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

FORM 8-K

CURRENT REPORT

Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934.

Date of Report: May 8, 2020
(Date of earliest event reported)

Oragenics, Inc.
(Exact name of registrant as specified in its charter)

FL	001-32188	59-3410522
(State or other jurisdiction of incorporation)	(Commission File Number)	(IRS Employer Identification Number)

4902 Eisenhower Boulevard, Suite 125 Tampa, FL	33634
(Address of principal executive offices)	(Zip Code)

813-286-7900
(Registrant's telephone number, including area code)

(Former Name or Former Address, if changed since last report)

Check the appropriate box below if the Form 8-K filing is intended to simultaneously satisfy the filing obligation of the registrant under any of the following provisions:

[ ] Written communications pursuant to Rule 425 under the Securities Act (17 CFR 230.425)

[ ] Soliciting material pursuant to Rule 14a-12 under the Exchange Act (17 CFR 240.14a-12)

[ ] Pre-commencement communications pursuant to Rule 14d-2(b) under the Exchange Act (17 CFR 240.14d-2(b))

[ ] Pre-commencement communications pursuant to Rule 13e-4(c) under the Exchange Act (17 CFR 240.13e-4(c))

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Common Stock	OGEN	NYSE American

Indicate by check mark whether the registrant is an emerging growth company as defined in Rule 405 of the Securities Act of 1933 (§230.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (§240.12b-2 of this chapter).

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. [ ]

Introductory Note

On May 1, 2020, Oragenics, Inc. a Florida corporation ("Oragenics" or the "Company"), completed its acquisition of Noachis Terra Inc., a privately-held Delaware corporation ("Noachis Terra"), dedicated to the development and commercialization of a vaccine candidate to provide specific immunity from the novel Severe Acute Respiratory Syndrome coronavirus (SARS-CoV-2), which causes the coronavirus disease 2019 ("COVID-19"), in accordance with the terms of a Stock Purchase Agreement, dated as of May 1, 2020 (the "Stock Purchase Agreement"), by and among the Company, and Mr. Joseph Hernandez, the sole shareholder of Noachis Terra. On May 1, 2020, pursuant to the Stock Purchase Agreement, the Company acquired from Mr. Hernandez one hundred percent (100%) of the issued and outstanding common stock of Noachis Terra, and Noachis Terra became a wholly-owned subsidiary of the Company (the "Transaction"). The Company is filing this Current Report on Form 8-K to update the description of the Company's business and risk factors after giving effect to the Transaction.

Item 7.01 Regulation FD Disclosure.

The Company will be making an investor presentation (the "Investor Presentation") on May 8, 2020 which includes updated information on its vaccine product candidate arising from the Transaction. The Company also expects to use the Investor Presentation from time to time thereafter in connection with presentations to potential investors, industry analysts and others. A copy of the Investor Presentation is attached hereto as Exhibit 99.1 and is incorporated herein by reference. Additionally, the Investor Presentation will be available under the "Presentations" tab in the "News and Media" section of the Company's website, located at www.oragenics.com.

By filing this Current Report on Form 8-K and furnishing the information contained herein, the Company makes no admission as to the materiality of any information in this report that is required to be disclosed solely by reason of Regulation FD.

The information contained in the Investor Presentation is summary information that is intended to be considered in the context of the Company's Securities and Exchange Commission ("SEC") filings and other public announcements that the Company may make, by press release or otherwise, from time to time. The Company undertakes no duty or obligation to publicly update or revise the information contained in this report, although it may do so from time to time as its management believes is warranted. Any such updating may be made through the filing of other reports or documents with the SEC, through press releases or through other public disclosure.

The information presented in Item 7.01 of this Current Report on Form 8-K and Exhibit 99.1 shall not be deemed to be "filed" for purposes of Section 18 of the Securities Exchange Act of 1934, as amended (the "Exchange Act"), or otherwise subject to the liabilities of that section, unless the Company specifically states that the information is to be considered "filed" under the Exchange Act or specifically incorporates it by reference into a filing under the Securities Act of 1933, as amended, or the Exchange Act.

Item 8.01. Other Events.

Cautionary Note Regarding Forward Looking Statements

This Current Report on Form 8-K, along with other documents that are publicly disseminated by us, contains or might contain forward-looking statements and information within the meaning of the Securities Exchange Act of 1934, as amended (the "Exchange Act"). All statements and information included in this report and in any subsequent filings made by us with the Securities and Exchange Commission (the "SEC") other than statements of or information relating to historical fact, that address activities, events or developments that we or our management expect, believe or anticipate will or may occur in the future are forward-looking statements or information. These statements and information represent our reasonable judgment on the future based on various factors and using numerous assumptions and are subject to known and unknown risks, uncertainties and other factors that could cause our actual results and financial position to differ materially. We claim the protection of the safe harbor for forward-looking statements and information provided in the Private Securities Litigation Reform Act of 1995, Section 27A of the Securities Act and Section 21E of the Exchange Act. Examples of forward-looking statements include: (i) projections of revenue, earnings, capital structure and other financial items, (ii) statements of our plans and objectives, (iii) statements of expected future economic performance, and (iv) assumptions underlying statements regarding us or our business. Forward-looking statements can be identified by, among other things, the use of forward-looking language, such as "believes," "expects," "estimates," "may," "will," "should," "could," "seeks," "plans," "intends," "anticipates" or "scheduled to" or the negatives of those terms, or other variations of those terms or comparable language, including, notably, language concerning the "impact" or "limitations" relating to COVID-19, or by discussions of strategy or other intentions, particularly as they relate to the development and funding of our new TerraCoV2 vaccine product candidate.

Forward-looking statements and information are subject to known and unknown risks, uncertainties and other factors that could cause the actual results to differ materially from those contemplated by the statements. The forward-looking statements and information are based on various factors and was derived using numerous assumptions. Important factors that could cause our actual results to be materially different from the forward-looking statements and information include the following risks and other factors discussed elsewhere in this Current Report on Form 8-K, including the section entitled "Risk Factors." These factors include:

- our financial capacity and performance, including our ability to obtain funding necessary to do the research, development, manufacture and commercialization of any one or all of our product candidates;
- the timing, progress and results of clinical trials of our product candidates, including statements regarding the timing of initiation and completion of preclinical studies or clinical trials or related preparatory work, the period during which the results of the trials will become available and our research and development programs;
- the timing of any submission of filings for regulatory approval of our product candidates and our ability to obtain and maintain regulatory approvals for our product candidates for any indication;

- our expectations regarding the potential benefits, activity, effectiveness and safety of our product candidates;
- our expectations regarding the size of the patient populations, market acceptance and opportunity for and clinical utility of our product candidates, if approved for commercial use;
- our manufacturing capabilities and strategy, including the, scalability and commercial viability of our manufacturing methods and processes, and those of our contractual partners;
- our expectations regarding the scope of any approved indications for our product candidates;
- our ability to successfully commercialize our product candidates;
- the potential benefits of and our ability to maintain our relationships and collaborations with the NIAID, the NIH, Precigen, ILH Holdings and other potential collaboration or strategic relationships;
- our ability to use our Lantibiotic platform to develop future product candidates;
- our estimates of our expenses, ongoing losses, future revenue, capital requirements and our needs for or ability to obtain additional funding, including any application for future grants or funding;
- our ability to identify, recruit and retain key personnel;
- our ability to obtain, retain, protect and enforce our intellectual property position for our product candidates, and the scope of such protection;
- our ability to advance the development of our new TerraCoV2 vaccine product candidate under the timelines and in accord with the milestones it projects;
- our inability to achieve success in our identification of lantibiotic homologs or the manufacture and nonclinical testing of our lantibiotic product candidates;
- our need to comply with extensive and costly regulation by worldwide health authorities, who must approve our product candidates prior to substantial research and development and could restrict or delay the future commercialization of certain of our product candidates;
- our ability to successfully complete preclinical and clinical development of, and obtain regulatory approval of our product candidates and commercialize any approved products on our expected timeframes or at all;
- the safety, efficacy and benefits of our product candidates;
- the content and timing of submissions to and decisions made by the FDA, other regulatory agencies and nongovernmental bodies and actors, such as investigational review boards;
- the effects of government regulation and regulatory developments, and our ability and the ability of the third parties with whom we engage to comply with applicable regulatory requirements;
- the capacities and performance of our suppliers and manufacturers and other third parties over whom we have limited control;
- our ability to maintain our listing on the NYSE American;
- the impact of the COVID-19 pandemic on our financial condition and business operations and our ability to continue research and development for existing product candidates on previously-projected timelines or in accord with ordinary practices, as well as the broader governmental, global health and macro- and microeconomic responses to and consequences of the pandemic;
- our competitive position and the development of and projections relating to our competitors or our industry; and
- the impact of laws and regulations, including those that may not yet exist.

We caution investors that actual results or business conditions may differ materially from those projected or suggested in forward-looking statements as a result of various factors including, but not limited to, those described above and in the Risk Factors section of this Current Report on Form 8-K. We cannot assure you that we have identified all the factors that create uncertainties. Moreover, new risks emerge from time to time and it is not possible for our management to predict all risks, nor can we assess the impact of all risks on our business or the extent to which any risk, or combination of risks, may cause actual results to differ from those contained in any forward-looking statements. Readers should not place undue reliance on forward-looking statements. Except as required by applicable law, we undertake no obligation to publicly release the result of any revision of these forward-looking statements to reflect events or circumstances after the date they are made or to reflect the occurrence of unanticipated events.

DESCRIPTION OF THE COMPANY'S BUSINESS

As used in this section entitled "Description of the Company's Business," references to "we," "our," "us," "the Company" and "Oragenics" refer to Oragenics, Inc. and includes, where appropriate, its wholly-owned subsidiaries, unless context requires otherwise.

Overview

We are focused on the creation of the TerraCoV2 immunization product candidate to combat the novel coronavirus pandemic and the further development of effective treatments for novel antibiotics against infectious disease and oral mucositis.

