial Immunotherapeutics, Inc., and Onconox (incorporated by reference to Exhibit 10.31 as filed with the registrant's Registration Statement on Form S-4 (File No. 333-156035) on April 27, 2009).
10.2†	R&D Collaboration and License Agreement dated December 18, 2006 by and between VGX International, Inc. and VGX Pharmaceuticals, Inc., as amended by First Amendment dated October 31, 2007 and as amended by Second Amendment dated August 4, 2008 (incorporated by reference to Exhibit 10.39 as filed with the registrant's Registration Statement on Form S-4 (File No. 333-156035) on April 27, 2009).
10.3†	Patent License Agreement dated April 27, 2007 by and between The Trustees of the University of Pennsylvania and VGX Pharmaceuticals, Inc., as amended by First Amendment dated June 12, 2008 (incorporated by reference to Exhibit 10.50 as filed with the registrant's Registration Statement on Form S-4 (File No. 333-156035) on April 27, 2009).
10.4†	License Agreement dated May 9, 2007 by and between Baylor University and VGX Pharmaceuticals, Inc. (incorporated by reference to Exhibit 10.34 as filed with the registrant's registration statement on Form S-4 (File No. 333-156035) on April 27, 2009).

Exhibit Number	Description of Document
10.5†	CELLECTRA® Device License Agreement dated April 16, 2008 by and between VGX International and VGX Pharmaceuticals, Inc. (incorporated by reference to Exhibit 10.44 as filed with the registrant's Registration Statement on Form S-4 (File No. 333-156035) on April 27, 2009).
10.7†	License and Collaboration Agreement dated March 24, 2010 between Inovio Pharmaceuticals, Inc. and VGX International, Inc. (incorporated by reference to Exhibit 10.2 as filed with the registrant's Form 10-Q quarterly report for the quarter ended March 31, 2010 filed on May 17, 2010).
10.8†	Collaborative Development and License Agreement dated October 7, 2011 between VGX International, Inc. and Inovio Pharmaceuticals, Inc., as amended by First Amendment dated August 21, 2013, and Second Amendment dated October 7, 2013 (incorporated by reference to Exhibit 10.1 as filed with the registrant's Form 10-Q quarterly report for the quarter ended September 30, 2011 filed on November 7, 2011).
10.9†	DNA Cancer Vaccine Collaboration and License Agreement dated August 7, 2015 by and between MedImmune, Limited and Inovio Pharmaceuticals, Inc. (incorporated by reference to Exhibit 10.1 of the registrant's Form 10-Q quarterly report for the quarter ended September 30, 2015 filed on November 9, 2015).
10.10	Collaborative Research Agreement dated March 14, 2016 by and between The Wistar Institute of Anatomy and Biology, a Commonwealth of Pennsylvania nonprofit corporation, and Inovio Pharmaceuticals, Inc. (incorporated by reference to Exhibit 10.1 as filed with the registrant's Form 10-Q quarterly report for the quarter ended March 31, 2016 filed on May 9, 2016).
10.11	Collaborative Research Agreement dated March 14, 2016 by and between The Wistar Institute of Anatomy and Biology, a Commonwealth of Pennsylvania nonprofit corporation, and Inovio Pharmaceuticals, Inc. (incorporated by reference to Exhibit 10.2 as filed with the registrant's Form 10-Q quarterly report for the quarter ended March 31, 2016 filed on May 9, 2016).
10.12††	Amended and Restated License and Collaboration Agreement, dated December 29, 2017, by and between Inovio Pharmaceuticals, Inc. and Beijing Apollo Saturn Biological Technology Limited (incorporated by reference to Exhibit 10.12 as filed with the registrant's Form 10-K annual report for the year ended December 31, 2017 filed on March 14, 2018).
10.13	At-the-Market Equity Offering Sales Agreement dated May 25, 2018 between Inovio Pharmaceuticals, Inc. and Stifel, Nicolaus & Company, Incorporated (incorporated by reference to Exhibit 1.1 of the registrant's Form 8-K filed on May 25, 2018).
10.14	Lease dated April 9, 2013 by and between BMR-Wateridge LP and Inovio Pharmaceuticals, Inc. (incorporated by reference to Exhibit 10.1 to registrant's quarterly report for the quarter ended March 31, 2013, filed on May 10, 2013).
10.15	Office Lease Agreement dated October 10, 2016 by and between 6759 Mesa Ridge Road Holdings, LLC and Inovio Pharmaceuticals, Inc. (incorporated by reference to Exhibit 10.1 as filed with the registrant's Form 10-Q quarterly report for the quarter ended September 30, 2016 filed on November 9, 2016).

10.16	Lease Agreement dated as of March 5, 2014 between Brandywine Operating Partnership L.P. and Inovio Pharmaceuticals, Inc. (incorporated by reference to Exhibit 10.36 as filed with the registrant's Form 10-K annual report for the year ended December 31, 2014 filed on March 17, 2014).

Exhibit Number	Description of Document
10.17	Second Amendment to the Lease Agreement dated June 22, 2017 between Brandywine Operating Partnership, L.P. and Inovio Pharmaceuticals, Inc. (incorporated by reference to Exhibit 10.1 as filed with the registrant's Form 10-Q quarterly report for the quarter ended June 30, 2017 filed on August 8, 2017).
10.18	Sublease dated June 21, 2017 between Accolade, Inc. and Inovio Pharmaceuticals, Inc. (incorporated by reference to Exhibit 10.2 as filed with the registrant's Form 10-Q quarterly report for the quarter ended June 30, 2017 filed on August 8, 2017).
10.19+	Employment Agreement dated March 31, 2008 by and between J. Joseph Kim, Ph.D. and VGX Pharmaceuticals, Inc., as amended by First Amendment of Employment Agreement dated March 31, 2008 (incorporated by reference to Exhibit 10.43 as filed with the registrant’s Registration Statement on Form S-4 (File No. 333-156035) on April 27, 2009).
10.20+	First Amendment to Employment Agreement dated as of December 31, 2012 between Inovio Pharmaceuticals, Inc. and J. Joseph Kim, PhD. (incorporated by reference to Exhibit 10.41 of the registrant’s Form 10-K annual report for the year ended December 31, 2012 filed on March 18, 2013).
10.21+	Employment Agreement dated December 10, 2009 between Inovio Pharmaceuticals, Inc. and Mark L. Bagarazzi (incorporated by reference to Exhibit 10.39 to the registrant’s Form 10-K report for the year ended December 31, 2011 filed on March 15, 2012).
10.22+	First Amendment to Employment Agreement dated as of December 31, 2012 between Inovio Pharmaceuticals, Inc. and Mark L. Bagarazzi (incorporated by reference to Exhibit 10.43 of the registrant’s Form 10-K annual report for the year ended December 31, 2012 filed on March 18, 2013).
10.23+	Second Amendment to Employment Agreement dated November 7, 2014 by and between Inovio Pharmaceuticals, Inc. and Dr. Mark Bagarazzi (incorporated by reference to Exhibit 10.1 of the registrant's Form 10-Q quarterly report for the quarter ended September 30, 2014 filed on November 10, 2014).
10.24+	Employment Agreement dated as of December 27, 2010 between Inovio Pharmaceuticals, Inc. and Peter Kies (incorporated by reference to Exhibit 10.5 to the registrant’s Form 10-K report for the year ended December 31, 2010 filed on March 16, 2011).
10.25+	First Amendment to Employment Agreement dated as of December 31, 2012 between Inovio Pharmaceuticals, Inc. and Peter Kies (incorporated by reference to Exhibit 10.42 of the registrant’s Form 10-K annual report for the year ended December 31, 2012 filed on March 18, 2013).
10.26+	Second Amendment to Employment Agreement dated November 7, 2014 by and between Inovio Pharmaceuticals, Inc. and Peter Kies (incorporated by reference to Exhibit 10.2 of the registrant's Form 10-Q quarterly report for the quarter ended September 30, 2014 filed on November 10, 2014).
10.27+	Employment Agreement dated December 27, 2010 between Inovio Pharmaceuticals, Inc. and Niranjan Y. Sardesai (incorporated by reference to Exhibit 10.7 to the registrant’s Form 10-K report for the year ended December 31, 2011 filed on March 15, 2012).
10.28+	First Amendment to Employment Agreement dated as of December 31, 2012 between Inovio Pharmaceuticals, Inc. and Niranjan Sardesai (incorporated by reference to Exhibit 10.44 of the registrant’s

	Form 10-K annual report for the year ended December 31, 2012 filed on March 18, 2013).
10.29+	Second Amendment to Employment Agreement dated November 7, 2014 by and between Inovio Pharmaceuticals, Inc. and Dr. Niranjan Sardesai (incorporated by reference to Exhibit 10.3 of the registrant's Form 10-Q quarterly report for the quarter ended September 30, 2014 filed on November 10, 2014).
10.30	Form of Indemnification Agreement for Directors and Officers of Inovio Pharmaceuticals, Inc. (incorporated by reference to Exhibit 10.1 to the registrant’s Form 10-Q quarterly report for the quarterly period ended June 30, 2009, filed on August 19, 2009).

Exhibit Number	Description of Document
10.31+	Amended and Restated 2007 Omnibus Incentive Plan, as amended (incorporated by reference to Exhibit 10.12 to the registrant's Form 10-K report for the year ended December 31, 2015 filed on March 14, 2016).
10.32+	Form of Restricted Stock Award Grants under the 2007 Omnibus Stock Incentive Plan (incorporated by reference to Exhibit 4.3 to the registrant's Registration Statement on Form S-8 filed on May 14, 2007).
10.33+	Form of Incentive and Non-Qualified Stock Option Grants under the 2007 Omnibus Stock Incentive Plan (incorporated by reference to Exhibit 4.4 to the registrant's Registration Statement on Form S-8 filed on May 14, 2007).
10.34+	GENEOS Therapeutics, Inc. 2016 Equity Incentive Plan (incorporated by reference to Exhibit 10.2 as filed with the registrant's Form 10-Q quarterly report for the quarter ended September 30, 2016 filed on November 9, 2016).
10.35+	Form of Incentive Stock Option Agreement under the GENEOS Therapeutics, Inc. 2016 Equity Incentive Plan (incorporated by reference to Exhibit 10.3 as filed with the registrant's Form 10-Q quarterly report for the quarter ended September 30, 2016 filed on November 9, 2016).
10.36+	Form of Employee Non-Qualified Stock Option Agreement under the GENEOS Therapeutics, Inc. 2016 Equity Incentive Plan (incorporated by reference to Exhibit 10.4 as filed with the registrant's Form 10-Q quarterly report for the quarter ended September 30, 2016 filed on November 9, 2016).
10.37+	Form of Outside Director Non-Qualified Stock Option Agreement under the GENEOS Therapeutics, Inc. 2016 Equity Incentive Plan (incorporated by reference to Exhibit 10.5 as filed with the registrant's Form 10-Q quarterly report for the quarter ended September 30, 2016 filed on November 9, 2016).
10.38+	Form of Restricted Stock Agreement under the GENEOS Therapeutics, Inc. 2016 Equity Incentive Plan (incorporated by reference to Exhibit 10.6 as filed with the registrant's Form 10-Q quarterly report for the quarter ended September 30, 2016 filed on November 9, 2016).
10.39+	Inovio Pharmaceuticals, Inc. 2016 Omnibus Incentive Plan (incorporated by reference to the registrant's Definitive Proxy Statement on Schedule 14A filed on March 25, 2016).
10.40+	Form of Incentive Stock Option Agreement under 2016 Omnibus Incentive Plan. (incorporated by reference to Exhibit 10.55 as filed with the registrant's Form 10-K annual report for the year ended December 31, 2016 filed on March 15, 2017.)
10.41+	Form of Nonqualified Stock Option Agreement under 2016 Omnibus Incentive Plan. (incorporated by reference to Exhibit 10.56 as filed with the registrant's Form 10-K annual report for the year ended December 31, 2016 filed on March 15, 2017.)
10.42+	Form of Restricted Stock Units Award Agreement under 2016 Omnibus Incentive Plan. (incorporated by reference to Exhibit 10.54 as filed with the registrant's Form 10-K annual report for the year ended December 31, 2016 filed on March 15, 2017.)
10.43+	Consulting Agreement dated February 21, 2019 by and between Inovio Pharmaceuticals, Inc. and Dr. Niranjan Sardesai (filed herewith).

21.1	Subsidiaries of the registrant.
23.1	Consent of Independent Registered Public Accounting Firm.
24.1	Power of Attorney (included on signature page).
31.1	Certification of the Principal Executive Officer pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.

Exhibit Number	Description of Document
31.2	Certification of the Principal Financial Officer pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.
32.1^	Certification of the Principal Executive Officer and Principal Financial Officer pursuant to 18 U.S.C. 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
101.INS	XBRL Instance Document.
101.SCH	XBRL Taxonomy Extension Schema Document.
101.CAL	XBRL Taxonomy Extension Calculation Linkbase Document.
101.DEF	XBRL Taxonomy Extension Definition Linkbase Document.
101.LAB	XBRL Taxonomy Extension Label Linkbase Document.
101.PRE	XBRL Taxonomy Extension Presentation Linkbase Document.

+ Designates management contract, compensatory plan or arrangement.

† Confidential treatment has been granted for certain portions omitted from this exhibit (indicated by asterisks) pursuant to Rule 24b-2 under the Securities Exchange Act of 1934, as amended. The confidential portions of this exhibit have been separately filed with the Securities and Exchange Commission.

^ These certifications are being furnished solely to accompany this Annual Report pursuant to 18 U.S.C. Section 1350, and are not being filed for purposes of Section 18 of the Securities Exchange Act of 1934, as amended, and are not to be incorporated by reference into any filing of the registrant, whether made before or after the date hereof, regardless of any general incorporation language in such filing.

ITEM 16. FORM 10-K SUMMARY

Not applicable.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the Registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized on March 12, 2019.

Inovio Pharmaceuticals, Inc.

By: /s/ J. JOSEPH KIM
J. Joseph Kim
President and Chief Executive Officer

POWER OF ATTORNEY

KNOW ALL PERSONS BY THESE PRESENTS, that each person whose signature appears below constitutes and appoints J. Joseph Kim and Peter Kies, and each of them severally, his or her true and lawful attorney-in-fact with power of substitution and resubstitution to sign in his or her name, place and stead, in any and all capacities, to do any and all things and execute any and all instruments that such attorney may deem necessary or advisable under the Securities Exchange Act of 1934 and any rules, regulations and requirements of the United States Securities and Exchange Commission in connection with the Annual Report on Form 10-K and any and all amendments hereto, as fully for all intents and purposes as he or she might or could do in person, and hereby ratifies and confirms all said attorneys-in-fact and agents, each acting alone, and his or her substitute or substitutes, may lawfully do or cause to be done by virtue hereof.

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the Registrant and in the capacities and on the dates indicated.