Our SARS-CoV-2 Vaccine Product Candidate—Pre-Clinical

In May 2020, we entered into a Stock Purchase Agreement pursuant to which the Company acquired one hundred percent (100%) of the total issued and outstanding common stock of Noachis Terra, which became our wholly-owned subsidiary. We are now dedicated to the development and commercialization of a vaccine product candidate to provide specific, lifetime immunity from the novel Severe Acute Respiratory Syndrome coronavirus ("SARS-CoV-2"), which causes the coronavirus disease 2019 ("COVID-19"). We are now party to a worldwide, nonexclusive intellectual property and biological materials license agreement with the National Institute of Allergy and Infectious Diseases ("NIAID"), an institute within the National Institutes of Health ("NIH"), relating to certain research, patent applications and biological materials involving prefusion coronavirus spike proteins and their use in the development and commercialization of vaccine to provide specific, lifetime immunity from SARS-CoV-2.

Coronaviruses are a family of viruses that can, when transmitted to humans, lead to upper-respiratory infections. Recent clinical reports also suggest that the SARS-CoV-2 virus can affect other bodily-system, including the nervous, cardiovascular, gastrointestinal and renal systems. Among the recent iterations of coronaviruses to move from animal to human carriers is SARS-CoV-2 (often referred to as COVID-19), which, beginning in Wuhan, China, in late 2019, caused a global pandemic due to its rapid spread and the relatively high mortality rate of COVID-19 (as compared to the seasonal influenza). By the end of April 2020, World Health Organization estimates indicate the number of worldwide COVID-19 infections exceeded 2,500,000 and the number of deaths directly attributed to COVID-19 approached 200,000. Currently, no governmental regulatory authority has approved an immunization specifically targeting SARS-CoV-2 or COVID-19. We intend to combine the research, patent applications and biological materials covered by our NIH license with our existing clinical research and manufacturing capabilities to respond rapidly to this ongoing, global, public health crisis.

Our Oral Mucositis Product Candidate-Clinical

In June of 2015, we entered into a worldwide Exclusive Channel Collaboration Agreement ("Oral Mucositis ECC") with Precigen, Inc. ("Precigen") (formerly known as Intrexon Corporation) and Intrexon Actobiotics NV, a wholly-owned subsidiary of Intrexon, pursuant to which we obtained certain exclusive rights to AG013 as a potential treatment of oral mucositis, or OM for cancer patients, which we intend to continue to develop. AG013, is an oral rinsing solution system designed to deliver human Trefoil Factor 1 (hTFF1) to protect and regenerate damaged mucosal lining of the oral cavity.

OM results in a painful inflammation and mucosal ulceration in the lining of the oral cavity, throat and esophagus and is one of the most commonly reported adverse events associated with cancer chemotherapy. Approximately 770,000 patients annually in the US are at an increased risk of developing OM according to cancer statistics provided by the Center for Disease Control (CDC) in 2017. OM has a negative effect on patient well-being and if severe, negatively affects adherence to a patient's cancer treatment regimen. At present, we are not aware of any drug that is approved to prevent the condition broadly and current therapies are primarily palliative in nature, only addressing symptom relief but not treating the underlying causes of the condition.

AG013 has been granted Orphan Drug status in the European Union. In November of 2016, the United States Food and Drug Administration (the "FDA") granted Fast Track designation for AG013, and we believe it may be eligible for Biologic License Application ("BLA") exclusivity as well. The FDA's fast track therapy designation program is intended to facilitate the development and expedite the review of drug candidates intended for the treatment of serious or life-threatening conditions and that demonstrate the potential to address unmet medical needs for those conditions. Under this program, FDA can, for example, review portions of a New Drug Application or BLA for a drug candidate before the entire application is complete, thus potentially beginning the review process at an earlier time. In Europe, orphan status for AG013 allows us to discuss an accelerated development program with the European Medicines Agency (EMA) which may influence the duration of the program prior to marketing approval.

We developed a Phase 2 protocol for AG013 with the FDA under the fast track designation. In August of 2016, we received feedback from the FDA in response to our Type C meeting and the pursuit of a Phase 2 trial on AG013 for the treatment of oral mucositis in head and neck cancer patients. We filed an Investigational New Drug ("IND") update in March 2017 and we initiated the Phase 2 study with AG013 in the United States in 2017 and in Europe in 2018. The Phase 2 trial was a double-blind, placebo-controlled, 2-arm, multi-center trial in which approximately 200 patients were randomized in a 1:1 ratio to receive either a placebo or AG013 following meals, beginning on the first day of chemoradiation therapy and continuing through the course of cancer treatment. The study enrolled patients receiving chemoradiation for treatment of head and neck cancer for 7 to 9 weeks. The clinical trial was conducted at 60 clinical sites across the United States and Europe. The purpose of the Phase 2 study (NCT03234465) was to evaluate the efficacy (preventing the occurrence and shortening the duration of severe oral mucositis ("SOM"), safety and tolerability of topically administered AG013 rinse system compared to the placebo for reducing the incidence and severity of OM in patients undergoing traditional chemoradiation for the treatment of head and neck cancer. Key efficacy measures included collection of data regarding the duration, time to development, and overall incidence of grades 3 and 4 OM (World Health Organization scale used) during the active treatment phase, beginning from the start of chemoradiation therapy until 2 weeks following its completion.

On December 2, 2019 we announced completion of enrollment in our Phase 2 clinical trial. On April 15, 2020, we announced that early top-line results of the Phase 2 clinical trial did not demonstrate statistical significance on the primary endpoint of severe oral mucositis duration when compared to a placebo. We expect to receive more detailed analyses of the Phase 2 clinical trial results to determine whether AG013 may have potential efficacy for sub-patient populations.

Our Antibiotic Product Candidate-Preclinical

Members of our scientific team discovered that a certain bacterial strain produces MU1140, a molecule belonging to the novel class of antibiotics known as lantibiotics. Lantibiotics, such as MU1140, are highly modified peptide antibiotics made by a small group of Gram-positive bacterial species. Approximately 60 lantibiotics have been discovered, to date. We believe lantibiotics are generally recognized by the scientific community to be potent antibiotic agents.

In nonclinical testing, MU1140 has shown activity against all Gram-positive bacteria against which it has been tested, including those responsible for a number of healthcare associated infections, or HAIs. A high percentage of hospital-acquired infections are caused by highly resistant bacteria such as methicillin-resistant Staphylococcus aureus (MRSA) or multidrug-resistant Gram-negative bacteria. We believe the need for novel antibiotics is increasing as a result of the growing resistance of target pathogens to existing FDA approved antibiotics on the market.

Lantibiotics have been difficult to investigate for their clinical usefulness as therapeutic agents in the treatment of infectious diseases due to a general inability to produce or synthesize sufficient quantities of pure amounts of these molecules. Traditional fermentation methods can only produce minute amounts of the lantibiotic.

In June 2012, we entered into the Lantibiotic Exclusive Channel Collaboration agreement ("Lantibiotic ECC") with Precigen for the development and commercialization of the native strain of MU1140 and related homologs using Precigen's advanced transgene and cell engineering platforms. Through our work with Precigen, we have been able to produce a significant increase in the fermentation titer of MU1140 compared to standard fermentation methods and have discovered a new purification process for MU1140. Our work with Precigen generated a substantial number of homologs of MU1140. In January Precigen consummated a reorganization of its ongoing API fermentation operations and assets into ILH Holdings, Inc. which at the time was an affiliate of Precigen. In connection with the reorganization, Precigen assigned the Lantibiotic ECC and related stock issuance agreements to ILH Holdings. Following such reorganization, Precigen divested certain of its assets to TS Biotechnology Holdings, LLC which included ILH Holdings and shares of Oragenics securities held by Precigen. As a result of such change by Precigen we expect to continue our research and development and collaboration efforts with ILH Holdings to develop potential derivatives of the MU1140 molecule using genetically modified bacteria.

In our pre-clinical studies to support a potential IND filing with the FDA, we tested a total of six homologs of MU1140 for certain compound characteristics, including but not limited to: drug activity (based on minimum inhibitory concentration or "MIC") equal or better than "standard of care" drugs against certain drug-resistant bacteria, safety, toxicity, stability, and manufacturability. An animal study specifically evaluated homolog efficacy in relation to survival, measurable amounts of *Clostridium difficile ("C. diff")* colony forming units, and toxin levels. Three homologs demonstrated promising results with one homolog, OG253 achieving a 100% survival rate throughout the entire study in contrast to an approximately 30% survival rate for the vancomycin positive control.

Based on these early results, we selected a lead candidate, OG253, for which we had a pre-IND meeting with the FDA in November of 2015 regarding the pursuit of an IND for OG253. Following additional research and development on second generation lantibiotics, in August of 2016, we opted to select a second generation lantibiotic, OG716, for treatment of *C. diff* as our new lead candidate. OG716 is a new, orally-active homolog, that has exhibited positive results in an animal model for potential treatment of *C. diff*. Generated from our MU1140 platform, this new lantibiotic showed promising efficacy in reducing clinically relevant *C. diff* infections as measured by increased animal survival and decreased relapse as well as reduced production of toxins A & B and *C. diff* spores.

The timing of the filing of an IND regarding OG716 is subject to our having sufficient available human, material and financing capital, which includes research subjects, both animal and human, given all of our anticipated needs and expected requirements in connection with our ongoing research and development initiatives. We will continue to advance the OG716 program to the IND filing based on the availability of both human and financial capital. Based upon the current funding available we will continue to conduct some of the requisite studies. While we commenced certain of these studies at the end of 2019, we expect to focus on efficient and cost-effective manufacturing of the product to support and be able to conduct further broad- based studies.

Product Candidates.

Through our wholly-owned subsidiary, Noachis Terra, we intend to begin the research and development stage for our new TerraCoV2 vaccine product candidate. We hold a nonexclusive, worldwide intellectual property license agreement for certain research, patent applications and biological materials relating to the use of prefusion coronavirus spike proteins for the development and commercialization of a vaccine for SARS-CoV-2.

Additionally, we are currently developing AG013 in connection with the treatment of Oral Mucositis and a product candidate, OG716, as an antibiotic, as well as other homolog antibiotic product candidates. We have an exclusive worldwide license from Precigen and its wholly owned subsidiary, Intrexon Actobiotics NV to use their intellectual property to develop AG013 for the treatment of oral mucositis in patients undergoing treatment for cancer. Effective January 1, 2018, Precigen assigned its interest in the license agreement to a wholly owned subsidiary, Precigen ActoBio Inc. (formerly known as ActoBio Therapeutics, Inc.). We also have an exclusive, worldwide license from ILH Holdings (as an assignee of Precigen) to use its technology to develop lantibiotics. We seek to protect our product candidates through patents and patent applications pursuant to the terms of our license agreements.

Product/Candidate	Description	Application	Status
TerraCoV2	Vaccine candidate (plasmid + adjuvant) to provide lifetime immunity from SARS-CoV-2	Broad, community-based vaccine immunity and/or therapeutic	Pre-clinical
AG013	*Lactococcus lacti* bacterial strain genetically modified to include the gene for hTTF1	Treatment of oral mucositis in cancer patients	Phase 2 completed. Awaiting full results analysis.
OG716	A homolog of MU1140: Member of lantibiotic class of antibiotics	Healthcare-associated infections	Nonclinical testing

Our SARS-CoV-2 Vaccine Product Candidate

In May 2020, we entered into a Stock Purchase Agreement with Mr. Joseph Hernandez, the sole shareholder of Noachis Terra pursuant to which the Company acquired one hundred percent (100%) of the total issued and outstanding common stock of Noachis Terra. Noachis Terra became a wholly-owned subsidiary of the Company, and is focused on the development and commercialization of the TerraCoV2 vaccine product candidate to provide specific, lifetime immunity from SARS-CoV-2, which causes COVID-19. We now hold a worldwide, nonexclusive intellectual property and biological materials license from the NIH relating to the use of prefusion coronavirus spike protein for the development and commercialization of an immunization for SARS-CoV-2. We intend to further the preclinical and clinical-stage research and development efforts related to the SARS-CoV-2 vaccine product candidate.

Market Opportunity

Coronaviruses are a large family of viruses that, when transmitted to humans from their ordinary animal carriers, frequently cause upper-respiratory tract illnesses. In recent years, scientists have identified a series of human-transmitted coronaviruses, including the severe acute respiratory syndrome (“SARS”) coronavirus (SARS-CoV), the Middle East respiratory syndrome (“MERS”) coronavirus (“MERS-CoV”), and, most recently, the novel SARS coronavirus, SARS-CoV-2, which causes the coronavirus disease 2019, COVID-19. First identified in China in late 2019, SARS-CoV-2 (often referred to as COVID-19) rapidly spread around the world, and by March 2020, the World Health Organization had declared COVID-19 a global pandemic. Although early data suggests mortality rates for COVID-19 are less than those for MERS and SARS, they are significantly higher than those for seasonal influenza. In response to the pandemic, governments imposed mandatory business shutdowns and stay-at-home orders to slow transmission rates, particularly in densely-populated areas. In particular, individuals who are sixty-five (65) years of age or older or have underlying conditions of cardiovascular disease, diabetes, hypertension, cancer and chronic respiratory disease are most at risk for COVID-19, with the World Health Organization reporting a mortality rate greater than twenty-one percent (21%) for individuals over the age of eighty (80). By the end of April 2020, estimates of the number of worldwide COVID-19 infections exceeded 2,500,000, while estimates of the number of deaths directly attributed to COVID-19 approached 200,000. Moreover, government restrictions have crippled economic output, with the International Monetary Fund projecting the economic impact of COVID-19 could be as severe as the worldwide economic depression that occurred in the late 1920s and 1930s, particularly if COVID-19 infection rates continue or reemerge as SARS-CoV-2 continues to evolve.

Because current research and models are unable to accurately predict the mutation of the SARS-CoV-2, and thus, the rate at which future global COVID-19 infections may persist or reemerge, international governments, private businesses and nongovernmental organizations are desperately searching—and paying—for solutions carrying potential to remedy, hinder, or prevent entirely, the impact of the SARS-CoV-2. For example, since the emergence of SARS-CoV-2, the United States government, through the Biomedical Advanced Research and Development Authority ("BARDA"), alone, has agreed to commit nearly $1,000,000,000 in clinical research and development funding for the development of a vaccine product candidate to remedy or prevent SARS-CoV-2. Although a variety of vaccine and therapeutic product candidates are in development, neither the FDA nor any other major medical regulatory agency has approved a vaccine product candidate for the prevention of SARS-CoV-2 or COVID-19 in humans. However, the FDA has indicated that it, in addition to utilizing its traditional accelerated regulatory approval tools, such as the "Fast Track" designation, will work with sponsors to expedite clinical trials for COVID-19 medical countermeasures. Thus, both the opportunity and funding mechanisms exist to support the development and commercialization of a vaccine product candidate for the SARS-CoV-2, which can be marketed to both public and private payers or users around the world. As described further, below, such global applications and opportunities are covered by our NIH license.

Our Solution

To begin clinical research and development efforts for our TerraCoV2 vaccine product candidate to provide specific, lifetime immunity from SARS-CoV-2, often referred to as COVID-19.

Our Strategy

We have a nonexclusive, worldwide license to certain intellectual property and biological materials relating to the development of the TerraCoV2 vaccine product candidate for SARS-CoV-2, and subject to our ability to obtain additional funding to accelerate development of TerraCoV2, including the acceptance of our application for BARDA funding and NIH operational support and funding, we expect to engage in further research and development of TerraCoV2, with the goal of moving TerraCoV2 expeditiously forward to a Phase 1 clinical trial by the end of 2020 or early 2021. We have identified a series of possible adjuvants to supplement the efficacy of the vaccine product candidate and considered multiple contract research organizations and contract development and manufacturing organizations that will be able to serve as partners through Phase 1 clinical trials. If successful, and subject to future events and developments, including, but not limited to, regulatory oversight and approval, our financial health and capacity and industry competition, we would expect to initiate Phase 2 clinical trials in 2021 and thereafter proceed to Phase 3 clinical trials, with the aim of submitting a Biologics License Application to the FDA as soon as possible.

Regulatory Status

As of May 2020, we hold a nonexclusive, worldwide intellectual property license covering certain intellectual property and biological materials that we intend to use in the development of TerraCoV2. An application to BARDA for funding to support our research, development and manufacturing of TerraCoV2 is currently pending. Additionally, in Q4 2020, we intend to file an Investigational New Drug application with the FDA for TerraCoV2. To further accelerate development, we also intend to explore the possibility, benefits, and other considerations of participating in the FDA's Coronavirus Treatment Acceleration Program, the NIH's Accelerating COIVD-19 Therapeutic Interventions and Vaccines partnership, and/or collaborating with the NIAID's Vaccine Research Center. In addition, we intend to seek other sources of funding and capital for TerraCoV2's development process, including from government agencies, academic institutions and nongovernmental and nonprofit organizations.

Manufacturing

We have identified multiple, potential contract research organizations and contract development and manufacturing organizations to serve as development partners for TerraCoV2, each of which are prepared to proceed with pre-clinical research through completion of clinical trials in accordance with "current good manufacturing practices" (cGMP) guidelines, as outlined by the International Conference of Harmonization (ICH) and FDA.

Our Oral Mucositis (OM) – Product Candidate

On June 9, 2015, we entered into our Oral Mucositis ECC with Precigen and Intrexon Actobiotics NV, a wholly-owned subsidiary of Precigen, through which we intend to research, develop and commercialize products, including the continued development and commercialization of AG013, for use in the treatment of oral mucositis in humans through the administration of an effector via genetically modified bacteria, but, in any case, excluding the delivery of anti-cancer effectors for the purpose of treatment or prophylaxis of cancer (collectively, the "Program"). Contemporaneously with the Oral Mucositis ECC, we also entered into a Stock Issuance Agreement (the "SIA") with Precigen which provided for the payment of a technology access fee and the potential future issuance by us of our common stock to Precigen upon the achievement of designated development milestones. We issued a Convertible Note in the amount of $5,000,000 as payment of the technology access fee associated with the Oral Mucositis ECC which was payable, at our option, in cash or shares of our common stock. The convertible note, including accrued interest, was repaid in December 2015 through the issuance of 338,101 shares of our common stock.

In November of 2017 the Oral Mucositis ECC was amended to: (i) consolidate the development milestone payments into one payment of $27,500,000 being due six months after receiving FDA approval of a New Drug Application (or equivalent regulatory action in a foreign jurisdiction); (ii) reduce the sublicense revenue percentage we would have had to pay from 50% to 25% of sublicensing revenue; and (iii) revise the field in which we have exclusive rights to our Oral Mucositis product candidate for the treatment of Oral Mucositis to clarify that we have an exclusive right for the treatment of Oral Mucositis in humans regardless of etiology. The November amendment superseded an amendment to the Oral Mucositis ECC in May 2017. Effective January 1, 2018, Precigen assigned its interest in the Oral Mucositis ECC and related SIA to its wholly owned subsidiary, ActoBio Therapeutics, Inc.

Market Opportunity

In the United States, upwards of 770,000 patients with cancer, including breast, colorectal, non-small cell lung, head & neck, and stem cell cancers will receive cytotoxic chemotherapy and are at increased risk of developing oral mucositis (CDC, 2017). The incidence of oral mucositis in cancer populations varies based on the type of cancer and chemotherapy regimen and treatment duration used to treat the cancer. For example, oral mucositis almost always occurs in patients with head and neck cancer treated with chemotherapy and radiation therapy (greater than 80% incidence of mucositis) and is common in patients undergoing high dose chemotherapy and hematopoietic cell transplantation, where the incidence and severity of oral mucositis depends greatly on the nature of the conditioning regimen used for myeloablation.

AG013 has been granted Orphan Drug status in the European Union. In November of 2016, the United States Food and Drug Administration (the "FDA") granted Fast Track designation for AG013, and we believe it may be eligible for Biologic License Application ("BLA") exclusivity as well. The FDA's fast track therapy designation program is intended to facilitate the development and expedite the review of drug candidates intended for the treatment of serious or life-threatening conditions and that demonstrate the potential to address unmet medical needs for those conditions. Under this program, FDA can, for example, review portions of a New Drug Application or BLA for a drug candidate before the entire application is complete, thus potentially beginning the review process at an earlier time.

Our Solution

To continue research and development of AG013 as an effective treatment for oral mucositis.

Our Strategy

In collaboration with Precigen and subject to our ability to raise additional capital to pursue further development of AG013, we expect to assess the data from our recently concluded clinical trial toward the goal of determining the extent of continued clinical development of AG013.