Signature	Title	Date
/s/ J. JOSEPH KIM J. Joseph Kim	President, Chief Executive Officer and Director (Principal Executive Officer)	March 12, 2019
/s/ SIMON X. BENITO Simon X. Benito	Chairman of the Board of Directors	March 12, 2019
/s/ PETER KIES Peter Kies	Chief Financial Officer (Principal Accounting Officer and Principal Financial Officer)	March 12, 2019
/s/ ANGEL CABRERA Angel Cabrera	Director	March 12, 2019
/s/ MORTON COLLINS Morton Collins	Director	March 12, 2019
/s/ DAVID WEINER David Weiner	Director	March 12, 2019
/s/ WENDY YARNO	Director	March 12, 2019

Wendy Yarno		
/s/ LOTA ZOTH Lota Zoth	Director	March 12, 2019

INOVIO PHARMACEUTICALS, INC.
Index to Consolidated Financial Statements

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

The Board of Directors and Stockholders of Inovio Pharmaceuticals, Inc.

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of Inovio Pharmaceuticals, Inc. (the "Company") as of December 31, 2018 and 2017, the related consolidated statements of operations, comprehensive loss, stockholders' equity, and cash flows, for each of the three years in the period ended December 31, 2018, 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 as of December 31, 2018 and 2017, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2018, in conformity with US generally accepted accounting principles.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the Company's internal control over financial reporting as of December 31, 2018, based on criteria established in Internal Control-Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 Framework) and our report dated March 12, 2019 expressed an unqualified opinion thereon.

Adoption of ASU No. 2014-09

As discussed in Note 2 to the consolidated financial statements, the Company changed its method for recognizing revenue as a result of the adoption of Accounting Standards Update (ASU) No. 2014-09, Revenue from Contracts with Customers (Topic 606), using the modified retrospective method effective January 1, 2018.

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 PCAOB and are required to be independent with respect to the Company in accordance with the US 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. 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 include 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 2002.

San Diego, California

March 12, 2019

Inovio Pharmaceuticals, Inc.
CONSOLIDATED BALANCE SHEETS

	December 31, 2018	2017
ASSETS		
Current assets:		
Cash and cash equivalents	$23,693,633	$23,786,579
Short-term investments	57,538,852	103,638,844
Accounts receivable	3,316,361	6,003,205
Accounts receivable from affiliated entities	738,583	486,619
Prepaid expenses and other current assets	1,406,590	2,600,906
Prepaid expenses and other current assets from affiliated entities	1,120,805	1,846,007
Total current assets	87,814,824	138,362,160
Fixed assets, net	15,949,014	18,320,176
Investment in affiliated entity - GeneOne	6,381,926	9,069,401
Investment in affiliated entity - PLS	3,023,987	2,325,079
Intangible assets, net	4,760,145	6,009,729
Goodwill	10,513,371	10,513,371
Other assets	2,669,998	2,639,354
Total assets	$131,113,265	$187,239,270
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Accounts payable and accrued expenses	$23,134,733	$23,278,798
Accounts payable and accrued expenses due to affiliated entities	977,792	926,943
Accrued clinical trial expenses	5,671,764	8,611,892
Common stock warrants	—	360,795
Deferred revenue	223,577	1,175,353
Deferred revenue from affiliated entities	33,575	174,110
Deferred rent	1,065,387	877,535
Deferred grant funding	4,165,848	—
Deferred grant funding from affiliated entities	27,083	—
Total current liabilities	35,299,759	35,405,426
Deferred revenue, net of current portion	150,793	215,853
Deferred rent, net of current portion	8,518,207	9,104,416
Deferred tax liabilities	24,766	24,766
Other liabilities	87,333	—
Total liabilities	44,080,858	44,750,461
Commitments and contingencies		
Inovio Pharmaceuticals, Inc. stockholders' equity:		
Preferred stock—par value $0.001; Authorized shares: 10,000,000, issued and outstanding shares: 23 at December 31, 2018 and December 31, 2017	—	—
Common stock—par value $0.001; Authorized shares: 600,000,000 at December 31, 2018 and December 31, 2017, issued and outstanding: 97,225,810 at December 31, 2018 and 90,357,644 at December 31, 2017	97,226	90,358
Additional paid-in capital	707,794,215	665,775,504
Accumulated deficit	(620,426,436)	(523,356,317)
Accumulated other comprehensive loss	(528,867)	(117,005)
Total Inovio Pharmaceuticals, Inc. stockholders' equity	86,936,138	142,392,540
Non-controlling interest	96,269	96,269
Total stockholders' equity	87,032,407	142,488,809

Total liabilities and stockholders' equity	$131,113,265	$187,239,270

The accompanying notes are an integral part of these consolidated financial statements.

Inovio Pharmaceuticals, Inc.
CONSOLIDATED STATEMENTS OF OPERATIONS

	For the Year ended December 31,		
	2018	2017	2016
Revenues:			
Revenue under collaborative research and development arrangements	$29,860,785	$28,407,388	$6,490,747
Revenue under collaborative research and development arrangements with affiliated entities	449,524	765,828	1,400,594
Grants and miscellaneous revenue	171,588	10,474,539	27,136,457
Grants and miscellaneous revenue from affiliated entity	—	2,572,331	340,563
Total revenues	30,481,897	42,220,086	35,368,361
Operating expenses:			
Research and development	95,257,876	98,572,618	88,712,035
General and administrative	29,315,159	28,290,369	23,892,263
Gain on sale of assets	—	(1,000,000)	(1,000,000)
Total operating expenses	124,573,035	125,862,987	111,604,298
Loss from operations	(94,091,138)	(83,642,901)	(76,235,937)
Other income (expense):			
Interest and other income, net	920,891	1,612,974	1,257,257
Change in fair value of common stock warrants	360,795	806,819	127,554
Gain (loss) on investment in affiliated entity	(1,988,567)	(6,982,664)	1,110,787
Net loss before provision for income tax	(94,798,019)	(88,205,772)	(73,740,339)
Provision for income taxes	(2,169,811)	—	—
Net loss	(96,967,830)	(88,205,772)	(73,740,339)
Net loss per share			
Basic	$(1.05)	$(1.08)	$(1.01)
Diluted	$(1.05)	$(1.09)	$(1.01)
Weighted average number of common shares outstanding			
Basic	92,539,997	81,777,493	73,214,766
Diluted	92,539,997	81,918,022	73,214,766

The accompanying notes are an integral part of these consolidated financial statements.

Inovio Pharmaceuticals, Inc.
CONSOLIDATED STATEMENTS OF COMPREHENSIVE LOSS

	For the Year ended December 31,		
	2018	2017	2016
Net loss	$(96,967,830)	$(88,205,772)	$(73,740,339)
Other comprehensive income (loss):			
Unrealized loss on investment in affiliated entity, net of tax	—	(1,452,431)	(1,268,404)
Unrealized gain (loss) on short-term investments, net of tax	(180,496)	7,458	(111,967)
Comprehensive loss	$(97,148,326)	$(89,650,745)	$(75,120,710)

The accompanying notes are an integral part of these consolidated financial statements.

Inovio Pharmaceuticals, Inc.
CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY

	Preferred stock		Common stock		Additional paid-in capital	Accumulated deficit	Accumulated other comprehensive income (loss)	Non-controlling interest	Total stockholders' equity
	Number of shares	Amount	Number of shares	Amount					
Balance at December 31, 2015	23	—	72,217,965	$72,218	$534,004,564	$(361,097,896)	$2,708,339	$245,828	$175,933,053
Issuance of common stock for cash, net of financing costs of $128,000	—	—	658,748	659	6,295,102	—	—	—	6,295,761
Issuance of common stock for Bioject acquisition	—	—	440,122	440	4,299,560	—	—	—	4,300,000
Payment to minority stockholders	—	—	—	—	—	—	—	(149,559)	(149,559)
Exercise of stock options and warrants for cash and vesting of RSUs, net of tax payments	—	—	450,045	449	1,640,291	—	—	—	1,640,740
Cashless exercise of stock options and warrants	—	—	295,490	296	(296)	—	—	—	—
Stock-based compensation	—	—	—	—	10,479,135	—	—	—	10,479,135
Net loss attributable to common stockholders	—	—	—	—	—	(73,740,339)	—	—	(73,740,339)
Unrealized loss on short-term investments, net of tax	—	—	—	—	—	—	(111,967)	—	(111,967)
Unrealized loss on investment in affiliated entity, net of tax	—	—	—	—	—	—	(1,268,404)	—	(1,268,404)
Balance at December 31,	23	—	74,062,370	$74,062	$556,718,356	$(434,838,235)	$1,327,968	$96,269	$123,378,420

2016 Cumulative effect of accounting change	—	—	—	—	312,310	(312,310)	—	—	—
Issuance of common stock for cash, net of financing costs of $4.9 million	—	—	15,437,406	15,437	94,332,485	—	—	—	94,347,922
Exercise of stock options for cash and vesting of RSUs, net of tax payments	—	—	857,868	859	1,341,391	—	—	—	1,342,250
Stock-based compensation	—	—	—	—	13,070,962	—	—	—	13,070,962
Net loss attributable to common stockholders	—	—	—	—	—	(88,205,772)	—	—	(88,205,772)
Unrealized gain on short-term investments, net of tax	—	—	—	—	—	—	7,458	—	7,458
Unrealized loss on investment in affiliated entity, net of tax	—	—	—	—	—	—	(1,452,431)	—	(1,452,431)
Balance at December 31, 2017	23	—	90,357,644	$90,358	$665,775,504	$(523,356,317)	$(117,005)	$96,269	$142,488,809
Cumulative effect of accounting change	—	—	—	—	—	231,366	(231,366)	—	—
Issuance of common stock for cash	—	—	5,669,025	5,669	29,222,107	—	—	—	29,227,776
Exercise of stock options and warrants for cash and vesting of RSUs, net of tax payments	—	—	1,199,141	1,199	1,808,327	—	—	—	1,809,526
Stock-based compensation	—	—	—	—	10,988,277	(333,655)	—	—	10,654,622

Net loss attributable to common stockholders	—	—	—	—	(96,967,830)	—	—	(96,967,830)
Unrealized loss on short-term investments	—	—	—	—	—	(180,496)	—	(180,496)
Balance at December 31, 2018	23	97,225,810	$97,226	$707,794,215	$(620,426,436)	$(528,867)	$96,269	$87,032,407

The accompanying notes are an integral part of these consolidated financial statements.

Inovio Pharmaceuticals, Inc.
CONSOLIDATED STATEMENTS OF CASH FLOWS

	For the Year ended December 31,		
	2018	2017	2016
Cash flows from operating activities:			
Net loss	$(96,967,830)	$(88,205,772)	$(73,740,339)
Adjustments to reconcile net loss to net cash used in operating activities:			
Depreciation	3,747,183	1,850,376	1,708,498
Amortization of intangible assets	1,249,584	1,618,665	1,377,466
Change in value of common stock warrants	(360,795)	(806,819)	(127,554)
Stock-based compensation	10,654,622	13,070,962	10,479,135
Amortization of premiums on investments	72,561	319,845	266,290
Deferred taxes	—	(150,027)	(849)
Loss on short-term investments	1,342,005	215,423	139,249
Loss on disposal of fixed assets	14,529	—	—
Loss (gain) on investment in affiliated entities	1,988,567	6,982,664	(1,110,787)
Gain on sale of intangible assets	—	(1,000,000)	(1,000,000)
Changes in operating assets and liabilities:			
Accounts receivable	2,686,844	9,818,306	(8,521,899)
Accounts receivable from affiliated entities	(251,964)	261,736	(714,908)
Prepaid expenses and other current assets	1,194,316	(851,847)	(831,802)
Prepaid expenses and other current assets from affiliated entities	725,202	(333,583)	(901,772)
Other assets	(30,644)	(526,207)	(1,442,314)
Accounts payable and accrued expenses	550,407	2,829,807	6,367,965
Accrued clinical trial expenses	(2,940,128)	2,243,503	3,767,906
Accounts payable and accrued expenses due to affiliated entities	50,849	(145,636)	907,532
Deferred revenue	(1,016,836)	(13,689,322)	1,527,686
Deferred revenue from affiliated entities	(140,535)	(319,876)	(687,827)
Deferred rent	(398,357)	3,608,881	(16,728)
Deferred grant funding	4,165,848	—	—
Deferred grant funding from affiliated entities	27,083	—	—
Other liabilities	87,333	—	—
Net cash used in operating activities	(73,550,156)	(63,208,921)	(62,555,052)
Cash flows from investing activities:			
Purchases of investments	(88,155,046)	(95,700,144)	(57,317,671)
Maturities of investments	132,659,976	77,162,902	76,528,030
Purchases of capital assets	(2,085,022)	(10,293,902)	(2,738,470)
Proceeds from sale of intangible assets	—	1,000,000	1,000,000
Purchase of intangible and other assets	—	—	(1,200,000)
Net cash provided by (used in) investing activities	42,419,908	(27,831,144)	16,271,889
Cash flows from financing activities:			
Proceeds from issuance of common stock and warrants, net of issuance costs	29,227,776	94,347,922	6,295,761
Proceeds from stock option and warrant exercises, net of tax payments	1,809,526	1,342,250	1,640,740
Expenses from other financing activities	—	—	(149,559)
Net cash provided by financing activities	31,037,302	95,690,172	7,786,942
Increase (decrease) in cash and cash equivalents	(92,946)	4,650,107	(38,496,221)
Cash and cash equivalents, beginning of period	23,786,579	19,136,472	57,632,693
Cash and cash equivalents, end of period	$23,693,633	$23,786,579	$19,136,472

Supplemental disclosure of non-cash activities			
Common stock issued for purchase of Bioject	$—	$—	$4,300,000
Change in amounts accrued for purchases of property and equipment	$694,472	$851,204	$164,923
Lease incentive recorded as fixed assets and deferred rent	$—	$—	$523,856

The accompanying notes are an integral part of these consolidated financial statements.

Inovio Pharmaceuticals, Inc.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
1. The Company
Inovio Pharmaceuticals, Inc. (the “Company” or “Inovio”), is a late-stage biotechnology company focused on the discovery, development, and commercialization of DNA-based immunotherapies and vaccines that transform the treatment and prevention of cancers and infectious diseases. The Company's DNA-based immunotherapies and vaccines, in combination with its proprietary, efficacy-enabling delivery devices, are intended to generate robust immune responses, in particular functional CD8+ killer T cells and antibodies, to fight target diseases.
Inovio’s synthetic products are based on its SynCon® immunotherapy design. The Company and its collaborators are currently conducting or planning clinical programs of its proprietary SynCon® immunotherapies for HPV-caused pre-cancers, including cervical, vulvar, and anal dysplasia; HPV-caused cancers, including head & neck, cervical, anal, penile, vulvar, and vaginal; bladder cancer; glioblastoma multiforme ("GBM"); hepatitis B virus; hepatitis C virus; HIV; Ebola; Middle East Respiratory Syndrome, or MERS; Lassa fever; and Zika virus.
The Company's partners and collaborators include MedImmune, the global biologics research and development arm of AstraZeneca ("AstraZeneca"), The Wistar Institute, University of Pennsylvania, GeneOne Life Science Inc. ("GeneOne"), ApolloBio Corporation, Regeneron Pharmaceuticals, Inc., Genentech, Inc., Plumbline Life Sciences, Inc., Drexel University, National Institute of Allergy and Infectious Diseases (“NIAID”), United States Military HIV Research Program, U.S. Army Medical Research Institute of Infectious Diseases, National Institutes of Health, HIV Vaccines Trial Network, Defense Advanced Research Projects Agency (“DARPA”), Parker Institute for Cancer Immunotherapy, and Coalition for Epidemic Preparedness Innovations (“CEPI”).
Inovio was incorporated in Delaware in June 2001 and has its principal executive offices in Plymouth Meeting, Pennsylvania.