Regulatory Status

AG013 has been granted Orphan Drug status in the European Union and we believe it may be eligible for Biologic License Application exclusivity. In November 2016, the U.S. FDA granted Fast Track designation for AG013.

We developed a Phase 2 protocol for AG013 with the FDA under the fast track designation. In August of 2016, we received feedback from the FDA in response to our Type C meeting and the pursuit of a Phase 2 trial on AG013 for the treatment of oral mucositis in head and neck cancer patients. We filed an Investigational New Drug ("IND") update in March 2017 and we initiated the Phase 2 study with AG013 in the United States in 2017 and in Europe in 2018. The Phase 2 trial was a double-blind, placebo-controlled, 2-arm, multi-center trial in which approximately 200 patients were randomized in a 1:1 ratio to receive either a placebo or AG013 following meals, beginning on the first day of chemoradiation therapy and continuing through the course of cancer treatment. The study enrolled patients receiving chemoradiation for treatment of head and neck cancer for 7 to 9 weeks. The clinical trial was conducted at clinical sites across the United States and Europe. The purpose of the Phase 2 study (NCT03234465) was to evaluate the efficacy (preventing the occurrence and shortening the duration of severe oral mucositis ("SOM"), safety and tolerability of topically administered AG013 rinse compared to the placebo for reducing the incidence and severity of OM in patients undergoing traditional chemoradiation for the treatment of head and neck cancer. Key efficacy measures include collection of data regarding the duration, time to development, and overall incidence of OM (World Health Organization scale used) during the active treatment phase, beginning from the start of chemoradiation therapy until 2 weeks following its completion. On December 2, 2019 we announced completion of enrollment in our Phase 2 clinical trial. As of February 27, 2020, all 200 randomized patients, have completed the Phase 2 clinical trial. On April 15, 2020, we announced that early top-line results of the Phase 2 clinical trial did not demonstrate statistical significance on the primary endpoint of severe oral mucositis duration when compared to a placebo. AG013, however, was found to be safe based on a review of topline adverse event information. We are currently awaiting a more detailed analysis on AG013's potential efficacy for sub-patient populations.

Manufacturing

We use contract manufacturing firms to produce our investigational product candidate AG013 in accordance with "current good manufacturing practices" (cGMP) guidelines outlined by the International Conference of Harmonization (ICH) and FDA.

OG716, Homologs of MU1140 and Other Lantibiotics

In the course of research and development, MU1140 was found to be a potent antibiotic that is naturally produced by the parent of the SMaRT strain. MU1140 shows antibacterial activity against all Gram-positive bacteria against which it has been tested, including those responsible for a variety of healthcare-associated infections, or HAIs.

On June 5, 2012, we entered into the Lantibiotic ECC with Precigen. In November of 2017 we amended the Lantibiotic ECC to: (i) consolidate the development milestone payments into one payment of $25,000,000, being due six months after receiving FDA approval of a New Drug Application, (ii) reduce the sublicense revenue percentage we would have had to pay from 50% to 25% of sublicensing revenue, (iii) reduce the royalty rate from 25% of Product Profit to 10% of Net Sales, (iv) revise the form of milestone payments from being share based or cash at our election to only cash, and (v) commit that Diligent Efforts (as defined in the Lantibiotic ECC) in pursuing the Lantibiotic Program would be deemed satisfied in 2018 provided that at least $1,200,000 was budgeted for the advancement of the Lantibiotic Program. In January Precigen consummated a reorganization of its ongoing API fermentation operations and assets into ILH Holdings, Inc. which at the time was an affiliate of Precigen. In connection with the reorganization, Precigen assigned the Lantibiotic ECC and related stock issuance agreements to ILH Holdings. Following such reorganization, Precigen divested certain of its assets to TS Biotechnology Holdings, LLC which included ILH Holdings and shares of Oragenics securities held by Precigen.

Through this collaboration we intend to develop lantibiotics, a novel class of broad-spectrum antibiotics, as active pharmaceutical ingredients toward the goal of commercialization for the treatment of infectious diseases in humans. We previously selected a lead candidate, OG253, and had a pre-IND meeting with the FDA in November of 2015 regarding the pursuit of an IND on OG253. Following additional research and development on second generation lantibiotics, in August of 2016, we selected a second generation lantibiotic, OG716, for treatment of *C. diff*. OG716 is a new, orally-active homolog, that has exhibited positive results in an animal model for potential treatment of *C. diff*. Generated from our MU1140 platform, this new lantibiotic showed promising efficacy in reducing clinically relevant *C. diff* infections as measured by increased animal survival and decreased relapse as well as reduced production of *C. diff* spores and toxin levels when compared to a vancomycin positive control. We had our pre-IND meeting with FDA for OG716 during the third quarter of 2017. We have transferred manufacturing to a contract manufacturer and conducted our initial rat toxicology program in support of our anticipated upcoming IND filing. The timing of the filing of an IND regarding OG716 is subject to our having sufficient available capital given all of our anticipated needs and expected requirements in connection with our ongoing research and development initiatives. We currently expect the IND for a first-in-human clinical trial of OG716 to be filed with the FDA based on our ability to complete the requisite studies, contingent on sufficient funding. Based upon the funding available we expect to conduct some of the requisite studies. While we commenced certain of these studies at the end of 2019, we expect to focus on efficient and cost-effective manufacturing of the product to support and be able to conduct further broad-based studies.

Market Opportunity

The most common gram (+) HAIs are caused by drug-resistant bacteria, including methicillin-resistant *Staphylococcus aureus*, or MRSA; vancomycin-resistant *Enterococcus faecalis*, or VRE; and *Clostridium difficile,* or *C. diff*. According to the Centers for Disease Control and Prevention, or CDC, HAIs are estimated to occur in approximately 5% of all acute-care hospitalizations. The CDC also estimates that the total direct medical cost to the U.S. healthcare system from HAIs is between $28.4 billion to $45 billion annually. Cubicin, a Gram positive lipopeptide antibiotic which was launched in the US market in November 2003 by the biotechnology company Cubist, had 2012 global sales of $926.4 million. In 2013, Cubist announced the acquisition of two companies Optimer and Trius each of which was for consideration over $800M. In 2015, Cubist was acquired by Merck for a total transaction value of $9.5 billion.

The need for novel antibiotics is increasing due to an increased pattern of resistance development by target pathogens to existing FDA approved antibiotics on the market. The CDC has estimated that up to 77% of certain nosocomial pathogenic bacteria are resistant to drugs of last resort (vancomycin-resistant E. faecium and vancomycin, respectively, in this example). HAIs are not exclusively a problem in the United States as the rest of the world has also seen a dramatic rise in HAIs during the last decade. We believe novel antibiotics have become increasingly scarce as major pharmaceutical companies focus more research and development resources on lifestyle drugs and fewer resources on specialty pharmaceuticals such as antibiotics. Between 1983 and 1987, 16 new antibiotics were approved by the FDA. Twenty years later, over an equivalent time period from 2003 to 2007, only five new antibiotics were approved by the FDA, of which only two possessed a novel mechanism of action. Since 2008, there have been no new antibiotics classes approved by FDA.

Lantibiotics such as MU1140 are highly modified peptide antibiotics made by a small group of Gram-positive bacterial species. Approximately 60 lantibiotics have been discovered since the first lantibiotic, nisin, was discovered. Lantibiotics are generally known to be potent antibiotic agents; however, attempts to investigate their clinical usefulness have generally met with failure due to the inability to produce sufficient pure amounts of any of these molecules to be able to test them as a therapeutic agent for the treatment of infectious diseases. Standard fermentation methods, such as those used to make a variety of other antibiotics, have historically resulted in the production of only minute amounts of the lantibiotic.

Our Solution

To develop homologs of MU1140 paired with high producing strains to the point of partnership, and to develop additional lantibiotics in connection with our work on MU1140. MU1140 has demonstrated activity against a wide variety of disease-causing Gram-positive bacteria, including MRSA, VRE, *C. diff, Mycobacterium tuberculosis* and *Bacillus anthracis*.

Our Strategy

In collaboration with ILH Holdings, we are developing and testing recombinantly derived homologs of the native MU1140 molecule with improved therapeutic profiles and physical-chemical characteristics. The data generated in collaboration with ILH Holdings over the past few years enabled us to engineer hundreds of homologs of MU1140, and select those homolog candidates with improved profiles, including homologs of higher activity and stability, lower toxicity and with a scalable manufacturability. The best homolog candidates were further developed internally and through the use of several Contract Research Organizations ("CROs"). We believe that this strategy represented the best and most efficient path to produce sufficient quantities of MU1140 homologs, to support continued research, selection of a lead candidate, nonclinical studies, clinical studies and ultimately commercialization. We selected a lead candidate, OG716, in 2016 targeted toward combating *C. diff* infections. In addition, we intend to continue research activities to identify additional MU1140 homologs to treat other HAIs.

Regulatory Status

We have performed nonclinical testing on MU1140 which demonstrated the molecule's novel mechanism of action. We began additional nonclinical activities on MU1140 under the Lantibiotic ECC and activities have expanded with new identified homologs as available. These nonclinical activities are expected to include toxicity results, pharmacokinetic studies, and efficacy studies in animals for selected candidates, including our lead candidate OG716 under development for *Clostridium difficile* associated diarrhea. This work is being done primarily through the use of outside contractors. Pursuit of clinical trials toward the goal of ultimately obtaining regulatory approval will depend upon further successful advancements in our research efforts and our efforts to have additional product manufactured. Developments from these efforts will dictate our regulatory path. We initially selected a lead candidate, OG253 and had a pre-IND meeting with the FDA in November of 2015 regarding the pursuit of an IND for OG253. Following additional research and development on second generation lantibiotics, in August of 2016, we selected a second generation lantibiotic homolog, OG716, for treatment of *C. diff*. We had a pre-IND meeting with FDA for OG716 during the third quarter of 2017. We expect to continue our research and development activities on OG716 subject to the availability of adequate financing as we move towards the filing of an IND.