2. Summary of Significant Accounting Policies

Basis of Presentation
Inovio incurred a net loss attributable to common stockholders of $97.0 million for the year ended December 31, 2018. Inovio had working capital of $52.5 million and an accumulated deficit of $620.4 million as of December 31, 2018. The Company has incurred losses in each year since its inception and expects to continue to incur significant expenses and operating losses for the foreseeable future in connection with the research and preclinical and clinical development of its product candidates. In the first quarter of 2019, the Company received net proceeds of $75.8 million from a private placement of $78.5 million aggregate principal amount of its 6.50% convertible senior notes due 2024 (the “Notes”). These proceeds, in addition to the Company’s cash, cash equivalents and short-term investments of $81.2 million and long-term investments of $9.4 million as of December 31, 2018, are sufficient to support the Company's operations for a period of at least 12 months from the date it issued these financial statements. In addition, the Company could sell up to an additional $71.8 million in shares of its common stock under its At-the-Market Equity Offering Sales Agreement (the “Sales Agreement”), subject to certain conditions set forth in the Sales Agreement.
In order to continue to fund future research and development activities, the Company will need to seek additional capital. This may occur through strategic alliance and licensing arrangements and/or future public or private debt or equity financings including use of its Sales Agreement. Although the Company has a history of equity financings including the receipt of net proceeds of $29.2 million under the current Sales Agreement and a prior agreement during the year ended December 31, 2018 and net proceeds of $94.3 million from an underwritten public offering and a previous at-the-market sales facility during the year ended December 31, 2017, sufficient funding may not be available, or if available, may be on terms that significantly dilute or otherwise adversely affect the rights of existing stockholders. If adequate funds are not available in the future, the Company may need to delay, reduce the scope of or put on hold one or more of its clinical and/or preclinical programs.
The Company’s ability to continue its operations is dependent upon its ability to obtain additional capital in the future and achieve profitable operations. The Company expects to continue to rely on outside sources of financing to meet its capital needs and the Company may never achieve positive cash flow. These consolidated financial statements do not

include any adjustments to the specific amounts and classifications of assets and liabilities, which might be necessary should Inovio be unable to continue as a going concern. Inovio's consolidated financial statements as of and for the year ended December 31, 2018 have been prepared on a going concern basis, which contemplates the realization of assets and the settlement of liabilities and commitments in the normal course of business for the foreseeable future. The Company has evaluated subsequent events after the balance sheet date through the date it issued these financial statements.

Consolidation

These consolidated financial statements include the accounts of Inovio Pharmaceuticals, Inc. and its subsidiaries. The Company consolidates its wholly-owned subsidiaries Genetronics, Inc., VGX Pharmaceuticals Inc. ("VGX"), and Geneos Therapeutics, Inc. ("Geneos"), and records a non-controlling interest for 15% of VGX Animal Health, Inc., a subsidiary of VGX. All intercompany accounts and transactions have been eliminated upon consolidation. Subsequent to December 31, 2018, Geneos is no longer a wholly owned subsidiary. See Note 18 for additional information.

Segment Reporting

Operating segments are identified as components of an enterprise about which separate discrete financial information is available for evaluation by the chief operating decision-maker in making decisions regarding resource allocation and assessing performance. The Company views its operations and manages its business as one segment operating primarily within the United States.

Use of Estimates

The preparation of consolidated financial statements in conformity with U.S. GAAP requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, disclosures of contingent assets and liabilities at the date of the consolidated financial statements and the reported amounts of revenues and expenses during the reporting period. Actual results could differ from those estimates.

Concentration of Credit Risk

Financial instruments, that potentially subject the Company to concentrations of credit risk consist primarily of cash and short-term investments. The Company limits its exposure to credit loss by placing its cash and investments with high credit quality financial institutions. Additionally, the Company has established guidelines regarding diversification of its investments and their maturities which are designed to maintain principal and maximize liquidity. The Company has contracts with certain of its customers that have represented more than 10% of the Company's total revenues, as discussed in Note 7.

Fair value of Financial Instruments

The Company’s financial instruments consist principally of cash equivalents, short-term investments and investments in affiliated entities. The carrying amounts of cash equivalents approximate the related fair values due to the short-term maturities of these instruments. Investments are recorded at fair value, based on current market valuations. After the adoption of ASU No. 2016-01 on January 1, 2018, unrealized gains and losses on the Company's equity investment in its affiliated entity Plumbline Life Sciences, Inc. ("PLS") are reported in the consolidated statement of operations as a gain (loss) on investment in affiliated entities, as discussed below in "Recent Accounting Pronouncements - Recently Adopted." The Company’s investment in GeneOne, an affiliated entity, is accounted for at fair value on a recurring basis, with changes in fair value recorded on the consolidated statements of operations within gain (loss) from investment in affiliated entity.

Cash and Cash Equivalents

Cash equivalents are considered by the Company to be highly liquid investments purchased with original maturities of three months or less from the date of purchase. Cash and cash equivalents included certain money market accounts at December 31, 2018 and 2017.

Investments

The Company defines investments as income-yielding securities that can be readily converted into cash or equity investments classified as available-for-sale. Investments included mutual funds. United States corporate debt securities and equity investments in the Company’s affiliated entities, PLS and GeneOne at December 31, 2018. Investments included mutual funds, United States corporate debt securities and an equity investment in the Company's affiliated entity PLS at December 31, 2017.

Accounts Receivable

Accounts receivable are recorded at invoiced amounts and do not bear interest. The Company performs ongoing credit evaluations of its customers’ financial condition. Credit is extended to customers as deemed necessary and generally does not require collateral. Management believes that the risk of loss is significantly reduced due to the quality and financial position of the Company's customers. No allowance for doubtful accounts was deemed necessary at December 31, 2018 and 2017.

Fixed Assets

Property and equipment are stated at cost and depreciated using the straight-line method over the estimated useful life of the assets, generally three to five years. Leasehold improvements are amortized over the shorter of the remaining term of the related leases or the estimated economic useful lives of the improvements. Repairs and maintenance are expensed as incurred.

Long-Lived Assets

All long-lived assets are reviewed for impairment in value when changes in circumstances dictate, based upon undiscounted future operating cash flows, and appropriate losses are recognized and reflected in current earnings, to the extent the carrying amount of an asset exceeds its estimated fair value determined by the use of appraisals, discounted cash flow analyses or comparable fair values of similar assets. The Company has not recognized any losses on long-lived assets through December 31, 2018 and 2017.

Valuation of Intangible Assets and Goodwill

Intangible assets are amortized over their estimated useful lives ranging from two to 18 years. Acquired intangible assets are continuously being developed for the future economic viability contemplated at the time of acquisition. The Company is concurrently conducting preclinical studies and clinical trials using the acquired intangibles and has entered into licensing agreements for the use of these acquired intangibles.

Historically, the Company has recorded patents at cost and amortized these costs using the straight-line method over the expected useful lives of the patents or 17 years, whichever is less. Patent cost consists of the consideration paid for patents and related legal costs. Effective as of the acquisition of VGX in 2009, all new patent costs are expensed as incurred, with patent costs capitalized as of that date continuing to be amortized over the expected life of the patent. License costs are recorded based on the fair value of consideration paid and are amortized using the straight-line method over the shorter of the expected useful life of the underlying patents or the term of the related license agreement to the extent the license has an alternative future use. As of December 31, 2018 and 2017, the Company’s intangible assets resulting from the acquisition of VGX, as well as the acquisitions of two other companies, Inovio AS and Bioject Medical Technologies, Inc. ("Bioject"), and additional intangibles including previously capitalized patent costs and license costs, net of accumulated amortization, totaled $4.8 million and $6.0 million, respectively.

The determination of the value of intangible assets requires management to make estimates and assumptions that affect the Company’s consolidated financial statements. The Company assesses potential impairments to intangible assets when there is evidence that events or changes in circumstances indicate that the carrying amount of an asset may not be recovered. The Company’s judgments regarding the existence of impairment indicators and future cash flows related to intangible assets are based on operational performance of its acquired businesses, market conditions and other factors. If impairment is indicated, the Company will reduce the carrying value of the intangible asset to fair value. While current and historical operating and cash flow losses are potential indicators of impairment, the Company believes the future cash flows to be received from its intangible assets will exceed the intangible assets’ carrying value, and accordingly, the Company has not recognized any impairment losses through December 31, 2018.

Goodwill represents the excess of acquisition cost over the fair value of the net assets of acquired businesses. Goodwill is reviewed for impairment at least annually at November 30, or more frequently if an event occurs indicating the potential for impairment. During its goodwill impairment review, the Company may assess qualitative factors to determine whether it is more likely than not that the fair value of its reporting unit is less than its carrying amount, including goodwill. The qualitative factors include, but are not limited to, macroeconomic conditions, industry and market considerations, and the overall financial performance of the Company. If, after assessing the totality of these qualitative factors, the Company determines that it is not more likely than not that the fair value of its reporting unit is less than its carrying amount, then no additional assessment is deemed necessary. Otherwise, the Company proceeds to perform the two-step test for goodwill impairment. The first step involves comparing the estimated fair value of the reporting unit with its carrying value, including goodwill. If the carrying amount of the reporting unit exceeds its fair value, the Company performs the second step of the goodwill impairment test to determine the amount of loss, which involves comparing the implied fair value of the goodwill to the carrying value of the goodwill. The Company may also elect to bypass the qualitative assessment in a period and elect to proceed to perform the first step of the goodwill impairment test. The Company performed its annual assessment for goodwill

impairment as of November 30, 2018, identifying no impairment.

Although there are inherent uncertainties in this assessment process, the estimates and assumptions the Company is using are consistent with its internal planning. If these estimates or their related assumptions change in the future, the Company may be required to record an impairment charge on all or a portion of its goodwill and intangible assets. Furthermore, the Company cannot predict the occurrence of future impairment triggering events nor the impact such events might have on its reported asset

values. Future events could cause the Company to conclude that impairment indicators exist and that goodwill or other intangible assets associated with its acquired businesses are impaired. Any resulting impairment loss could have an adverse impact on the Company's results of operations. See Note 9 for further discussion of the Company's goodwill and intangible assets.

Income Taxes

The Company recognizes deferred tax assets and liabilities for temporary differences between the financial reporting basis and the tax basis of the Company's assets and liabilities along with net operating loss and tax credit carry forwards. The Company records a valuation allowance against its deferred tax assets to reduce the net carrying value to an amount that it believes is more likely than not to be realized. When the Company establishes or reduces the valuation allowance against its deferred tax assets, its provision for income taxes will increase or decrease, respectively, in the period such determination is made.

Valuation allowances against the Company's deferred tax assets were $115.0 million and $94.0 million at December 31, 2018 and 2017, respectively. Changes in the valuation allowances, when they are recognized in the provision for income taxes, are included as a component of the estimated annual effective tax rate.

Revenue Recognition

Effective January 1, 2018, the Company adopted Accounting Standards Update ("ASU") 2014-09, Revenue from Contracts with Customers ("Topic 606") using the modified retrospective method which consisted of applying and recognizing the cumulative effect of Topic 606 at the date of initial application. Topic 606 supersedes the revenue recognition requirements in Accounting Standards Codification ("ASC") Topic 605, Revenue Recognition ("Topic 605"), including most industry-specific revenue recognition guidance throughout the Industry Topics of the ASC. All periods prior to the adoption date of Topic 606 have not been restated to reflect the impact of the adoption of Topic 606, but continue to be accounted for and presented under Topic 605.

The following paragraphs in this section describe the Company's revenue recognition accounting policies under Topic 606 upon adoption on January 1, 2018. Refer to Note 2 to the consolidated financial statements included in the Company's Annual Report on Form 10-K for the year ended December 31, 2017 for revenue recognition accounting policies under Topic 605.

The Company recognizes revenue when it transfers promised goods or services to customers in an amount that reflects the consideration to which it expects to be entitled in exchange for those goods or services. To determine revenue recognition for contracts with customers, the Company 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 Company satisfies its performance obligations. At contract inception, the Company assesses the goods or services agreed upon within each contract and assess whether each good or service is distinct and determine those that are performance obligations. The Company then recognizes as revenue the amount of the transaction price that is allocated to the respective performance obligation when (or as) the performance obligation is satisfied.

Collaborative Arrangements

The Company enters into collaborative arrangements with partners that typically include payment of one or more of the following: (i) license fees; (ii) milestone payments related to the achievement of developmental, regulatory, or commercial goals; and (iii) royalties on net sales of licensed products. Where a portion of non-refundable, upfront fees or other payments received are allocated to continuing performance obligations under the terms of a collaborative arrangement, they are recorded as deferred revenue and recognized as revenue when (or as) the underlying performance obligation is satisfied.

As part of the accounting for these arrangements, the Company must develop estimates and assumptions that require judgment of management to determine the underlying stand-alone selling price for each performance obligation which determines how the transaction price is allocated among the performance obligation. The standalone selling price may include items such as forecasted revenues, development timelines, discount rates and probabilities of technical and regulatory success. The Company evaluates each performance obligation to determine if it can be satisfied at a point in time or over time. In addition, variable consideration must be evaluated to determine if it is constrained and, therefore, excluded from the transaction price.

License Fees

If a license to intellectual property is determined to be distinct from the other performance obligations identified in the arrangement, the Company will recognize revenues from non-refundable, up-front fees allocated to the license when the license is transferred to the licensee and the licensee is able to use and benefit from the license. For licenses that are bundled with other

promises, the Company will utilize judgment to assess the nature of the combined performance obligation to determine whether the combined performance obligation is satisfied over time or at a point in time and, if over time, the appropriate method of measuring progress for purposes of recognizing revenue. The Company evaluates the measure of progress each reporting period and, if necessary, adjusts the measure of performance and related revenue recognition.

Milestone Payments

At the inception of each arrangement that includes milestone payments (variable consideration), the Company evaluates whether the milestones are considered probable of being reached and estimates the amount to be included in the transaction price using the most likely amount method. If it is probable that a significant revenue reversal would not occur, the associated milestone value is included in the transaction price. Milestone payments that are not within the Company's or its collaboration partner’s control, such as regulatory approvals, are generally not considered probable of being achieved until those approvals are received. The transaction price is then allocated to each performance obligation on a relative stand-alone selling price basis, for which the Company recognizes revenue as or when the performance obligations under the contract are satisfied. At the end of each subsequent reporting period, the Company re-evaluates the probability of achieving such milestones and any related constraint, and if necessary, adjusts its estimate of the overall transaction price. Any such adjustments are recorded on a cumulative catch-up basis, which would affect license, collaboration or other revenues and earnings in the period of adjustment.

Royalties

For arrangements that include sales-based royalties, including milestone payments based on the level of sales, and for which the license is deemed to be the predominant item to which the royalties relate, the Company recognizes revenue at the later of (i) when the related sales occur, or (ii) when the performance obligation to which some or all of the royalty has been allocated has been satisfied (or partially satisfied). To date, the Company has not recognized any royalty revenue resulting from any of its collaborative arrangements.

Under certain collaborative arrangements, the Company has been reimbursed for a portion of its research and development ("R&D") expenses, including costs of drug supplies. When these R&D services are performed under a reimbursement or cost sharing model with its collaboration partner, the Company records these reimbursements as a reduction of R&D expense in its consolidated statements of operations.

Grants

The Company has determined that as of January 1, 2018, accounting for the Company’s various grant agreements falls under the contributions guidance under Subtopic 958-605, Not-for-Profit Entities-Revenue Recognition, which is outside the scope of Topic 606, as the government agencies granting the Company funds are not receiving reciprocal value for their contributions. Beginning on January 1, 2018, all contributions received from current grant agreements are recorded as a contra expense as opposed to revenue on the consolidated statement of operations.

Research and Development Expenses

The Company’s activities have largely consisted of research and development efforts related to developing electroporation delivery technologies and DNA immunotherapies and vaccines. Research and development expenses consist of expenses incurred in performing research and development activities including salaries and benefits, facilities and other overhead expenses, clinical trials, contract services and other outside expenses. Research and development expenses are charged to operations as they are incurred. These expenses result from the Company's independent research and development efforts as well as efforts associated with collaborations and licensing arrangements. The Company reviews and accrues clinical trial expense based on work performed, which relies on estimates of total costs incurred based on patient enrollment, completion of studies and other events. The Company follows this method since reasonably dependable estimates of the costs applicable to various stages of a research agreement or clinical trial can be made. Accrued clinical trial costs are subject to revisions as trials progress. Revisions are charged to expense in the period in which the facts that give rise to the revision become known. Historically, revisions have not resulted in material changes to research and development expense; however, a modification in the protocol of a clinical trial or cancellation of a trial could result in a charge to the Company's results of operations.

Net Loss Per Share

Basic net loss per share is computed by dividing the net loss for the year by the weighted average number of common shares outstanding during the year. Diluted net loss per share is calculated in accordance with the treasury stock method and reflects the potential dilution that would occur if securities or other contracts to issue common stock were exercised or converted to common stock. The calculation of diluted net loss per share requires that, to the extent the average market price of the underlying shares for the reporting period exceeds the exercise price of the options, warrants or other securities and the presumed exercise of such securities are dilutive to net loss per share for the period, an adjustment to net loss used in the calculation is required to remove the change in fair value of such securities from the numerator for the period. Likewise, an adjustment to the denominator is required to reflect the related dilutive shares, if any, under the treasury stock method.

The following tables reconcile the components of the numerator and denominator included in the calculations of diluted net loss per share:

	Year Ended December 31,		
	2018	2017	2016
Numerator			
Net loss (numerator for use in basic net loss per share)	$(96,967,830)	$(88,205,772)	$(73,740,339)
Adjustment for decrease in fair value of warrant liability	—	(806,819)	—
Numerator for use in diluted net loss per share	$(96,967,830)	$(89,012,591)	$(73,740,339)
Denominator			
Weighted average number of common shares outstanding (denominator for use in basic net loss per share)	92,539,997	81,777,493	73,214,766
Effect of dilutive potential common shares	—	140,529	—
Denominator for use in diluted net loss per share	92,539,997	81,918,022	73,214,766
Net loss per share, diluted	$(1.05)	$(1.09)	$(1.01)
Net loss per share, basic	$(1.05)	$(1.08)	$(1.01)

The following table summarizes potential shares of common stock that were excluded from diluted net loss per share calculation because of their anti-dilutive effect:

	Year Ended December 31,		
	2018	2017	2016
Options to purchase common stock	8,752,677	7,694,870	6,806,183
Warrants to purchase common stock	—	—	284,091
Restricted stock units	1,688,017	1,234,168	798,834
Convertible preferred stock	8,456	8,456	8,456
Total	10,449,150	8,937,494	7,897,564

Leases

Leases are classified as either capital or operating leases. Leases which transfer substantially all of the benefits and risks incidental to the ownership of assets are accounted for as if there was an acquisition of an asset and incurrence of an obligation at the inception of the lease. All other leases are accounted for as operating leases. Inovio’s Plymouth Meeting, PA headquarters and San Diego, CA facility leases, which have escalating payments, are expensed on a straight-line basis over the term of the lease. The allowance provided by the lessor for non-structural, normal leasehold improvements are considered tenant incentives and are amortized on a straight-line basis over the term of the lease. These leases represent the primary expense and commitment as indicated in Note 12, “Commitments”. Other leases exist for office machinery, such as copiers, wherein lease expense is recorded as incurred.

Stock-Based Compensation

The Company incurs stock-based compensation expense related to restricted stock units and stock options. The fair value of restricted stock is determined by the closing price of the Company's common stock reported on the Nasdaq Global Select Market on the date of grant. The Company estimates the fair value of stock options granted using the Black-Scholes option pricing model. The Black-Scholes option pricing model was developed for use in estimating the fair value of traded options, which have no vesting restrictions and are fully transferable. In addition, option valuation models require the input of subjective assumptions, including the expected stock price volatility and expected option life. The Company amortizes the fair value of the awards on a straight-line basis over the requisite vesting period of the awards. Expected volatility is based on historical volatility. The expected life of options granted is based on historical expected life. The risk-free interest rate is based on the U.S. Treasury yield in effect at the time of grant. The dividend yield is based on the fact that no dividends have been paid

historically and none are currently expected to be paid in the foreseeable future. Upon adoption of ASU 2016-09 on January 1, 2017, the Company elected to remove the forfeiture rate from the calculation and recorded a cumulative catch-up adjustment to accumulated deficit with a corresponding offset to additional paid-in-capital of $312,000. Previously, the forfeiture rate was based on historical data and the Company recorded stock-based compensation expense only for those awards that were expected to vest.

The weighted average assumptions used in the Black-Scholes model for option grants to employees and directors are presented below:

	Year Ended December 31,		
	2018	2017	2016
Risk-free interest rate	2.73%	2.20%	0.91%
Expected volatility	72%	73%	76%
Expected life in years	6	6	5
Dividend yield	—	—	—
Forfeiture rate	N/A	N/A	7%

Stock-based compensation expense related to stock options granted to non-employees is recognized based on the fair value of the stock options, determined using the Black-Scholes option pricing model, as they are earned. The fair value of the non-employee options is remeasured at each reporting period.

Assumptions used in the Black-Scholes model for non-employees are presented below:

	Year Ended December 31,		
	2018	2017	2016
Risk-free interest rate	2.6%-3.0%	2.4%-2.6%	2.3%-2.5%
Expected volatility	68%-101%	97%-102%	71%-104%
Expected life in years	9-10	9-10	7-10
Dividend yield	—	—	—

Recent Accounting Pronouncements - Recently Adopted

The recent accounting pronouncements below may have a significant effect on the Company's financial statements. Recent accounting pronouncements that are not anticipated to have an impact on or are unrelated to the Company's financial condition, results of operations, or related disclosures are not discussed.

ASU No. 2014-09. In May 2014, the FASB issued ASU No. 2014-09, Revenue from Contracts with Customers ("Topic 606”), which amended the existing accounting standards for revenue recognition, outlines a comprehensive revenue recognition model and supersedes most current revenue recognition guidance. The new standard requires a company to recognize revenue upon transfer of goods or services to a customer at an amount that reflects the expected consideration to be received in exchange for those goods or services. The amended guidance defines a five-step approach for recognizing revenue, which will require a company to use more judgment and make more estimates than under the current guidance. The Company adopted this new standard effective January 1, 2018, using the modified retrospective transition method. The impact of adoption of Topic 606 on the Company's existing agreements was as follows:

Collaboration Agreement with AstraZeneca

The Company determined that no cumulative catch-up adjustment was required.

Grant Agreements

The Company determined that, as of January 1, 2018, accounting for the Company’s various grant agreements falls under the contributions guidance under Subtopic 958-605, Not-for-Profit Entities-Revenue Recognition, which is outside the scope of Topic 606, as the government agencies granting the Company funds are not receiving reciprocal value for their contributions. Beginning on January 1, 2018, all contributions received from current grant agreements have been recorded as a contra-expense as opposed to revenue on the consolidated statements of operations. For the year ended December 31, 2018, $9.5 million would have been recorded as grant revenue but under the new guidance was instead recorded as a reduction to research and development expense.

The following table illustrates the impact that adopting Topic 606 has had on the Company's reported results in the consolidated statements of operations for the year ended December 31, 2018.

	Balances Without Adoption of Topic 606 for the Year Ended December 31, 2018	Impact of Adopting Topic 606	As Reported for the Year Ended December 31, 2018
Revenues:			
Revenue under collaborative research and development arrangements	$29,860,785	$—	$29,860,785
Revenue under collaborative research and development arrangements with affiliated entities	449,524	—	449,524
Grants and miscellaneous revenue	6,315,116	(6,143,528)	171,588
Grants and miscellaneous revenue from affiliated entity	3,348,177	(3,348,177)	—
Total revenues	39,973,602	(9,491,705)	30,481,897
Operating expenses:			
Research and development	104,749,581	(9,491,705)	95,257,876
General and administrative	29,315,159	—	29,315,159
Total operating expenses	$134,064,740	$(9,491,705)	$124,573,035

ASU No. 2016-01. In January 2016, the FASB issued ASU No. 2016-01, Recognition and Measurement of Financial Assets and Financial Liabilities. The amended guidance requires the Company to measure and record equity investments, except those accounted for under the equity method of accounting that have a readily determinable fair value, at fair value and for the Company to recognize the changes in fair value in its consolidated statements of operations, instead of recognizing unrealized gains and losses through accumulated other comprehensive income (loss), as done under the previous guidance. The amended guidance also changes several disclosure requirements for financial instruments, including the methods and significant assumptions used to estimate fair value. The standard was effective for annual reporting periods beginning after December 15, 2017, including interim periods within those annual reporting periods. The Company adopted this guidance on January 1, 2018 and recorded a $231,000 cumulative effect adjustment to reclassify the cumulative unrealized gain, net of tax effect, from its investment in PLS from accumulated other comprehensive loss to accumulated deficit. After the adoption of ASU No. 2016-01, the Company recorded a gain on investment in affiliated entity related to PLS of $699,000 on the consolidated statement of operations for the year ended December 31, 2018.

The cumulative effect of the changes made to the Company's consolidated balance sheet as of January 1, 2018 for the adoption of ASU No. 2016-01 are included in the table below:

Equity:	Balance at December 31, 2017	Adjustments due to ASU No. 2016-01	Balance at January 1, 2018
Accumulated deficit	$(523,356,317)	$231,366	$(523,124,951)
Accumulated other comprehensive loss	$(117,005)	$(231,366)	$(348,371)

Recent Accounting Pronouncements

ASU No. 2016-02. In February 2016, the FASB issued ASU No. 2016-02, Leases ("ASU 2016-02"). ASU 2016-02 is aimed at making leasing activities more transparent and comparable, and requires lessees to recognize substantially all leases on their balance sheet as a right-of-use asset and a corresponding lease liability, including leases currently accounted for as operating leases. The Company will adopt ASU 2016-02 on January 1, 2019. The Company anticipates recognizing a right-of-use asset and a lease liability on its consolidated balance sheet for the discounted value for future lease payment from the adoption of this ASU. The Company is currently evaluating the full impact of the adoption of ASU 2016-02; however, the Company expects the adoption to have a material impact on the

consolidated balance sheet.

3. Revenue Recognition

On January 1, 2018, the Company adopted Topic 606 using the modified retrospective method. Results for reporting periods beginning after January 1, 2018 are presented under Topic 606, while prior period amounts are not adjusted and continue to be reported in accordance with the Company's historical accounting under Topic 605.

For additional details about Topic 606, refer to Note 2 above.

During the year ended December 31, 2018, the Company recognized total revenue under collaborative research and development and other agreements of $23.0 million from ApolloBio; $6.9 million from AstraZeneca; $342,000 from its affiliated entity GeneOne; and $117,000 from various other contracts. The Company defers revenue when contract is entered into with a collaborator and cash payments are received prior to satisfaction of the related performance obligation. Of the total revenue recognized during the year ended December 31, 2018, $1.3 million was in deferred revenue as of December 31, 2017. During the twelve months ended December 31, 2017, the Company recognized revenue of $14.8 million that was included in deferred revenue at December 31, 2016. Performance obligations are generally satisfied within 12 months of the initial contract date.

4. Collaborative Agreements

ApolloBio Corporation

On December 29, 2017, the Company entered into an Amended and Restated License and Collaboration Agreement (the "ApolloBio Agreement"), with ApolloBio Corporation ("ApolloBio"), with an effective date of March 20, 2018. Under the terms of the ApolloBio Agreement, the Company granted to ApolloBio the exclusive right to develop and commercialize VGX-3100, its DNA immunotherapy product designed to treat pre-cancers caused by HPV, within the territories of China, Hong Kong, Macao, Taiwan, and may include Korea in the event that no patent covering VGX-3100 is issued in China within the three years following the effective date of the ApolloBio Agreement.

Under the ApolloBio Agreement, the Company received proceeds of $19.4 million in March 2018, which comprised the upfront payment of $23.0 million less $2.2 million in foreign income taxes and $1.4 million in certain foreign non-income taxes. The foreign income taxes were recorded as a provision for income taxes and the foreign non-income taxes were recorded as a general and administrative expense, on the condensed consolidated statement of operations during the quarter ended March 31, 2018. The Company also incurred advisory fees of $960,000 in connection with receiving the upfront payment from ApolloBio. These fees were determined to be incremental costs of obtaining the contract. The Company applied the practical expedient that permits a company to expense incremental costs to obtain a contract when the expected amortization period is one year or less and recorded the fees in general and administrative expense during the quarter ended March 31, 2018. No additional advisory fees are due related to the ApolloBio Agreement.

In addition to the upfront payment, the Company is entitled to receive up to an aggregate of $20.0 million, less required income, withholding or other taxes, upon the achievement of specified milestones related to the regulatory approval of VGX-3100 in the United States, China and Korea. In the event that VGX-3100 is approved for marketing, the Company will be entitled to receive royalty payments based on a tiered percentage of annual net sales, with such percentage being in the low- to mid-teens, subject to reduction in the event of generic competition in a particular territory. ApolloBio’s obligation to pay royalties will continue for 10 years after the first commercial sale in a particular territory or, if later, until the expiration of the last-to-expire patent covering the licensed products in the specified territory.