Manufacturing

While we have been able to produce a significant increase in the fermentation titer of our lead compound OG716, we continue to work to improve on the manufacturing through collaborations with fermentation and purification experts and third party CROs. We will need to further optimize and scale up the production/purification scheme internally and through third party vendors. The need to examine many new homologs of MU1140 has resulted in the need to reproduce the fermentation and purification steps on each individual homolog candidate being studied. Each homolog requires different optimizations for both the fermentation and purification steps and in some cases requires a new approach. As such, our work on the research and development of new lantibiotic homologs using genetically modified bacteria continues. We believe these developments represent progress toward our goal of commercial production of sufficient quantities of our MU1140 homologs, including our lead compound OG716 and deliver a step in validating the lantibiotics platform targeting infectious diseases.

We are working with a third-party manufacturer to produce additional quantities of designated homologs including our lead compound OG716, based upon the developments achieved from our work with our collaboration partners and outside contractors. The production of additional quantities of designated homologs including OG716, that are needed for the consummation and pursuit of our nonclinical testing activities supporting the IND filing are currently ongoing. We will continue to explore improved methods of manufacturing to improve our yields and ultimately, potentially reduce our cost of manufacture.

Our NIH License Agreement

Through our wholly-owned subsidiary, Noachis Terra, we are party to a Patent License and Biological Materials License Agreement (the "License Agreement" or "NIH License"), dated March 23, 2020, with the United States Department of Health and Human Services (the "HHS"), as represented by the NIAID, an Institute of the NIH. Under the terms of the License Agreement, we hold a nonexclusive, worldwide license to certain specified patent rights (including patent applications, provisional patent applications and Patent Cooperation Treaty ("PCT") patent applications) and biological materials relating to the use of prefusion coronavirus spike proteins to exploit products ("Licensed Products") and practice processes ("Licensed Processes") that are covered by the licensed patent rights and biological materials for the purpose of developing and commercializing a vaccine product candidate for SARS-CoV-2. The License Agreement is subject to certain statutory limits and reserved rights, as required under federal law and NIH requirements, including the requirement to provide reasonable quantities of Licensed Products or materials made through the Licensed Processes for NIH research and to manufacture Licensed Products or materials made through the Licensed Processes substantially in the United States. We may not sublicense the intellectual property or biological materials licensed to us under the License Agreement.

Pursuant to the License Agreement, we must use reasonable commercial efforts to manufacture, practice or operate the Licensed Products and the Licensed Processes, including adhering to a commercial development plan and achieving certain benchmarks. Additionally, following the first commercial sale of any Licensed Products or the practice of any Licensed Processes, we must use reasonable commercial efforts to make the Licensed Products and the Licensed Processes reasonably accessible to the United States public and reasonable quantities of the Licensed Products and the Licensed Processes available to patient assistance program, among other educational support activities. The NIAID has agreed to assume responsibility for the preparation, filing, prosecution and maintenance of all patent applications and patents covered by the licensed patent rights.

Under the terms of the License Agreement, the NIAID is entitled to receive a noncreditable, nonrefundable upfront license issue royalty (which has already been paid), as well as reimbursement for our pro rata share of the NIAID's past and future patent prosecution-related expenses. Additionally, the NIAID is entitled to receive nonrefundable minimum annual royalties, which increase each year after the first commercial sale of any Licensed Products or the practice of any Licensed Processes, as well as benchmark royalties following our completion of certain commercial development and sales-related benchmarks. The NIH is entitled to receive earned royalties on the annual net sales of Licensed Products and the practice of any Licensed Processes (subject to certain reductions), at certain low- to mid-single digit royalty rates, which rates vary based on the total amount of annual net sales and the geographic market in which those sales occur. We must provide regular written reports to the NIAID on the development status of and royalty payments relating to the Licensed Products and the Licensed Processes.

We must indemnify and hold the NIAID and its associates harmless from and against all liability and damages in connection with or arising out of (a) the use or beneficial use of the Licensed Patent rights by us, our directors, employees or third parties and (b) the design, manufacture, distribution or use of any Licensed Products or Licensed Processes, including other products or processes developed in connection with the Licensed Patent Rights.

Unless terminated earlier, the License Agreement will terminate upon the earlier of (a) twenty (20) years from the first commercial sale where no licensed patent rights exist or have ceased to exist or (b) the expiration of the last to expire of any licensed patent rights. At this time, no patents covered by the licensed patent rights have been issued. We may terminate the License Agreement at any time, subject to advance notice. Subject to certain cure and appeal rights, the NIAID may terminate or modify the License Agreement in the event of a material breach or default, including, among others, the following:

(i) We become insolvent or the subject of a bankruptcy petition;

(ii) We fail to follow the commercial development plan, fail to achieve certain commercial development and sales-related benchmarks or cannot otherwise demonstrate progress toward a practical application of the Licensed Products or Licensed Processes;

(iii) We fail to keep any Licensed Products or Licensed Processes reasonably available to the public following the commencement of commercial use or fail to reasonably justify noncompliance with its domestic production obligation;

(iv) We cannot reasonably satisfy public health and safety needs; or

(v) The NIAID determines termination or modification is necessary because we cannot meet federal public use regulatory requirements, as issued after the effective date of the License Agreement.

Our Lantibiotic ECC

On June 5, 2012, we entered into the Lantibiotic ECC with Precigen that governs a "channel collaboration" arrangement in which we will use Precigen's advanced transgene and cell engineering platforms for the development and production of lantibiotics, a class of peptide antibiotics that are naturally produced in Gram-positive bacteria and contain the characteristic polycyclic thioether amino acids lanthionine and methyllanthonine (collectively, the "Lantibiotics Program"). The Lantibiotic ECC and Lantibiotic Stock Issuance Agreement were assigned to and assumed by ILH Holdings, Inc., ("ILH") a wholly owned subsidiary of Precigen, Precigen subsequently sold the majority of its bioengineering assets, inclusive of ILH, to TS Biotechnology LLC, an entity managed by Third Security. In addition, Precigen sold its holdings in our securities to TS Biotechnology. The Lantibiotic ECC provides for the establishment of committees comprised of our representatives and representatives from ILH Holdings, Inc. ("Collaboration Partner") following the assignment by Precigen that will govern activities related to the Lantibiotics Program in the areas of project establishment, chemistry, manufacturing and controls matters, clinical and regulatory matters, commercialization efforts and intellectual property matters. The Joint Steering Committee establishes projects for the Lantibiotics Program and establishes the priorities, as well as approved the budgets for projects. In November of 2017 in connection with our Series B Preferred Financing, we amended the Lantibiotic ECC to revise the payments, we are obligated to make to our Collaboration Partner as described below.

The Lantibiotic ECC grants us an exclusive worldwide license to use patents and other intellectual property of Precigen in connection with the research, development, use, importing, exporting, manufacture, sale, and offer for sale of drug products involving the direct administration to humans or companion animals of a lantibiotic for the prevention or treatment of infectious disease ("Oragenics Products"). Such license is exclusive with respect to any clinical development, selling, offering for sale or other commercialization of Oragenics Products, and otherwise is non-exclusive. Subject to limited exceptions, we may not sublicense the rights described without Precigen's written consent.

Under the Lantibiotic ECC, and subject to certain exceptions, we are responsible for, among other things, funding the further anticipated development of lantibiotics toward the goal of commercialization, conducting nonclinical and clinical development of candidate lantibiotics, as well as for other aspects of manufacturing and the commercialization of the product(s). Among other things, our Collaboration Partner is responsible for technology discovery efforts, cell-engineering development, certain aspects of the manufacturing process, and costs of filing, prosecution and maintenance of our Collaboration Partner's patents. Under the Lantibiotic ECC our Collaboration Partner has the option to perform any manufacturing activities in connection with the Lantibiotic Program that relate to the use of our Collaboration Partner material, the manufacture of bulk drug products, the manufacturing of bulk quantities, other components of Oragenics Products, or any earlier steps in the manufacturing process for Oragenics Products. To the extent our Collaboration Partner so elects, a separate manufacturing and supply agreement may be entered into between our Collaboration Partner and the Company.

Pursuant to the terms of the Lantibiotic ECC, as amended, we are obligated to pay our Collaboration Partner on a quarterly basis 10% of net sales derived in that quarter from the sale of products developed from the Lantibiotic ECC, calculated on an Oragenics Product-by-Oragenics Product basis and we will pay our Collaboration Partner on a quarterly basis 25% of revenue obtained in that quarter from a sublicensor in the event of a sublicensing arrangement.

We have agreed to indemnify and hold our Collaboration Partner -harmless from any damages caused as a result of (i) our negligence or willful misconduct, (ii) the use, handling, storage, or transport of our Collaboration Partner Materials (as defined in the Lantibiotic ECC), (iii) our breach of a material representation, warranty or covenant in the Lantibiotic ECC, or (iv) the design, development, manufacture, regulatory approval, handling, storage, transport, distribution, sale or other disposition of any Oragenics Product.

Our Collaboration Partner may terminate the Lantibiotic ECC if we fail to use diligent efforts to develop and commercialize Oragenics Products or if we elect not to pursue the development of a Lantibiotics Program identified by our Collaboration Partner that is a "Superior Therapy" as defined in the Lantibiotic ECC. We may voluntarily terminate the Lantibiotic ECC at any time upon 90 days written notice to our Collaboration Partner.

Upon termination of the Lantibiotic ECC, we may continue to develop and commercialize any Oragenics Product that has been, at the time of termination:

(i) commercialized by us;

(ii) approved by regulatory authorities;

(iii) a subject of an application for regulatory approval that is pending before the applicable regulatory authority; or

(iv) the subject of at least an ongoing Phase 1, Phase 2 or Phase 3 clinical trial in the Field (in the case of a termination by our Collaboration Partner due to an uncured material breach by the Company or a voluntary termination by us).

Our obligation to pay 10% of net sales, 25% of sublicensing revenue and the milestone payments described below with respect to these "retained" products as well as to use diligent efforts to develop and commercialize these "retained" Oragenics Products will survive termination of the Lantibiotic ECC.

In addition, in partial consideration for each party's execution and delivery of the Lantibiotic ECC, we entered into a Stock Issuance Agreement with our Collaboration Partner. Pursuant to the Stock Issuance Agreement, we issued to our Collaboration Partner 439,243 shares of our common stock as an initial technology access fee, in consideration for the execution and delivery of the Lantibiotic ECC and granted our Collaboration Partner certain equity participation rights and registration rights.