The Company evaluated the terms of the ApolloBio Agreement under Topic 606, and the license to VGX-3100 in the territories was identified as the only distinct performance obligation on a standalone basis as of the inception of the agreement. The Company concluded that the license was distinct from potential future manufacturing and supply obligations. The Company further determined that the transaction price under the agreement consisted of the $23.0 million upfront payment. The future potential milestone amounts were not included in the transaction price, as they were all determined to be fully constrained. As part of the evaluation of the development and regulatory milestones constraint, the Company determined that the achievement of such milestones is contingent upon success in future clinical trials and regulatory approvals, each of which is uncertain at this time. Future potential milestone amounts may be recognized as revenue under the ApolloBio Agreement, as well as under other collaborative research and development arrangements, if unconstrained. Reimbursable program costs will be recognized proportionately with the performance of the underlying services or delivery of drug supply and are excluded from the transaction price.

The ApolloBio Agreement will continue in force until ApolloBio has no remaining royalty obligations. Either party may terminate the ApolloBio Agreement in the event the other party shall materially breach or default in the

performance of its material obligations thereunder and such default continues for a specified period after written notice thereof. In addition, ApolloBio may terminate the ApolloBio Agreement at any time beginning one year after the effective date for any reason upon 90 days written notice to the Company.

Under Topic 606, the entire transaction price of $23.0 million was allocated to the license performance obligation. The Company determined that during the quarter ended June 30, 2018, the transfer of technology occurred and accordingly, the performance obligation was fully satisfied. The Company has recorded the gross upfront payment received from ApolloBio of $23.0 million as revenue under collaborative research and development arrangements on the consolidated statement of operations during the year ended December 31, 2018.

AstraZeneca

On August 7, 2015, the Company entered into a license and collaboration agreement with MedImmune, the global biologics research and development arm of AstraZeneca ("AstraZeneca"). Under the agreement, AstraZeneca acquired exclusive rights to the Company's INO-3112 immunotherapy, renamed as MEDI0457, which targets cancers caused by human papillomavirus (HPV) types 16 and 18, with the ability to sublicense those license rights. AstraZeneca made an upfront payment of $27.5 million to the Company in September 2015 and agreed to make potential future development and regulatory event-based payments totaling up to $355 million and potential future commercial event-based payments totaling up to $345 million, in each case upon the achievement of specified milestones set forth in the license and collaboration agreement. AstraZeneca will fund all development costs associated with MEDI0457 immunotherapy. The Company is entitled to receive up to mid-single to double-digit tiered royalties on MEDI0457 product sales. Within the broader collaboration, at AstraZeneca’s discretion, AstraZeneca and the Company will develop up to two additional DNA-based cancer vaccine products not included in the Company's current product pipeline, which AstraZeneca will have the exclusive rights to develop and commercialize. These additional development services would be provided by the Company at an industry standard full-time-equivalent rate. Under the agreement, AstraZeneca can also request the Company to provide certain clinical manufacturing at an agreed upon price. The Company determined these options did not represent material rights at the inception of the agreement.

As of December 31, 2017, the Company had recognized all of the $27.5 million upfront payment as revenue, as all identified material performance obligations had been met with respect to that payment. In December 2017 and December 2018, the Company recognized as revenue $7.0 million and $2.0 million, respectively, in milestone payments from AstraZeneca triggered by AstraZeneca’s initiation of the Phase 2 portion of ongoing clinical trials in the first and second major indication, respectively, under the agreement. During the year ended December 31, 2018, the Company recognized total revenues of $6.9 million from AstraZeneca primarily for manufacturing services and the milestone achieved as discussed above. As of December 31, 2018 and 2017, the Company has a deferred revenue balance of $288,000 and $1.1 million, respectively, related to AstraZeneca. The deferred revenue relates to advanced payments made by the Company to a third-party biologics manufacturer for which AstraZeneca is obligated to reimburse. As of December 31, 2018 and 2017, the Company had an accounts receivable balance of $3.2 million and $1.7 million, respectively, related to the collaboration agreement with AstraZeneca.

Prior to January 1, 2018 the Company accounted for the arrangement under Topic 605, which resulted in revenue of $22.3 million from AstraZeneca for the year ended December 31, 2017.

Roche

In September 2013, the Company entered into a Collaborative, License, and Option Agreement with F. Hoffmann-La Roche Ltd. and Hoffmann-La Roche Inc. (together, “Roche”) and received an upfront payment of $10.0 million. The parties agreed to co-develop multi-antigen DNA immunotherapies targeting prostate cancer and hepatitis B.

On November 14, 2014, Roche provided notice to the Company that it would be partially terminating the agreement with respect to the development of the Company’s DNA immunotherapy targeting prostate cancer. The termination was effective in February 2015. All of Roche’s rights to the Company’s DNA immunotherapy targeting prostate cancer, including the right to license the product to other parties, have been returned to the Company.

On July 28, 2016, Roche provided notice to the Company that it would be discontinuing the agreement and its development of INO-1800, the Company’s DNA immunotherapy against the hepatitis B virus. The termination was effective in October 2016. All of Roche’s rights to INO-1800, including the right to license the product to other parties, have been returned to the Company. In February 2017, the Company received full payment of $8.5 million from Roche for its past and future obligations which were completed during the quarter ended June 30, 2017, associated with the termination of the agreement. During the year ended December 31, 2018, the Company recognized no revenues from Roche. During the year ended December 31, 2017, the Company recognized revenues of $6.1 million from Roche.

Coalition for Epidemic Preparedness Innovations

On April 11, 2018, the Company entered into agreements with the Coalition for Epidemic Preparedness Innovations ("CEPI"), pursuant to which the Company intends to develop vaccine candidates against Lassa fever and MERS. The goal of the collaboration between the Company and CEPI is to conduct research and development so that investigational stockpiles will be ready for clinical efficacy trial testing during potential disease outbreaks. The

agreements with CEPI contemplate preclinical studies, as well as Phase 1 and Phase 2 clinical trials, occurring over the next few years. As part of the arrangement between the parties, CEPI has agreed to fund up to an aggregate of $56 million of costs over a five-year period for preclinical studies, as well as planned Phase 1 and Phase 2 clinical trials, to be conducted by the Company and collaborators, with funding from CEPI based on the achievement of identified milestones. During the year ended December 31, 2018, the Company received upfront funding of $6.5 million related to the CEPI grant, and recorded $4.3 million as contra-research and development expense. As of December 31, 2018, the Company had a deferred grant funding balance related to the CEPI grant of $2.1 million recorded as deferred grant funding on the consolidated balance sheet.

DARPA- Ebola

In April 2015, the Company received a grant from the Defense Advanced Research Projects Agency ("DARPA") to lead a collaborative team to develop multiple treatment and prevention approaches against Ebola. The consortium, led by the Company, is taking a multi-faceted approach to develop products to prevent and treat Ebola infection. The award covers pre-clinical development costs as well as good manufacturing practice, manufacturing costs and the Phase 1 clinical study costs. The initial funding period covers a base award of $19.6 million and an option award of $24.6 million, which was exercised in September 2015. During the year ended December 31, 2018, the Company received funding of $1.1 million related to the DARPA Ebola grant and recorded it as contra-research and development expense. During the year ended December 31, 2017, the Company recognized revenues of $9.8 million related to the DARPA Ebola grant. As of December 31, 2018 the Company had a deferred grant funding balance of $74,000, and as of December 31, 2017 the Company had a deferred revenue balance of $149,000, related to the DARPA grant. As of December 31, 2018 and 2017, the Company had an accounts receivable balance of $82,000 and $4.1 million, respectively, related to the DARPA grant.

5. Investments

Investments at December 31, 2018 consisted of mutual funds and United States corporate debt securities. Investments at December 31, 2017 consisted of mutual funds, United States corporate debt securities and an equity investment in the Company's affiliated entity PLS. Investments are recorded at fair value, based on current market valuations. After the adoption of ASU No. 2016-01 on January 1, 2018, unrealized gains and losses on the Company's equity securities are reported in the consolidated statement of operations as non-operating other income (expense). Unrealized gains and losses on the Company's debt securities will continue to be excluded from earnings and are reported as a separate component of other comprehensive loss until realized. Realized gains and losses are included in non-operating other income (expense) on the consolidated statement of operations and are derived using the specific identification method for determining the cost of the securities sold. During the years ended December 31, 2018 and 2017, net realized loss on investments of $1.3 million and $215,000, respectively, was recorded. The Company assessed each of its investments on an individual basis to determine if any decline in fair value was other-than-temporary. Interest and dividends on investments classified as available-for-sale are included in interest and other income, net, in the consolidated statements of operations. There were no impairments considered to be other-than-temporary during the years ended December 31, 2018 and 2017. As of December 31, 2018, the Company had 14 available-for-sale securities in a gross unrealized loss position, of which 10 with an aggregate total unrealized loss of $193,000 were in such position for longer than 12 months.

The following is a summary of available-for-sale securities as of December 31, 2018 and 2017:

	As of December 31, 2018			
	Contractual Maturity (in years)	Cost	Gross Unrealized Gains	Gross Unrealized Losses	Fair Market Value
Mutual funds	---	$57,842,955	$ —	$ (528,084)	$ 57,314,871
US corporate debt securities	Less than 2	224,633	—	(652)	223,981
Total investments		$58,067,588	$ —	$ (528,736)	$ 57,538,852

	As of December 31, 2017			
	Contractual Maturity (in years)	Cost	Gross Unrealized Gains	Gross Unrealized Losses	Fair Market Value
Mutual funds	---	$68,776,165	$ 42,097	$ (252,373)	$ 68,565,889
US corporate debt securities	Less than 2	35,210,121	3,032	(140,198)	35,072,955
Investment in affiliated entity (PLS)	---	—	2,325,079	—	2,325,079
Total investments		$103,986,286	$ 2,370,208	$ (392,571)	$ 105,963,923

6. Marketable Securities and Fair Value Measurements

The guidance regarding fair value measurements establishes a three-tier fair value hierarchy which prioritizes the inputs used in measuring fair value. These tiers include: Level 1, defined as observable inputs such as quoted prices in active markets that are accessible at the measurement date; Level 2, defined as inputs other than quoted prices in active markets that are either directly or indirectly observable; and Level 3, defined as unobservable inputs in which little or no market data exists, therefore requiring an entity to develop its own assumptions.

Assets and liabilities are classified based on the lowest level of input that is significant to the fair value measurements. The Company reviews the fair value hierarchy classification on a quarterly basis. Changes in the ability to observe valuation inputs may result in a reclassification of levels for certain securities within the fair value hierarchy. The Company did not have any transfer of assets and liabilities between Level 1, Level 2 and Level 3 of the fair value hierarchy during the years ended December 31, 2018 and 2017.

The following table presents the Company's assets that are measured at fair value on a recurring basis, and are determined using the following inputs as of December 31, 2018:

	Fair Value Measurements at December 31, 2018			
	Total	Quoted Prices in Active Markets (Level 1)	Significant Other Unobservable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Assets:				
Money market funds	$9,646,507	$9,646,507	$—	$ —
Mutual funds	57,314,871	—	57,314,871	—
US corporate debt securities	223,981	—	223,981	—
Investments in affiliated entities	9,405,913	9,405,913	—	—
Total assets	$76,591,272	$19,052,420	$57,538,852	$ —

The following table presents the Company's assets and liabilities that are measured at fair value on a recurring basis, and are determined using the following inputs as of December 31, 2017:

	Fair Value Measurements at December 31, 2017			
	Total	Quoted Prices in Active Markets (Level 1)	Significant Other Unobservable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Assets:				
Money market funds	$9,843,482	$9,843,482	$—	$ —
Mutual funds	68,565,889	—	68,565,889	—
US corporate debt securities	35,072,955	—	35,072,955	—
Investments in affiliated entities	11,394,480	11,394,480	—	—
Total assets	$124,876,806	$21,237,962	$103,638,844	$ —
Liabilities:				
Common stock warrants	$360,795	$—	$—	$ 360,795
Total liabilities	$360,795	$—	$—	$ 360,795

Level 1 assets at December 31, 2018 and 2017 consisted of money market funds held by the Company that are valued at quoted market prices, as well as the Company's investments in affiliates, GeneOne and PLS. The Company accounts for its investment in 1,644,155 common shares of GeneOne based on the closing price of the shares on the Korean Stock Exchange on the applicable balance sheet date. The Company accounts for its investment in 395,758 common shares of PLS as an equity investment with a fair value based on the closing price of the shares on the Korea New Exchange (KONEX) Market on the applicable balance sheet date. The Company elected the fair value option in conjunction with the investment in GeneOne at the inception of the investment; therefore, changes in the fair value of the investment are reflected as other income (expense) in the consolidated statements of operations. The Company did

not elect the fair value option for the investment in PLS at the inception of the investment, but rather recorded the investment under the equity method until its ownership interest dropped below 20% in June 2015 and, accordingly, began recording the investment under the cost method using the carryover basis from the equity method of zero. Once shares of PLS began trading on the KONEX, the Company classified the investment as available-for-sale and began recording the investment at fair value. After the adoption of ASU No. 2016-01 on January 1, 2018,

unrealized gains and losses on the Company's equity securities are reported in the consolidated statement of operations as a gain (loss) on investment in affiliated entities, as discussed in Note 2.

Level 2 assets at December 31, 2018 and 2017 consisted of U.S. corporate debt securities and mutual funds held by the Company that are initially valued at the transaction price and subsequently valued, at the end of each reporting period, typically utilizing market observable data. The Company obtains the fair value of its Level 2 assets from a professional pricing service, which may use quoted market prices for identical or comparable instruments, or inputs other than quoted prices that are observable either directly or indirectly. The professional pricing service gathers quoted market prices and observable inputs from a variety of industry data providers. The valuation techniques used to measure the fair value of the Company's Level 2 financial instruments were derived from non-binding market consensus prices that are corroborated by observable market data, quoted market prices for similar instruments, or pricing models such as discounted cash flow techniques. The Company validates the quoted market prices provided by the primary pricing service by comparing the service's assessment of the fair values of the Company's investment portfolio balance against the fair values of the Company's investment portfolio balance obtained from an independent source.

There were no Level 3 assets held as of December 31, 2018 and 2017.

There were no Level 3 liabilities held as of December 31, 2018. Level 3 liabilities as of December 31, 2017 consisted of common stock warrant liabilities associated with warrants to purchase the Company's common stock issued in March 2013. During the third quarter of 2018, all of the remaining 284,091 warrants were exercised for net proceeds to the Company of $902,000. During the year ended December 31, 2017, none of these warrants were exercised.

As of December 31, 2017, the Company had a $361,000 common stock warrant liability. The Company reassessed the fair value of the common stock warrants at each reporting date utilizing a Black-Scholes pricing model. Inputs used in the pricing model include estimates of stock price volatility, expected warrant life and risk-free interest rate. The Company develops its estimates based on historical data. The assumptions used to estimate the fair value of common stock warrants at December 31, 2017 is presented below:

	Year Ended December 31, 2017
Risk-free interest rate	1.75%
Expected volatility	55%
Expected life in years	0.70
Dividend yield	—

Changes in these assumptions as well as fluctuations in the Company's stock price between the valuation dates can have a significant impact on the fair value of the common stock warrant liability. As a result of these calculations, the Company recorded a decrease in fair value of $(361,000), $(807,000) and $(134,000) for the years ended December 31, 2018, 2017 and 2016, respectively. The change in fair value is reflected in the Company's consolidated statement of operations as a component of change in fair value of common stock warrants.

The following table presents the changes in fair value of the Company’s total Level 3 financial liabilities for the years ended December 31, 2018 and 2017:

	Year Ended December 31,	
	2018	2017
Balance at beginning of year	$360,795	$1,167,614
Decrease in fair value included in change in fair value of common stock warrants	(360,795)	(806,819)
Balance at end of year	$—	$360,795

7. Major Customers and Concentration of Credit Risk

Customer	2018 Revenue	% of Total Revenue	2017 Revenue	% of Total Revenue	2016 Revenue	% of Total Revenue
ApolloBio	$23,000,000	75 %	$—	— %	$—	— %
AstraZeneca	6,850,424	23	22,269,773	53	1,518,639	4
DARPA	—	—	9,983,927	24	26,602,183	75
Roche	—	—	6,107,254	14	4,917,929	14
GeneOne (affiliated entity)	342,386	1	551,208	1	1,188,432	4
All other	289,087	1	3,307,924	8	1,141,178	3
Total revenue	$30,481,897	100 %	$42,220,086	100 %	$35,368,361	100 %

During the year ended December 31, 2018, the Company recognized revenue from various license fees and collaborative research and development agreements. The Company has determined that as of January 1, 2018, accounting for the Company’s various grant agreements falls under the contributions guidance under Subtopic 958-605, Not-for-Profit Entities-Revenue Recognition, which is outside the scope of Topic 606. Beginning on January 1, 2018, all contributions received from current grant agreements have been recorded as a contra-expense as opposed to revenue on the consolidated statements of operations, as discussed in Note 2. During the years ended December 31, 2017 and 2016, the Company recognized revenue from various license fees, collaborative research and development agreements, grants and government contracts. As of December 31, 2018, $3.2 million, or 98%, of the Company's accounts receivable was attributable to AstraZeneca. As of December 31, 2017, $4.1 million, or 69%, and $1.7 million, or 28%, of the Company's accounts receivable was attributable to DARPA and AstraZeneca, respectively. There is minimal credit risk with these customers based upon collection history, their size and financial condition. Accordingly, the Company does not consider it necessary to record a reserve for uncollectible accounts receivable.

8. Fixed Assets

Fixed assets at December 31, 2018 and 2017 consist of the following:

	Cost	Accumulated Depreciation and Amortization	Net Book Value
As of December 31, 2018			
Leasehold improvements	$14,909,341	$(3,464,444)	$11,444,897
Laboratory equipment	4,031,965	(2,425,854)	1,606,111
Office furniture and fixtures	3,198,803	(1,767,653)	1,431,150
Computer equipment and other	3,808,824	(2,341,968)	1,466,856
	$25,948,933	$(9,999,919)	$15,949,014
As of December 31, 2017			
Leasehold improvements	$14,553,993	$(2,042,871)	$12,511,122
Laboratory equipment	3,787,578	(1,724,946)	2,062,632
Office furniture and fixtures	3,366,896	(1,471,705)	1,895,191
Computer equipment and other	3,718,266	(1,867,035)	1,851,231
	$25,426,733	$(7,106,557)	$18,320,176

Depreciation expense for the years ended December 31, 2018, 2017 and 2016 was $3.7 million, $1.9 million and $1.7 million, respectively. The Company determined that the carrying value of these long-lived assets was not impaired during the periods presented.

9. Goodwill and Intangible Assets

The following sets forth goodwill and intangible assets by major asset class:

		December 31, 2018			December 31, 2017		
	Useful Life (Yrs)	Gross	Accumulated Amortization	Net Book Value	Gross	Accumulated Amortization	Net Book Value
Indefinite lived:							
Goodwill(a)		$10,513,371	$—	$10,513,371	$10,513,371	$—	$10,513,371
Definite lived:							
Patents	8 – 17	5,802,528	(5,742,079)	60,449	5,802,528	(5,681,673)	120,855
Licenses	8 – 17	1,323,761	(1,219,357)	104,404	1,323,761	(1,190,609)	133,152
CELLECTRA®(b)	5 – 11	8,106,270	(7,679,190)	427,080	8,106,270	(7,252,108)	854,162
GHRH(b)	11	335,314	(303,630)	31,684	335,314	(271,948)	63,366
Bioject (c)	2 – 15	5,100,000	(1,882,222)	3,217,778	5,100,000	(1,405,556)	3,694,444
Other(d)	18	4,050,000	(3,131,250)	918,750	4,050,000	(2,906,250)	1,143,750
Total intangible assets		24,717,873	(19,957,728)	4,760,145	24,717,873	(18,708,144)	6,009,729
Total goodwill and intangible assets		$35,231,244	$(19,957,728)	$15,273,516	$35,231,244	$(18,708,144)	$16,523,100

(a) Goodwill was recorded from the Inovio AS acquisition in January 2005, the acquisition of VGX in June 2009 and the acquisition of Bioject in April 2016 for $3.9 million, $6.2 million and $400,000, respectively.

(b) CELLECTRA® and GHRH are developed technologies which were recorded from the acquisition of VGX.

(c) Bioject intangible assets represent the estimated fair value of developed technology and intellectual property which were recorded from the Bioject asset acquisition.

(d) Other intangible assets represent the estimated fair value of acquired intellectual property from the Inovio AS acquisition.

Aggregate amortization expense on intangible assets was $1.2 million, $1.6 million and $1.4 million for the years ended December 31, 2018, 2017 and 2016, respectively. Amortization expense related to intangible assets at December 31, 2018 is expected to be incurred as follows:

Year ending December 31,	
2019	$1,066,251
2020	547,081
2021	520,414
2022	492,818
2023	275,803
Thereafter	1,857,778
	$4,760,145

There were no impairment or impairment indicators present and no losses were recorded during the years ended December 31, 2018, 2017 and 2016, respectively.

10. Accounts Payable and Accrued Expenses

Accounts payable and accrued expenses at December 31, 2018 and 2017 consist of the following:

	As of December 31,	
	2018	2017
Trade accounts payable	$10,043,816	$7,564,830
Accrued compensation	9,466,821	7,997,152
Accrued subcontract costs	83,812	3,746,937
Other accrued expenses	3,540,284	3,969,879
	$23,134,733	$23,278,798

11. Stockholders' Equity

Preferred Stock

			Shares Outstanding as of December 31,	
	Shares Authorized	Shares Issued	2018	2017
Series C Preferred Stock, par $0.001	1,091	1,091	23	23

The shares of the Company's Series C Preferred Stock have the following pertinent rights and privileges, as set forth in the Company's Amended and Restated Certificate of Incorporation and its Certificates of Designations, Rights and Preferences related to the various series of preferred stock.

Rights on Liquidation

In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Company (a "liquidation event"), before any distribution of assets of the Company shall be made to or set apart for the holders of common stock, the holders of Series C Preferred Stock, pari passu, are entitled to receive payment of such assets of the Company in an amount equal to $10,000 per share of such series of preferred stock, plus any accumulated and unpaid dividends thereon (whether or not earned or declared).

If the assets of the Company available for distribution to stockholders exceed the aggregate amount of the liquidation preferences payable with respect to all shares of each series of preferred stock then outstanding, then, after the payment of such preferences is made or irrevocably set aside, the holders of the Company's common stock are entitled to receive a pro rata portion of such assets based on the aggregate number of shares of common stock held by each such holder. The holders of the Company's outstanding preferred stock shall participate in such a distribution on a pro-rata basis, computed based on the number of shares of common stock which would be held by such preferred holders if immediately prior to the liquidation event all of the outstanding shares of the preferred stock had been converted into shares of common stock at the then current conversion value applicable to each series.

A Change of Control of the Company (as defined in the Certificates of Designations, Rights and Preferences) is not a liquidation event triggering the preferences described above, and is instead addressed by separate terms in the Series C Certificates of Designations, Rights, and Preferences.

Although the liquidation preferences are in excess of the par value of $0.001 per share of the Company's preferred stock, these preferences are equal to or less than the stated value of such shares based on their original purchase price.

Voting Rights

The holders of Series C Preferred Stock have full voting rights and powers equal to the voting rights and powers of holders of the Company's common stock and are entitled to notice of any stockholders' meeting in accordance with the Company's Bylaws. Holders are entitled to vote on any matter upon which holders of the Company's common stock have the right to vote, including, without limitation, the right to vote for the election of directors together with the holders of common stock as one class. Series C Preferred holders are entitled to 368 votes for each share of Series C Preferred Stock held.

Holder Optional Conversion Right

The holder of any share or shares of Series C Preferred Stock has the right at any time, at such holder's option, to convert all or any lesser portion of such holder's shares of the Preferred Stock into such number of fully paid and

non-assessable shares of Common Stock as is determined by dividing (i) the aggregate Liquidation Preference applicable to the particular series of preferred shares, plus accrued and unpaid dividends thereon by (ii) the applicable Conversion Value (as defined in the relevant series' Certificate of Designations, Rights and Preferences) then in effect for such series of preferred shares. As of December 31, 2018, the Conversion Value was $27.20, such that the outstanding shares of Series C Preferred Stock were convertible into 8,456 shares of common stock. The Company is not obligated to issue any fractional shares or

scrip representing fractional shares upon such conversion and instead shall pay the holder an amount in cash equal to such fraction multiplied by the current market price per share of the Company's common stock.

Company Mandatory Conversion Option

The Company has the option upon thirty (30) days prior written notice, to convert all of the outstanding shares of the Series C Preferred Stock into such number of fully paid and non-assessable shares of common stock as is determined by dividing (i) the aggregate Liquidation Preference of the shares of the relevant series of preferred stock to be converted, plus accrued and unpaid dividends thereon by (ii) the applicable Conversion Value (as defined in the relevant series' Certificate of Designations, Rights and Preferences) then in effect, if the following triggering events have occurred:

(i) the price of the Company's common stock exceeds $72.00 per share for 20 out of 30 consecutive trading days; and (ii) the average daily trading volume (subject to adjustment for stock dividends, subdivisions and combinations) of the common stock exceeds 6,250 shares for at least 20 out of 30 consecutive trading days.

Common Stock

In May 2018, the Company entered into an At-the-Market Equity Offering Sales Agreement (the "Sales Agreement") with an outside placement agent (the "Placement Agent") to sell shares of its common stock with aggregate gross proceeds of up to $100.0 million, from time to time, through an "at-the-market" equity offering program under which the Placement Agent will act as sales agent. Under the Sales Agreement, the Company will set the parameters for the sale of shares, including the number of shares to be issued, the time period during which sales are requested to be made, limitation on the number of shares that may be sold in any one trading day and any minimum price below which sales may not be made. The Sales Agreement provides that the Placement Agent will be entitled to compensation for its services in an amount equal to up to 3.0% of the gross proceeds from the sales of shares sold through the Placement Agent under the Sales Agreement. The Company has no obligation to sell any shares under the Sales Agreement, and may at any time suspend solicitation and offers under the Sales Agreement.

During the year ended December 31, 2018, the Company sold a total of 5,354,075 shares of common stock under the Sales Agreement. The sales were made at a weighted average price of $5.27 per share resulting in aggregate net proceeds of $27.7 million. The Company may sell up to an additional $71.8 million in shares of its common stock under the Sales Agreement. The registration statement that registered with the SEC the shares that may be sold under the Sales Agreement expires on June 8, 2021.

In June 2016, the Company entered into an At-the-Market Equity Offering Sales Agreement (the "Prior Sales Agreement") with the same placement agent. The registration statement that registered with the SEC the shares sold under the Prior Sales Agreement expired on June 5, 2018, and no further sales will be made under the Prior Sales Agreement. The Company sold an aggregate of 3,911,104 shares of common stock under the Prior Sales Agreement resulting in aggregate net proceeds of $32.1 million. During the period beginning January 1 and ending June 5, 2018, the Company sold a total of 314,950 shares of common stock under the Prior Sales Agreement. The sales were made at a weighted average price of $5.07 per share resulting in aggregate net proceeds of $1.6 million. During the year ended December 31, 2017, the Company sold a total of 2,937,406 shares of common stock under the Prior Sales Agreement. The sales were made at a weighted average price of $8.41 per share resulting in aggregate net proceeds of $24.2 million.

On July 25, 2017, the Company closed an underwritten public offering of 12,500,000 shares of common stock at a public offering price of $6.00 per share. The net proceeds to the Company, after deducting the underwriters' discounts and commissions and other offering expenses, were $70.1 million.

Warrants

During the year ended December 31, 2018, warrants to purchase 284,091 shares of the Company's common stock were exercised, with net proceeds to the Company of $902,000. No common stock warrants were exercised during the year ended December 31, 2017.

As of December 31, 2018 there were no common stock warrants outstanding. Previously, the Company accounted for the common stock warrants issued in March 2013 under the authoritative guidance on accounting for derivative financial instruments indexed to, and potentially settled in, a company's own stock, on the understanding that in compliance with applicable securities laws, the registered warrants required the issuance of registered securities upon exercise and did not sufficiently preclude an implied right to net cash settlement. The Company classified registered

warrants on the consolidated balance sheet as a current liability which was revalued at each balance sheet date subsequent to the initial issuance. Changes in the fair market value of the warrants were reflected in the consolidated statement of operations as change in fair value of common stock warrants.

The following table summarizes the warrants outstanding as of December 31, 2018 and 2017:

Issued in Connection With:	Exercise Price	Expiration Date	As of December 31, 2018 Number of Warrants	As of December 31, 2018 Common Stock Warrant Liability	As of December 31, 2017 Number of Warrants	As of December 31, 2017 Common Stock Warrant Liability
March 2013 financing	$ 3.17	September 12, 2018	—	$ —	284,091	$ 360,795
Total			—	$ —	284,091	$ 360,795

Stock Options and Restricted Stock Units

The Company has a stock-based incentive plan, the 2016 Omnibus Incentive Plan (the "2016 Incentive Plan"), pursuant to which the Company may grant stock options, restricted stock awards, restricted stock units and other stock-based awards or short-term cash incentive awards to employees, directors and consultants.