The registration rights granted to our Collaboration Partner in the Stock Issuance Agreement by us consisted of "piggyback registration" rights which permit our Collaboration Partner to participate in any firm commitment underwritten offering of securities by us, subject to underwriter cutbacks and lockups. In addition, we are precluded from granting registration rights in connection with a private placement unless (i) all shares held by our Collaboration Partner are, at the time of such private placement, included on a registration statement, or (ii) we agree, in connection with such private placement, to grant our Collaboration Partner the right to include on the registration statement a number of our Collaboration Partner's Company shares equal to one half of the number of shares to be registered on behalf of the other holders or prospective holders.

Pursuant to the Stock Issuance Agreement, our Collaboration Partner is also entitled, at its election, to participate in future securities offerings by us that constitute "qualified financings" and purchase securities equal to 30% of the number of shares of common stock or other securities sold in such offering (exclusive of our Collaboration Partner's purchase). For this purpose, a "qualified financing" means a sale of common stock or equity securities convertible into common stock in a public or private offering, raising gross proceeds of at least $1,000,000, where the sale of shares is either registered under the Securities Act of 1933, as amended, at the time of issuance or we agree to register the resale of such shares.

In November of 2017, the Stock Issuance Agreement was also amended. Under the terms of the amendment, we have agreed to make certain payments, in cash, to our Collaboration Partner upon our achievement of designated milestones. The milestone events and amounts payable are as follows:

(i) a one-time payment of twenty-five million United States dollars ($25,000,000) within six (6) months of the achievement of the Regulatory Approval Milestone Event meaning receiving approval from the FDA of a New Product Application (or equivalent regulatory action in a foreign jurisdiction) for an Oragenics Product;

(ii) a one-time payment of five million United States dollars ($5,000,000) within six (6) months of the achievement of the New Indication Milestone Event meaning receiving approval from the FDA of a Supplemental FDA Application (or an equivalent filing with another equivalent regulatory agency) which Supplemental FDA Application sought approval of an indication for use of the Oragenics Product other than the current regulatory-approved indication; and

(iii) a one-time payment of five million United States dollars ($5,000,000) within six (6) months of the achievement of the New Product Milestone Event meaning the receiving of approval from the FDA of a New Product that is deemed to be a different drug product that the first Oragenics Product that was clinically pursued under the Lantibiotics Program.

On July 21, 2016, the Lantibiotics ECC was amended to revise the definition of Field in view of a provisional patent application filing between our Collaboration Partner and Oragenics and to further clarify Oragenics' rights under the Lantibiotic ECC to genetically modified *Streptococcus mutans* that express Lantibiotic(s).

None of the Lantibiotic ECC milestones had been achieved as of December 31, 2019.

The Oral Mucositis ECC

On June 9, 2015, we entered into an Oral Mucositis ECC with Precigen and Intrexon Actobiotics NV, a wholly-owned subsidiary of Precigen, through which we intend to research, develop and commercialize products, including the continued development and commercialization of AG013, for use in the treatment of oral mucositis in humans through the administration of an effector via genetically modified bacteria, but, in any case, excluding the delivery of anti-cancer effectors for the purpose of treatment or prophylaxis of cancer (collectively, the "Program"). Contemporaneously with the Oral Mucositis ECC, we and Precigen also entered into a Stock Issuance Agreement (the "SIA") which authorized the issuance of the Technology Access Fee and the future stock issuance of our Common Stock to Precigen upon the achievement of designated milestones. We issued a Convertible Note in the amount of $5,000,000 as payment of the technology access fee associated with the Oral Mucositis ECC which was payable, at our option, in cash or shares of our common stock. The convertible note, including accrued interest, was repaid in December 2015 through the issuance of 338,101 shares of our common stock. In November of 2017 we amended the Oral Mucositis ECC to revise the payments we are obligated to make to Precigen, as described below, and we revised the field in which we have exclusive rights to our Oral Mucositis product candidate for the treatment of Oral Mucositis to clarify that we have an exclusive right for the treatment of Oral Mucositis in humans regardless of etiology.

The Oral Mucositis ECC governs the "channel collaboration" arrangement in which we will use Precigen's proprietary technology relating to the identification, design and production of genetically modified bacteria for the purpose of developing the Program.

The Oral Mucositis ECC provides for the establishment of committees comprised from us and Precigen representatives that will govern activities in the areas of project establishment, chemistry, manufacturing and controls, clinical and regulatory matters, commercialization efforts, and intellectual property.

The Oral Mucositis ECC grants us an exclusive worldwide license to utilize Precigen's and Actobiotics' intellectual property to develop and commercialize products, including the continued development and commercialization of AG013, for use in the treatment of oral mucositis in humans through the administration of an effector via genetically modified bacteria, but, in any case, excluding the delivery of anti-cancer effectors for the purpose of treatment or prophylaxis of cancer (the "Field"). It also grants us an exclusive license in the Field under all Information Controlled by Actobiotics (or otherwise by Precigen) and existing as of the Effective Date relating to the regulatory approval of AG013, including regulatory filings, data, clinical trial reports, and rights thereunder.

Under the Oral Mucositis ECC, and subject to certain exceptions, we are responsible for, among other things, funding the further anticipated development of products toward the goal of commercialization, conducting preclinical and clinical development of candidate products, as well as for other aspects of manufacturing and the commercialization of the product(s). Among other things, Precigen is responsible for technology discovery efforts, cell-engineering development, and certain aspects of the manufacturing process.

Pursuant to the terms of the Oral Mucositis ECC, as amended, we are obligated to pay Precigen on a quarterly basis 12% of the net sales derived from the sale of products developed from the exclusive channel collaboration. We are also obligated to pay Precigen on a quarterly basis 25% of revenue obtained in that quarter from a sublicensor in the event of a sublicensing arrangement.

We have agreed to indemnify and hold Precigen harmless from any damages caused as a result of (i) our negligence or willful misconduct, (ii) the use, handling, storage, or transport of Precigen Materials (as defined in the Oral Mucositis ECC) or materials that are Actobiotics IP (as defined in the Oral Mucositis ECC), (iii) our breach of a material representation, warranty or covenant in the Oral Mucositis ECC, or (iv) the design, development, manufacture, regulatory approval, handling, storage, transport, distribution, sale or other disposition of any Oragenics Product.

We may voluntarily terminate the Oral Mucositis ECC upon 90 days written notice to Precigen. Precigen may also terminate the Oral Mucositis ECC if we breach and fail to cure the breach within 60 days or we do not pursue development of a Superior Therapy identified by Precigen that is a "Superior Therapy" as defined in the Oral Mucositis ECC.

Upon termination of the ECC, we may continue to develop and commercialize any Oragenics Product that, at the time of termination that satisfies at least one of the following criteria:

(i) the particular Oragenics Product is being sold by us triggering profit sharing payments under the Oral Mucositis ECC to Precigen;

(ii) the particular Oragenics Product has received regulatory approval;

(iii) the particular Oragenics Product is a subject of an application for regulatory approval in the Field covered by the ECC that is pending before the applicable regulatory authority;

(iv) the particular Oragenics Product is AG013, and such Oragenics Product has been the subject of at least one completed Phase 2 clinical trial (as such is defined by relevant FDA guidelines) during the Term; or

(v) the particular Oragenics Product other than AG013 and such Oragenics Product is the subject of at least an ongoing Phase 1, Phase 2 or Phase 3 clinical trial in the Field.

Our obligation to pay 12% of net sales, 25% of sublicensing revenue and the milestone payments described below with respect to these "retained" products as well as to use diligent efforts to develop and commercialize these "retained" Oragenics Products will survive termination of the Oral Mucositis ECC.

In November of 2017, the Stock Issuance Agreement was also amended. Under the terms of the amended Oral Mucositis ECC (including the May 2017 amendment which was superseded by the November amendment) and amended Stock Issuance Agreement agreed to make certain payments to Precigen upon our achievement of designated milestones in the form of shares of our common stock (based upon the fair market value of the shares otherwise required to be issued) unless the issuance of such shares would reasonably likely cause Precigen to consolidate our financial statements with Precigen's financial statements, or at our option make a cash payment to Precigen. The milestone events and amounts payable are as follows:

(i) a one-time payment of twenty-seven million five hundred thousand United States dollars ($27,500,000) within six (6) months of the achievement of the Regulatory Approval Milestone Event meaning receiving approval from the FDA of a New Product Application for an Oragenics Product (or equivalent regulatory action in a foreign jurisdiction);

(ii) a one-time payment of five million United States dollars ($5,000,000) within six (6) months of the achievement of the New Indication Milestone Event meaning receiving approval from the FDA of a Supplemental FDA Application (or an equivalent filing with another equivalent regulatory agency) which Supplemental FDA Application sought approval of an indication for use of the Oragenics Product other than the current regulatory-approved indication; and

(iii) a one-time payment of five million United States dollars ($5,000,000) within six (6) months of the achievement of the New Product Milestone Event meaning receiving approval from the FDA of a New Product that is deemed to be a different drug product that the first Oragenics Product that was clinically pursued under the Program.

None of the Oral Mucositis ECC milestones had been achieved as of December 31, 2019.

Effective January 1, 2018, Precigen assigned its interest in the Oral Mucositis ECC and Stock Issuance Agreement to its wholly owned subsidiary, ActoBio Therapeutics, Inc.

Brexit and the Regulatory Framework in the United Kingdom

In June 2016, the United Kingdom (the "UK") electorate voted in a referendum to leave the European Union (the "EU"), which is commonly referred to as "Brexit". In March 2017, the UK government formally notified the European Council of its intention to leave the EU after it triggered Article 50 of the Lisbon Treaty to begin the two-year negotiation process establishing the terms of the exit and outlining the future relationship between the UK and the EU. Formal negotiations officially started in June 2017. The UK withdrew from the EU on January 31, 2020. The outcome after Brexit also continues to be uncertain, which may pose certain implications to our research, commercial and general business operations in the UK and the EU, including the approval and supply of our products. At present, it is still unclear whether and to what extent the UK will remain aligned to the EU system of medicines regulation, depending on the ultimate outcome of the negotiations. However, both the UK and the EU have issued detailed guidance for the industry on how medicines, medical devices and clinical trials will be separately regulated in their respective territories in the event of a 'hard Brexit', meaning an outcome where no negotiated settlement is reached.

Our preparation for Brexit, including for a potential 'hard Brexit', includes the changes necessary to meet the relevant requirements in the EU and the UK after Brexit, especially in the regulatory, research, manufacturing and supply chain areas. The principal aim is to ensure the continuity of supply to patients in Europe (EU and the UK) participating in our AG013 clinical program.

Other Product Candidates and Technologies

We have historically developed other product candidates and potential product candidates. For example, we developed a weight loss candidate, LPT3-04, and a topical treatment to prevent dental carries which we refer to as SMaRT Replacement Therapy. We outlicened LPT3-04 to a third party and continue to monitor our licensees performance under the license. We do not expect the LPT3-04 license to have a material effect on our business or operations. While we retain certain intellectual property rights with respect to homologs through our (i) prior relationship with Texas A&M University Systems and (ii) ILH Holdings (as assignee of Precigen) that could allow for the continued research and development of compounds for the SMaRT replacement Therapy, we do not intend to pursue further development of SMaRT Replacement Therapy and as such we do not consider these rights to be a material part of our business and operations.

Government Regulations

In the United States, foods (including dietary supplements), drugs (including biological products), medical devices, cosmetics, tobacco products and radiation-emitting products are subject to extensive regulation by the FDA. The FDC Act and other federal and state statutes and regulations govern, among other things, the manufacture, distribution and sale of these products. These laws and regulations prescribe criminal and civil penalties that can be assessed, and violation of these laws and regulations can result in enforcement action by the FDA and other regulatory agencies.

FDA Regulation of Drugs and Biologics—New Drug Approval Process

Pharmaceutical products are subject to extensive regulation by the FDA. The FDC Act, and other federal and state statutes and regulations, govern, among other things, the research, development, testing, manufacture, storage, recordkeeping, approval, labeling, promotion and marketing, distribution, post-approval monitoring and reporting, sampling, and import and export of pharmaceutical products. Failure to comply with applicable U.S. requirements may subject a company to a variety of administrative or judicial sanctions, such as FDA refusal to approve pending NDAs or BLAs, warning or untitled letters, product recalls, product seizures, total or partial suspension of production or distribution, injunctions, fines, civil penalties and criminal prosecution. Any administrative or judicial enforcement action taken by the FDA or other regulatory authorities could have a material adverse effect on us.

Pharmaceutical product development for a new product or certain changes to an approved product in the United States typically involves the following steps before a biological product or new drug may be marketed in the United States:

- preclinical laboratory tests, animal studies and formulation studies in compliance with the FDA's Good Laboratory Practice and Good Manufacturing Practice regulations;
- submission to the FDA of an Investigational New Drug application (IND) for human clinical testing, which must become effective before human clinical trials may commence;
- performance of adequate and well-controlled clinical trials in three phases, as described below, to establish the safety and efficacy of the drug for each indication according to Good Clinical Practices;
- submission of an NDA or Biologics License Application (BLA) to the FDA for review;
- random inspections of clinical sites to ensure validity of clinical safety and efficacy data;
- satisfactory completion of an FDA inspection of the manufacturing facility or facilities at which the drug is produced to assess compliance with current good manufacturing practices;
- FDA approval of the NDA or BLA; and
- payment of user and establishment fees, if applicable.

Satisfaction of FDA pre-market approval requirements typically takes many years and the actual time required may vary substantially based upon the type, complexity and novelty of the product or disease

Preclinical tests include laboratory evaluation of product chemistry, formulation and toxicity, as well as animal trials to assess the characteristics and potential safety and efficacy of the product. The conduct of the preclinical tests must comply with federal regulations and requirements, including good laboratory practices. The results of preclinical testing are submitted to the FDA as part of an IND along with other information, including information about product chemistry, manufacturing and controls, and a proposed clinical trial protocol. Long term preclinical tests, such as animal tests of reproductive toxicity and carcinogenicity, may continue after the IND is submitted.

A 30-day waiting period after the submission of each IND is required prior to the commencement of clinical testing in humans. If the FDA has neither commented on nor questioned the IND within this 30-day period, the clinical trial proposed in the IND may begin.

Clinical trials involve the administration of the investigational new drug to healthy volunteers or patients under the supervision of a qualified investigator. Clinical trials must be conducted: (i) in compliance with federal regulations; (ii) in compliance with good clinical practice, or GCP, an international standard meant to protect the rights and health of patients and to define the roles of clinical trial sponsors, administrators, and monitors; as well as (iii) under protocols detailing the objectives of the trial, the parameters to be used in monitoring safety, and the effectiveness criteria to be evaluated. Each protocol involving testing on U.S. patients and subsequent protocol amendments must be submitted to the FDA as part of the IND.

The FDA may order the temporary, or permanent, discontinuation of a clinical trial at any time, or impose other sanctions, if it believes that the clinical trial is not being conducted in accordance with FDA requirements or presents an unacceptable risk to the clinical trial patients. The trial protocol and informed consent information for patients in clinical trials must also be submitted to an institutional review board or IRB for approval. An IRB may also require the clinical trial at the site to be halted, either temporarily or permanently, for failure to comply with the IRB's requirements, or may impose other conditions.

Clinical trials to support NDAs or BLAs for marketing approval are typically conducted in three sequential phases, but the phases may overlap. In Phase 1, the initial introduction of the drug into healthy human subjects or patients, the drug is tested to assess metabolism, pharmacokinetics, pharmacological actions, side effects associated with increasing doses, and, if possible, early evidence on effectiveness. Phase 2 usually involves trials in a limited patient population to determine the effectiveness of the drug for a particular indication, dosage tolerance, and optimum dosage, and to identify common adverse effects and safety risks. If a compound demonstrates evidence of effectiveness and an acceptable safety profile in Phase 2 evaluations, Phase 3 trials are undertaken to obtain the additional information about clinical efficacy and safety in a larger number of patients, typically at geographically dispersed clinical trial sites, to permit the FDA to evaluate the overall benefit-risk relationship of the drug and to provide adequate information for the labeling of the drug. In most cases the FDA requires two adequate and well-controlled Phase 3 clinical trials to demonstrate the efficacy of the drug. A single Phase 3 clinical trial with other confirmatory evidence may be sufficient in rare instances where the trial is a large multicenter trial demonstrating internal consistency and a statistically very persuasive finding of a clinically meaningful effect on mortality, irreversible morbidity or prevention of a disease with a potentially serious outcome and confirmation of the result in a second trial would be practically or ethically impossible. 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 thereapeutic indication and are commonly intended to generate additional safety data regarding use of the product in a clinical setting. In certain instances, the FDA may mandate the performance of Phase 4 clinical trials as a condition of approval of a BLA or NDA.

The length of time and related costs necessary to complete clinical trials varies significantly and may be difficult to predict. Clinical trial results are frequently susceptible to varying interpretations that may delay, limit or prevent regulatory approvals. Additional factors that can cause delay or termination of our clinical trials, or cause the costs of these clinical trials to increase, include:

- interruptions to or limitations on our ability to conduct preclinical research and development and clinical trials due to the COVID-19 pandemic and government restrictions in response to the pandemic, including difficulties identifying capable research and testing partners, lack of available subjects and supplies for preclinical or clinical research and testing, limitations on work schedules for government regulators and their employees, slow or delayed patient enrollment because of an inability to access testing or research facilities, or other financial costs implicated by a global economic slowdown;

- slow patient enrollment due to the nature of the protocol, the proximity of patients to clinical sites, the eligibility criteria for the trial, competition with clinical trials for other drug candidates or other factors;

- inadequately trained or insufficient personnel at the trial site to assist in overseeing and monitoring clinical trials;

- delays in approvals from a trial site’s contracts office and/or IRB;

- longer than anticipated treatment time required to demonstrate effectiveness or determine the appropriate product dose;

- lack of sufficient supplies of the drug candidate for use in clinical trials;

- adverse medical events or side effects in treated patients; and

- lack of effectiveness of the drug candidate being tested.

Any drug is likely to produce some toxicities or undesirable side effects in animals and in humans when administered at sufficiently high doses and/or for sufficiently long periods of time. Unacceptable toxicities or side effects may occur at any dose level, and at any time in the course of animal studies designed to identify unacceptable effects of a drug candidate, known as toxicological studies, or in clinical trials of our drug candidates. The appearance of any unacceptable toxicity or side effect could cause us or regulatory authorities to interrupt, limit, delay or abort the development of any of our drug candidates, and could ultimately prevent their marketing approval by the FDA or foreign regulatory authorities for any or all targeted indications.

The FDA's fast track and breakthrough therapy designation programs are intended to facilitate the development and expedite the review of drug candidates intended for the treatment of serious or life-threatening conditions and that demonstrate the potential to address unmet medical needs for these conditions. Under these programs, FDA can, for example, review portions of an NDA or BLA for a drug candidate before the entire application is complete, thus potentially beginning the review process at an earlier time.

We cannot guarantee that the FDA will grant any of our requests for fast track or breakthrough therapy designations, that any such designations would affect the time of review or that the FDA will approve the NDA or BLA submitted for any of our drug candidates, whether or not these designations are granted. Additionally, FDA approval of a fast track/breakthrough product can include restrictions on the product's use or distribution (such as permitting use only for specified medical conditions or limiting distribution to physicians or facilities with special training or experience). Approval of such designated products can be conditioned on additional clinical trials after approval.

In addition, the manufacturer of an investigational drug in a Phase 2 or Phase 3 clinical trial for a serious or life-threatening disease is required to make available, such as by posting on its website, its policy on evaluating and responding to requests for expanded access.

After completion of the required clinical testing, an NDA or BLA is prepared and submitted to the FDA. FDA approval of the NDA or BLA is required before marketing of the product may begin in the U.S. The NDA or the BLA must include the results of all preclinical, clinical and other testing and a compilation of data relating to the product's pharmacology, chemistry, manufacture and controls. The cost of preparing and submitting an NDA is substantial. The submission of most NDAs and BLAs is additionally subject to a substantial application user fee, currently exceeding $2,942,965 for fiscal year 2020. Beginning in fiscal year 2018, this annual program fee replaces the annual product and establishment fees. These fees typically increase annually.