The 2016 Incentive Plan was approved by the Company's stockholders on May 13, 2016. The maximum number of shares of the Company’s common stock available for issuance over the term of the 2016 Incentive Plan may not exceed 6,000,000 shares, provided that commencing with the first business day of each calendar year beginning January 1, 2018, such maximum number of shares shall be increased by 2,000,000 shares of common stock unless the Board determines, prior to January 1 for any such calendar year, to increase such maximum amount by a fewer number of shares or not to increase the maximum amount at all for such year. On January 1, 2018, the maximum number of shares to be issued was increased by 2,000,000. At December 31, 2018, there were 8,000,000 shares of common stock reserved for issuance upon exercise of incentive awards granted and to be granted at future dates under the 2016 Incentive Plan. At December 31, 2018, the Company had 3,039,566 shares of common stock available for future grant under the 2016 Incentive Plan, 1,519,187 shares underlying outstanding but unvested restricted stock units and options outstanding to purchase 3,062,183 shares of common stock under the 2016 Incentive Plan. The awards granted and available for future grant under the 2016 Incentive Plan generally vest over three years and have a maximum contractual term of ten years. The 2016 Incentive Plan terminates by its terms on March 9, 2026.

The Amended and Restated 2007 Omnibus Incentive Plan (the "2007 Incentive Plan") was adopted on March 31, 2007 and terminated by its terms on March 31, 2017. At December 31, 2018, the Company had 168,830 shares underlying outstanding but unvested restricted stock units and options outstanding to purchase 5,690,494 shares of common stock under the 2007 Incentive Plan. The awards granted under the 2007 Incentive Plan generally vest over three years and have a maximum contractual term of ten years.

Total employee and director stock-based compensation expense recognized in the consolidated statement of operations for the years ended December 31, 2018, 2017 and 2016 was $10.2 million, $12.9 million and $10.2 million, respectively, of which $5.9 million, $5.8 million and $4.8 million was included in research and development expenses and $4.3 million, $7.1 million and $5.4 million was included in general and administrative expenses, respectively.

At December 31, 2018 and 2017, there was $5.2 million and $5.9 million, respectively, of total unrecognized compensation expense related to unvested stock options, which is expected to be recognized over a weighted-average period of 1.7 years and 1.8 years, respectively.

At December 31, 2018 and 2017, there was $5.1 million and $5.3 million, respectively, of total unrecognized compensation expense related to unvested restricted stock units, which is expected to be recognized over a weighted-average period of 1.7 years and 1.8 years, respectively.

The fair value of stock options granted to non-employees at the measurement dates were estimated using the Black-Scholes pricing model. Total stock-based compensation expense for stock options and restricted stock units granted to non-employees for the years ended December 31, 2018, 2017 and 2016 was $302,000, $201,000 and $321,000, respectively. As of December 31, 2018, options to purchase 628,125 shares of common stock granted to non-employees remained outstanding.

The following table summarizes total stock options outstanding at December 31, 2018:

Exercise Price	Options Outstanding			Options Exercisable	
	Shares Underlying Options Outstanding	Weighted-Average Remaining Contractual Life (in Years)	Weighted Average Exercise Price	Shares Underlying Options Exercisable	Weighted Average Exercise Price
$1.48-$3.00	879,321	3.7	$ 2.26	879,321	$ 2.26
$3.01-$6.00	2,558,453	7.9	$ 4.38	974,723	$ 4.44
$6.01-$9.00	4,394,357	6.7	$ 7.11	3,408,953	$ 7.20
$9.01-$12.00	257,836	6.9	$ 9.79	228,788	$ 9.81
$12.01-$15.00	662,710	5.2	$ 12.96	662,710	$ 12.96
	8,752,677	6.7	$ 6.35	6,154,495	$ 6.78

At December 31, 2018, the aggregate intrinsic value of options outstanding was $1.6 million, the aggregate intrinsic value of options exercisable was $1.6 million, and the weighted average remaining contractual term of options exercisable was 5.8 years.

At December 31, 2018, the aggregate intrinsic value of unvested restricted stock units was $6.8 million and the aggregate intrinsic value of restricted stock units which vested during the year ended December 31, 2018 was $2.4 million.

At December 31, 2018, options to purchase 8,752,677 shares of common stock and 1,688,017 restricted stock units were expected to vest.

Stock option activity under the Company's equity incentive plans during the year ended December 31, 2018 was as follows:

	Number of Shares	Weighted-Average Exercise Price
Balance, December 31, 2017	7,694,870	$ 6.77
Granted	2,176,935	4.32
Exercised	(472,762)	3.21
Cancelled	(646,366)	6.83
Balance, December 31, 2018	8,752,677	$ 6.35

Restricted stock unit activity under the Company's equity incentive plans during the year ended December 31, 2018 was as follows:

	Number of Shares	Weighted-Average Exercise Price
Balance, December 31, 2017	1,234,168	$ —
Granted	1,070,106	—
Vested	(539,468)	—
Cancelled	(76,789)	—
Balance, December 31, 2018	1,688,017	$ —

The weighted average exercise price per share was $5.17 for the 119,091 options which expired during the year ended December 31, 2018, $9.67 for the 200,501 options which expired during the year ended December 31, 2017 and $9.01 for the 69,570 options which expired during the year ended December 31, 2016.

The weighted average grant date fair value per share was $2.86, $4.33 and $4.59 for options granted during the years ended December 31, 2018, 2017 and 2016, respectively.

The weighted average grant date fair value was $4.31, $6.66 and $7.41 per share for restricted stock units granted during the years ended December 31, 2018, 2017 and 2016, respectively.

The Company received $1.5 million, $2.3 million and $1.8 million in proceeds from the exercise of stock options during the years ended December 31, 2018, 2017 and 2016, respectively. The aggregate intrinsic value of options exercised was $910,000, $519,000 and $3.5 million during the years ended December 31, 2018, 2017 and 2016,

respectively.

12. Commitments

San Diego Leases

In April 2013, the Company entered into a lease for 26,500 square feet of office space located in San Diego, California (the "San Diego Lease"). The term of the San Diego Lease commenced on December 1, 2013. The initial term of the San Diego Lease is ten years, with a right to terminate on December 1, 2019 and a right to extend the term by five years, subject to specified conditions. In June 2015, the Company amended the San Diego Lease to increase the total leased space to 31,207 square feet and occupy the entire building. The commencement of the amended San Diego Lease was in January 2016. As of December 31, 2018, rent payments under the San Diego Lease include base rent with an annual increase of approximately 3 percent, and additional monthly fees to cover the Company’s share of certain facility expenses, including utilities, property taxes, insurance and maintenance. The Company has capitalized $3.4 million of total tenant improvements within fixed assets on the consolidated balance sheet related to the entire building and has recorded a corresponding increase to deferred rent.

In October 2016, the Company entered into an office lease (the “new Lease”) for a second property located in San Diego, California. The total space under the new Lease is approximately 51,000 square feet. The Company is using the facility for office, manufacturing and research and development purposes. The term of the new Lease commenced on June 1, 2017. The initial term of the new Lease is ten years, with a right to terminate on November 30, 2023, subject to specified conditions.

The base rent adjusts periodically throughout the term of the new Lease. As of December 31, 2018, rent payments under the San Diego Lease include base rent with an annual increase of approximately 3 percent, and additional monthly fees to cover the Company’s share of certain facility expenses, including utilities, property taxes, insurance and maintenance. In addition, the Company has paid a security deposit of $95,000. The Company has capitalized $2.3 million of reimbursable tenant improvements to the new office which has been recorded as a leasehold improvement within fixed assets on the consolidated balance sheet, offset by a corresponding amount recorded in deferred rent.

Plymouth Meeting Lease

In March 2014, the Company entered into a lease (the "Lease") for 20,858 square feet of office space located in Plymouth Meeting, Pennsylvania. The Company occupied the space in June 2014. The initial term of the Lease was 11.5 years, with a right to extend the term by five years, subject to specified conditions.

The base rent adjusts periodically throughout the term of the Lease. As of December 31, 2018, rent payments under the Lease include base rent with an annual increase of approximately 2 percent, and additional monthly fees to cover the Company’s share of certain facility expenses, including utilities, property taxes, insurance and maintenance. In addition, the Company has paid a security deposit of $49,000. In July 2015, the Company amended the Lease to increase the total leased space to 27,583 square feet. The Company has capitalized $2.6 million of tenant improvements to the Plymouth Meeting office within fixed assets on the consolidated balance sheet, offset by a corresponding amount recorded in deferred rent.

In June 2017, the Company entered into another amendment to the Lease to increase the total leased space to 57,361 square feet and extend the lease term through December 31, 2029. In connection with this amendment, the Company has paid the landlord an additional security deposit of $75,000.

Rent expense was $3.2 million, $2.4 million and $1.6 million for the years ended December 31, 2018, 2017 and 2016, respectively. The terms of the leases provide for rental payments on a monthly basis on a graduated scale. The Company recognizes rent expense on a straight-line basis over the lease period. Future minimum lease payments under non-cancelable operating leases as of December 31, 2018 are as follows:

Year ending December 31,	
2019	$3,756,000
2020	3,891,000
2021	3,979,000
2022	4,052,000
2023	4,023,000

Thereafter	15,952,000
Total	$35,653,000

In the normal course of business, the Company is a party to a variety of agreements pursuant to which it may be obligated to indemnify the other party. It is not possible to predict the maximum potential amount of future payments under

these types of agreements due to the conditional nature of the Company's obligations and the unique facts and circumstances involved in each particular agreement. Historically, payments made by us under these types of agreements have not had a material effect on the Company's business, consolidated results of operations or financial condition.

13. Investments in Affiliated Entities

The Company held 1,644,155 common shares, representing a 7.8% ownership interest in GeneOne as of December 31, 2018 and 2017, and 395,758 common shares, representing a 15.1% and 16.4% ownership interest in PLS as of December 31, 2018 and 2017, respectively. Please see further information as discussed in Note 2 and Note 6.

14. Income Taxes

In accordance with the guidance pursuant to accounting for income taxes, a deferred tax asset or liability is determined based on the difference between the financial statement and tax basis of assets and liabilities as measured by the enacted tax rates which will be in effect when these differences reverse. The Company provides a valuation allowance against net deferred tax assets unless, based upon the available evidence, it is more likely than not that the deferred tax asset will be realized.

The components of the provision for income taxes are presented in the following table:

	Year Ended December 31,		
	2018	2017	2016
Current:			
Federal	$—	$ —	$ —
State	—	—	—
Foreign	2,170,000	—	—
	2,170,000	—	—
Deferred:			
Federal	—	—	
State	—	—	—
Foreign	—	—	—
	—	—	—
	$2,170,000	$ —	$ —

The reconciliation of income taxes attributable to continuing operations computed at the statutory tax rates to income tax expense (recovery), using a 21% statutory tax rate for December 31, 2018, and 35% statutory tax rate for December 31, 2017 and 2016, is as follows:

	Year Ended December 31,		
	2018	2017	2016
Income (benefit) taxes at statutory rates	$(19,908,000)	$(30,872,000)	$(25,809,000)
State income tax, net of federal benefit	(4,000)	(4,000)	(4,000)
Foreign income taxes	2,170,000	—	—
Change in valuation allowance	20,898,000	(20,965,000)	29,678,000
Research and development tax credits	(3,170,000)	(3,456,000)	(3,117,000)
Fair value warrant	(76,000)	(282,000)	(47,000)
Stock compensation	1,094,000	2,332,000	113,000
Uncertain tax positions	1,268,000	846,000	1,367,000
Expired NOLs and credits	2,176,000	454,000	4,269,000
Limited NOLs and credits	(2,176,000)	(165,000)	(6,456,000)

Change in tax rates	—	50,019,000	(495,000)
Other	(102,000)	2,093,000	501,000
	$2,170,000	$—	$—

The income tax expense recorded during the year ended December 31, 2018 of $2.2 million was related to foreign income taxes on the upfront payment received from ApolloBio in March 2018.

Significant components of the Company's deferred tax assets and liabilities as of December 31, 2018 and 2017 are shown below:

	As of December 31,	
	2018	2017
Deferred tax assets:		
Capitalized research expense	$7,408,000	$8,546,000
Net operating loss carryforwards	89,399,000	71,665,000
Research and development and other tax credits	9,432,000	7,531,000
Deferred revenue	985,000	297,000
Deferred rent	2,013,000	2,097,000
Stock-based compensation	3,408,000	3,091,000
Acquired intangibles	912,000	858,000
Other	2,693,000	1,906,000
	116,250,000	95,991,000
Valuation allowance	(115,007,000)	(94,039,000)
Total deferred tax assets	1,243,000	1,952,000
Deferred tax liabilities:		
Acquired intangibles	(142,000)	(124,000)
Investment in affiliated entity	(4,000)	(422,000)
Fixed assets	(1,121,000)	(1,430,000)
Net deferred tax liabilities	$(24,000)	$(24,000)

As of December 31, 2018, the Company had federal, California and Pennsylvania tax net operating loss carryforwards of approximately $383.3 million, $68.6 million and $75.6 million, respectively, net of the net operating losses that will expire due to IRC Section 382 limitations. The federal net operating loss generated in 2018 of $86.5 million will carryforward indefinitely and be available to offset up to 80% of future taxable income each year. The federal, California and Pennsylvania net operating loss carryforwards will begin to expire in 2019, 2028 and 2021, respectively, unless previously utilized.

In addition, the Company had federal and state research tax credit carryforwards of approximately $13.8 million and $2.7 million, respectively. The federal tax credit carryforwards will begin to expire in 2029. The California research tax credits do not expire.

Based upon statute, federal and state losses and credits are expected to expire as follows (in millions):

Expiration Date:	Federal NOLs	State NOLs	Federal R&D	State R&D
2019	$2.4	$—	$—	$—
2020	1.6	—	—	—
2021	2.3	0.3	—	—
2022	6.0	0.3	—	—
2023	4.5	0.4	—	—
2024 and thereafter	280.0	143.2	13.8	—
Indefinite	86.5	—	—	2.7
	$383.3	$144.2	$ 13.8	$ 2.7

Pursuant to Internal Revenue Code (IRC) Sections 382 and 383, annual use of the Company's net operating loss and research and development credit carryforwards may be limited in the event that a cumulative change in ownership of more than 50% occurs within a three-year period. The Company has completed an IRC Section 382/383 analysis,

regarding the limitation

of net operating loss and research and development credit carryforwards as of December 31, 2018. As a result of the analysis, the Company estimates that approximately $11.2 million of tax benefits related to NOL and tax credit carryforwards will expire unused. Accordingly, the related NOL and R&D credit carryforwards have been removed from deferred tax assets accompanied by a corresponding reduction of the valuation allowance. Due to the existence of the valuation allowance, limitations created by current and future ownership changes, if any, related to the Company's operations in the United States will not impact its effective tax rate. Any additional ownership changes, may further limit the ability to use the net operating losses and credits carryovers.

The Tax Cuts and Jobs Act ("the Act") was enacted on December 22, 2017. The Act included a number of changes to existing U.S. tax laws that impact the Company, most notably a reduction of the U.S. federal corporate tax rate from a maximum of 35% to a flat 21%, effective January 1, 2018. In conjunction with the tax law changes, the SEC staff issued Staff Accounting Bulletin 118 ("SAB 118") to address the application of U.S. GAAP in situations when a registrant does not have the necessary information available, prepared, or analyzed (including computations) in reasonable detail to complete the accounting for certain income tax effects of the Act. In these instances, a company can record provisional amounts in its financial statements for the income tax effects for which a reasonable estimate can be determined. For items for which a reasonable estimate cannot be determined, a company should continue to apply ASC 740 based on the provisions of the tax laws that were in effect immediately prior to the Act being enacted.

SAB 118

The Company applied the guidance in SAB 118 when accounting for the enactment-date effects of the Act in 2017 and throughout 2018. At December 31, 2017, the Company had not completed its accounting for all of the enactment-date income tax effects of the Act under ASC 740, Income Taxes, and recorded a provisional amount of $50.0 million, with respect to the remeasurement of deferred tax assets and liabilities, which was reduced by a valuation allowance of $(50.2) million for a net impact of $(0.2) million. At December 31, 2018, the Company has now completed its accounting for all of the enactment-date income tax effects of the Act and no adjustments were made to the provisional amounts recorded at December 31, 2017.

The following table summarizes the activity related to the Company's unrecognized tax benefits:

	Year ended December 31,		
	2018	2017	2016
Balance at beginning of the year	$8,313,000	$6,855,000	$5,455,000
Increases related to current year tax positions	1,319,000	1,532,000	1,183,000
Increases (decreases) related to prior year tax positions	—	(74,000)	217,000
Balance at end of the year	$9,632,000	$8,313,000	$6,855,000

The amount of unrecognized tax benefits that, if recognized and realized, would affect the effective tax rate was $8.3 million, $7.1 million and $5.7 million, as of December 31, 2018, 2017 and 2016, respectively, subject to valuation allowances. The Company has not recorded any interest and penalties on the unrecognized tax positions as the Company has continued to generate net operating losses after accounting for the unrecognized tax benefits. The Company does not anticipate that the total amount of unrecognized tax benefits will significantly increase or decrease within twelve months of the reporting date.

The Company and its subsidiaries are subject to U.S. federal income tax as well as income tax in multiple state jurisdictions. With few exceptions, the Company is no longer subject to United States federal income tax examinations for years before 2015 and state and local income tax examinations before 2014. However, to the extent allowed by law, the tax authorities may have the right to examine prior periods where net operating losses were generated and carried forward, and make adjustments up to the amount of the net operating loss carryforward amount. The Company is not currently under Internal Revenue Service (“IRS”), state or local tax examination.

15. 401(k) Plan

The Company has adopted a 401(k) Profit Sharing Plan covering substantially all of its employees. The defined contribution plan allows the employees to contribute a percentage of their compensation each year. The Company currently matches 50% of its employees’ contributions, up to 6% of their annual compensation. The Company’s

contributions are recorded as expense in the accompanying consolidated statements of operations and totaled $1.2 million, $822,000 and $496,000 for the years ended December 31, 2018, 2017 and 2016, respectively.

16. Related Party Transactions
GeneOne Life Sciences

The Company owns 1,644,155 shares of common stock in GeneOne as of December 31, 2018; one of the Company's directors, Dr. David B. Weiner, acts as a consultant to GeneOne.

In 2010, the Company entered into a collaboration and license agreement (the "GeneOne Agreement") with GeneOne. Under the GeneOne Agreement, the Company granted GeneOne an exclusive license to the Company's SynCon® universal influenza vaccine delivered with electroporation to be developed in certain countries in Asia (the "Product"). As consideration for the license granted to GeneOne, the Company received an upfront payment of $3.0 million, and is entitled to receive research support, annual license maintenance fees and royalties on net Product sales. The GeneOne Agreement also provides the Company with exclusive rights to supply devices for clinical and commercial purposes (including single use components) to GeneOne for use in the Product. The term of the GeneOne Agreement commenced upon execution and will extend on a country by country basis until the last to expire of all Royalty Periods for the territory (as such term is defined in the GeneOne Agreement) for any Product in that country, unless the GeneOne Agreement is terminated earlier in accordance with its provisions as a result of breach, by mutual agreement, or by GeneOne's right to terminate without cause upon prior written notice.

In 2011, the Company entered into a collaborative development and license agreement (the "Hep Agreement") with GeneOne. Under the Hep Agreement, as originally executed, the Company and GeneOne agreed to co-develop the Company's SynCon® therapeutic vaccines for hepatitis B and C infections (the "Hep Products"). Under the terms of the Hep Agreement, GeneOne will receive marketing rights for the Products in Asia, excluding Japan, and in return will fully fund IND-enabling and initial Phase 1 and 2 clinical studies with respect to the Hep Products. The Company will receive from GeneOne payments based on the achievement of clinical milestones and royalties based on sales of the Hep Products in the licensed territories, retaining all commercial rights to the Hep Products in all other territories. In 2013, the Company amended the Hep Agreement to grant back to the Company the SynCon® therapeutic vaccines targeting hepatitis B, along with all associated rights, from the collaboration in return for certain remuneration including a percentage of license fees. In 2013, the Company further amended the Hep Agreement to in part provide exclusive patent rights to IL-28 technology for use with the Hep Products in Asia, excluding Japan. The Hep Agreement shall terminate upon the later of the expiration or abandonment of the last patent that is a component of the rights or 20 years after the effective date.

In May 2015, the Company entered into a Collaborative Development Agreement with GeneOne to co-develop a DNA vaccine for MERS through Phase 1 clinical trials. Under the terms of the agreement, GeneOne will be responsible for funding all preclinical and clinical studies through Phase 1. In return, GeneOne will receive up to a 35% milestone-based ownership interest in the MERS immunotherapy upon achievement of the last milestone event of completion of the Phase 1 safety and immunogenicity study. The collaborative research program shall terminate upon the completion of activities under the development plan, unless sooner terminated.

In January 2016, the Company and GeneOne amended the Collaborative Development Agreement for MERS to expand the agreement to test and advance the Company's DNA-based vaccine for preventing and treating Zika virus. GeneOne will be responsible for funding all preclinical and clinical studies through Phase 1. In return, GeneOne will receive up to a 35% milestone-based ownership interest in the Zika immunotherapy upon achievement of the last milestone event of the completion of the Phase 1 safety and immunogenicity study. All other agreement terms remain the same.

In December 2017, the Company completed the sale of certain assets related to its compound VGX-1027 to GeneOne for a purchase price of $1.0 million.

Revenue recognized from GeneOne consisted of licensing and other fees from the influenza and Zika collaborations. For the years ended December 31, 2018, 2017 and 2016, the Company recognized revenue from GeneOne of $342,000, $551,000 and $1.2 million, respectively.

Operating expenses recorded from transactions with GeneOne relate primarily to biologics manufacturing and were $7.0 million, $2.3 million and $2.8 million for the years ended December 31, 2018, 2017 and 2016, respectively.

At December 31, 2018 and 2017, the Company had an accounts payable and accrued liability balance of $372,000 and $107,000, respectively, related to GeneOne and its subsidiaries. At December 31, 2018 and 2017, $381,000 and $331,000, respectively, of prepayments made to GeneOne were classified as long-term other assets on the consolidated balance sheet.

Plumbline Life Sciences, Inc.

The Company owns 395,758 shares of common stock in PLS as of December 31, 2018; one of the Company's directors, Dr. David B Weiner, acts as a consultant to PLS.

For the years ended December 31, 2018 and 2017, the Company recognized revenue from PLS of $107,000 and $215,000, respectively. At December 31, 2018 and 2017, the Company had an accounts receivable balance of $478,000 and $370,000, respectively, related to its license agreement with PLS.

The Wistar Institute

One of the Company's directors, Dr. David B. Weiner, is the Executive Vice President and Director of the Vaccine Center of The Wistar Institute ("Wistar").

In March 2016, the Company entered into collaborative research agreements with Wistar for preventive and therapeutic DNA-based immunotherapy applications and products developed by Dr. Weiner and Wistar for the treatment of cancers and infectious diseases. Under the terms of the agreement, the Company will reimburse Wistar for all direct and indirect costs incurred in the conduct of the collaborative research, not to exceed $3.1 million during the five-year term of the agreement. The Company will have the exclusive right to in-license new intellectual property developed in this agreement.

In December 2016 the Company received a $6.1 million sub-grant through Wistar to develop a DNA-based monoclonal antibody against the Zika infection.

The Company is also a collaborator with Wistar on an Integrated Preclinical/Clinical AIDS Vaccine Development grant from the NIAID, awarded in 2015.

Deferred grant funding recognized from Wistar and recorded as contra-research and development expense, which was classified as grant revenue in the prior year, is related to work performed by the Company on the research sub-contract agreements. For the year ended December 31, 2018, the Company recorded $3.3 million as contra-research and development expense from Wistar. For the year ended December 31, 2017, the Company recognized revenue from Wistar of $2.6 million.

Research and development expenses recorded from Wistar relate primarily to the collaborative research agreements and sub-contract agreements for the DARPA Ebola grant (see Note 4). Research and development expenses recorded from Wistar for the years ended December 31, 2018 and 2017 were $1.8 million and $2.3 million, respectively. At December 31, 2018 and 2017, the Company had an accounts receivable balance of $258,000 and $117,000, respectively, and an accounts payable and accrued liability balance of $554,000 and $820,000, respectively, related to Wistar.

17. Quarterly Financial Information (Unaudited)

The following is a summary of the quarterly results of operations of the Company for the years ended December 31, 2018 and 2017 (unaudited):

	Quarter Ended December 31, 2018	Quarter Ended September 30, 2018	Quarter Ended June 30, 2018	Quarter Ended March 31, 2018
Consolidated Statements of Operations:				
Revenue:				
Revenue under collaborative research and development arrangements	$2,372,600	$1,813,287	$24,385,852	$1,289,046
Revenue under collaborative research and development arrangements with affiliated entity	56,207	184,990	60,319	148,008
Grants and miscellaneous revenue	73,817	2,591	2,590	92,590
Total revenues	2,502,624	2,000,868	24,448,761	1,529,644
Operating Expenses:				
Research and development	26,365,647	21,851,858	22,462,620	24,577,751
General and administrative	5,636,141	6,791,693	7,189,310	9,698,015
Total operating expenses	32,001,788	28,643,551	29,651,930	34,275,766
Loss from operations	(29,499,164)	(26,642,683)	(5,203,169)	(32,746,122)
Interest and other income, net	(169,300)	380,987	396,681	312,523
Change in fair value of common stock warrants	—	228,665	259,971	(127,841)
Gain (loss) from investment in affiliated entity	(3,293,741)	1,017,359	(2,092,608)	2,380,423
Net loss before provision for income taxes	$(32,962,205)	$(25,015,672)	$(6,639,125)	$(30,181,017)
Provision for income taxes	—	—	—	(2,169,811)
Net loss	$(32,962,205)	$(25,015,672)	$(6,639,125)	$(32,350,828)
Net loss per share				
Basic	$(0.34)	$(0.27)	$(0.07)	$(0.36)
Diluted	$(0.34)	$(0.27)	$(0.08)	$(0.36)

	Quarter Ended December 31, 2017	Quarter Ended September 30, 2017	Quarter Ended June 30, 2017	Quarter Ended March 31, 2017
Consolidated Statements of Operations:				
Revenue:				
Revenue under collaborative research and development arrangements	$7,409,214	$351,272	$16,358,316	$4,288,586
Revenue under collaborative research and development arrangements with affiliated entity	226,486	129,133	176,879	233,330
Grants and miscellaneous revenue	980,443	1,456,216	2,797,647	5,240,233
Grants and miscellaneous revenue from affiliated entity	171,091	707,922	1,079,282	614,036
Total revenues	8,787,234	2,644,543	20,412,124	10,376,185
Operating Expenses:				
Research and development	24,641,124	25,510,239	23,878,751	24,542,504
General and administrative	8,033,899	6,319,775	6,169,106	7,767,589
Gain on sale of assets	(1,000,000)	—	—	—
Total operating expenses	31,675,023	31,830,014	30,047,857	32,310,093
Loss from operations	(22,887,789)	(29,185,471)	(9,635,733)	(21,933,908)
Interest and other income, net	509,266	463,346	300,021	340,341
Change in fair value of common stock warrants	579,546	423,296	(312,500)	116,477
Gain (loss) from investment in affiliated entity	292,798	(5,835,741)	169,096	(1,608,817)
Net loss	$(21,506,179)	$(34,134,570)	$(9,479,116)	$(23,085,907)
Net loss per share				
Basic	$(0.24)	$(0.39)	$(0.13)	$(0.31)
Diluted	$(0.24)	$(0.40)	$(0.13)	$(0.31)

18. Subsequent Events

On February 19, 2019 and March 1, 2019, the Company completed a private placement of $78.5 million aggregate principal amount of its 6.50% convertible senior notes due 2024 (the “Notes”). The notes were sold in a private offering to qualified institutional buyers pursuant to Rule 144A under the Securities Act of 1933, as amended. The Company estimates that the net proceeds from the offering were approximately $75.8 million, after deducting the initial purchasers' discount and estimated offering expenses payable by the Company.

The notes will be senior unsecured obligations of the Company and will accrue interest payable in cash semi-annually in arrears at a rate of 6.50% per annum. The notes will mature on March 1, 2024, unless earlier converted, redeemed or repurchased. Prior to the close of business on the business day immediately preceding November 1, 2023, the notes will be convertible at the option of the holders only upon the satisfaction of certain circumstances. Thereafter, the notes will be convertible at the option of the holders at any time until the close of business on the scheduled trading day immediately before the maturity date. Upon conversion, the Company will pay or deliver, as the case may be, cash, shares of its common stock or a combination of cash and shares of its common stock, at its election. The initial conversion rate will be 185.8045 shares per $1,000 principal amount of notes (equivalent to an initial conversion price of approximately $5.38 per share), subject to adjustment upon the occurrence of specified events.

The Company may not redeem the notes prior to March 1, 2022. On or after March 1, 2022, the Company may redeem all, or any portion, of the notes for cash if the last reported sale price per share of the Company's common stock exceeds 130% of the conversion price on (i) each of at least 20 trading days (whether or not consecutive) during the 30 consecutive trading days ending on, and including, the trading day immediately before the Company sends the related redemption notice; and (ii) the trading day immediately before the date the Company sends such redemption notice. The redemption price will be equal to 100% of the principal amount of the notes to be redeemed, plus accrued and unpaid interest to, but excluding, the redemption date.

On February 21, 2019, the Company announced the completion of a spin-out of its previously wholly-owned subsidiary Geneos Therapeutics, Inc. (“Geneos”). On February 21, 2019, Geneos completed the initial closing of a preferred stock financing with outside investors. The Company participated in the preferred stock financing, which was led by an outside

investor. The terms of the stock purchase agreement include commitments for additional investments by the Company and the other investors upon the occurrence of a specified regulatory event, as well as an option on the part of the Company and the other investors to purchase additional preferred stock of Geneos upon the achievement of a specified milestone. Following the initial closing of the financing transaction, the Company continues to hold a majority of the outstanding equity, on an as-converted to common stock basis, of Geneos. The Company's ownership percentage of Geneos would decrease in the event of additional purchases of preferred stock of Geneos by the other investors under the terms of the stock purchase agreement.