The FDA has 60 days from its receipt of an NDA or BLA to determine whether the application will be filed based on the agency's threshold determination that it is sufficiently complete to permit substantive review. If the NDA or BLA submission is filed, the FDA reviews the NDA or BLA to determine, among other things, whether the proposed product is safe and effective for its intended use. The FDA has agreed to certain performance goals in the review of NDAs or BLAs. Most such applications for standard review drug products are reviewed within ten to twelve months; most applications for priority review drugs are reviewed in six to eight months. Priority review can be applied to drugs that the FDA determines offer major advances in treatment, or provide a treatment where no adequate therapy exists. For biologics, priority review is further limited to drugs intended to treat a serious or life-threatening disease relative to the currently approved products. The review process for both standard and priority review may be extended by the FDA for three additional months to consider certain late-submitted information, or information intended to clarify information already provided in the submission.

The FDA may also refer applications for novel drug products, or drug products that 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. The FDA is not bound by the recommendation of an advisory committee, but it generally follows such recommendations. Before approving an NDA or BLA, the FDA will typically inspect one or more clinical sites to assure compliance with GCP. Additionally, the FDA will inspect the facility or the facilities at which the drug is manufactured. The FDA will not approve the product unless compliance with cGMPs is satisfactory and the NDA or BLA contains data that provide substantial evidence that the drug is safe and effective in the indication studied.

After the FDA evaluates the NDA or BLA and the manufacturing facilities, it issues either an approval letter or a complete response letter. A complete response letter generally outlines the deficiencies in the submission and may require substantial additional testing, or information, in order for the FDA to reconsider the application. If, or when, those deficiencies have been addressed to the FDA's satisfaction in a resubmission of the NDA or BLA, the FDA will issue an approval letter. The FDA has committed to reviewing such resubmissions in two or six months depending on the type of information included.

An approval letter authorizes commercial marketing of the drug with specific prescribing information for specific indications. As a condition of NDA or BLA approval, the FDA may require a risk evaluation and mitigation strategy, or REMS, to help ensure that the benefits of the drug outweigh the potential risks. REMS can include medication guides, communication plans for healthcare professionals, and elements to assure safe use, or ETASU. ETASU can include, but are not limited to, special training or certification for prescribing or dispensing, dispensing only under certain circumstances, special monitoring and the use of patient registries. The requirement for a REMS can materially affect the potential market and profitability of the drug. Moreover, product approval may require substantial post-approval testing and surveillance to monitor the drug's safety or efficacy. Once granted, product approvals may be withdrawn if compliance with regulatory standards is not maintained or problems are identified following initial marketing.

Changes to some of the conditions established in an approved application, including changes in indications, labeling, or manufacturing processes or facilities, require submission and FDA approval of a new NDA or BLA supplement before the change can be implemented. An NDA or BLA supplement for a new indication typically requires clinical data similar to that in the original application, and the FDA uses the same procedures and actions in reviewing NDA or BLA supplements as it does in reviewing NDAs or BLAs.

The required testing, data collection, analysis and compilation of an IND and a BLA or NDA are labor intensive and costly and may take a great deal of time. Tests may have to be redone or new tests performed in order to comply with FDA requirements. It can take considerable time (e.g. 5-10 years) and resources to achieve enrollment sufficient to commence such trials and complete Phase 2 or 3 clinical trials. Moreover, there is no guarantee a product will be approved.

In Canada, the Therapeutic Products Directorate and the Biologics and Genetic Therapies Directorate of HC ensure that clinical trials are properly designed and undertaken and that subjects are not exposed to undue risk. Regulations define specific Investigational New Drug Submission (or IND) application requirements, which must be complied with before a new drug can be distributed for trial purposes. The Directorates currently review the safety, efficacy and quality data submitted by the sponsor and approve the distribution of the drug to the investigator. The sponsor of the trial is required to maintain accurate records, report adverse drug reactions, and ensure that the investigator adheres to the approved protocol. Trials in humans should be conducted according to generally accepted principles of good clinical practice. Management believes that these standards provide assurance that the data and reported results are credible and accurate, and that the rights, integrity, and privacy of clinical trial subjects are protected.

Sponsors wishing to conduct clinical trials in Phases 1 to 3 of development must apply under a 30-day default system. Applications must contain the information described in the regulations, including: a clinical trial attestation; a protocol; statements to be contained in each informed consent form, that set out the risks posed to the health of clinical trial subjects as a result of their participation in the clinical trial; an investigator's brochure; applicable information on excipients (delivery vehicles); and chemistry and manufacturing information.

The sponsor can proceed with the clinical trial if the Directorates have not objected to the sale or importation of the drug within 30 days after the date of receipt of the clinical trial application and Research Ethics Board approval for the conduct of the trial at the site has been obtained. Additional information is available on Health Canada's website - www. hc-sc.gc.ca .

Outside the United States and Canada, our ability to market a product is contingent upon receiving a marketing authorization from the appropriate regulatory authorities. The requirements governing the conduct of clinical trials, marketing authorization, pricing and reimbursement vary widely from country to country. At present, foreign marketing authorizations are applied for at a national level, although within the European Union (EU) registration procedures are available to companies wishing to market a product in more than one EU member state. If the regulatory authority is satisfied that adequate evidence of safety, quality and efficacy has been presented, a marketing authorization may be granted. This foreign regulatory approval process involves all of the risks associated with FDA approval discussed above and may also include additional risks.

The Orphan Drug Act provides incentives to manufacturers to develop and market drugs for rare diseases and conditions affecting fewer than 200,000 persons in the United States at the time of application for orphan drug designation. The first developer to receive FDA marketing approval for an orphan drug is entitled to a seven-year exclusive marketing period in the United States for the orphan drug indication. However, a drug that the FDA considers to be clinically superior to, or different from, another approved orphan drug, even though for the same indication, may also obtain approval in the United States during the seven-year exclusive marketing period.

Under the FDA Modernization Act of 1997, designation as a Fast Track product for a new drug or biological product means that the FDA will take such actions as are appropriate to expedite the development and review of the application for approval of such product.

Legislation similar to the Orphan Drug Act has been enacted in other countries outside of the United States, including the EU. The orphan legislation in the EU is available for therapies addressing conditions that affect five or fewer out of 10,000 persons, are life-threatening or chronically debilitating conditions and for which no satisfactory treatment is authorized. The market exclusivity period is for ten years, although that period can be reduced to six years if, at the end of the fifth year, available evidence establishes that the product does not justify maintenance of market exclusivity.

Pediatric Information

Under the Pediatric Research Equity Act, or PREA, NDAs, BLAs or supplements to NDAs or BLAs must contain data to assess the safety and effectiveness of the drug for the claimed indications in all relevant pediatric subpopulations and to support dosing and administration for each pediatric subpopulation for which the drug is safe and effective. The FDA may grant full or partial waivers, or deferrals, for submission of data. Unless otherwise required by regulation, PREA does not apply to any drug for an indication for which orphan designation has been granted, except a product with a new active ingredient that is a molecularly targeted cancer product intended for the treatment of an adult cancer and directed at a molecular target determined by FDA to be substantially relevant to the growth or progression of a pediatric cancer that is subject to an NDA submitted on or after August 18, 2020.

The Best Pharmaceuticals for Children Act, or BPCA, provides NDA holders a six-month extension of any exclusivity – patent or non-patent – for a drug if certain conditions are met. For BLAs, the BPCA provides a six-month extension for non-patent exclusivity if certain conditions are met. Conditions for exclusivity include the FDA's determination that information relating to the use of a new drug in the pediatric population may produce health benefits in that population, the FDA making a written request for pediatric studies, and the applicant agreeing to perform, and reporting on, the requested studies within the statutory timeframe. Applications under the BPCA are treated as priority applications, with all of the benefits that designation confers.

Disclosure of Clinical Trial Information

Sponsors of clinical trials of FDA-regulated products, including drugs, are required to register and disclose certain clinical trial information. 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 discuss the results of their clinical trials after completion. Disclosure of the results of these trials can be delayed in certain circumstances for up to two years after the date of completion of the trial. Competitors may use this publicly available information to gain knowledge regarding the progress of development programs.

The Hatch-Waxman Amendments

Orange Book Listing

In seeking approval for a drug through an NDA, applicants are required to list with the FDA each patent with claims covering the applicant's product or method of using the product. Upon approval of a drug, each of the patents listed in the application for the drug is then published in the FDA's Approved Drug Products with Therapeutic Equivalence Evaluations, commonly known as the Orange Book. Drugs listed in the Orange Book can, in turn, be cited by potential generic competitors in support of approval of an abbreviated new drug application, or ANDA. An ANDA provides for marketing of a drug product that has the same active ingredients in the same strengths and dosage form as the listed drug and has been shown to be bioequivalent to the listed drug. Other than the requirement for bioequivalence testing, ANDA applicants are not required to conduct, or submit results of, pre-clinical or clinical tests to prove the safety or effectiveness of their drug product. Drugs approved in this way are commonly referred to as "generic equivalents" to the listed drug, and can often be substituted by pharmacists under prescriptions written for the original listed drug.

The ANDA applicant is required to certify to the FDA concerning any patents listed for the approved product in the FDA's Orange Book. Specifically, the applicant must certify that: (i) the required patent information has not been filed; (ii) the listed patent has expired; (iii) the listed patent has not expired, but will expire on a particular date and approval is sought after patent expiration; or (iv) the listed patent is invalid or will not be infringed by the new product. The ANDA applicant may also elect to submit a section viii statement certifying that its proposed ANDA labeling does not contain (or carves out) any language regarding the patented method-of-use rather than certify to a listed method-of-use patent. If the applicant does not challenge the listed patents, the ANDA application will not be approved until all the listed patents claiming the referenced product have expired.

A certification that the new product will not infringe the already approved product's listed patents, or that such patents are invalid, is called a Paragraph IV certification. If the ANDA applicant has provided a Paragraph IV certification to the FDA, the applicant must also send notice of the Paragraph IV certification to the NDA and patent holders once the ANDA has been received by the FDA. The NDA and patent holders may then initiate a patent infringement lawsuit in response to the notice of the Paragraph IV certification. The filing of a patent infringement lawsuit within 45 days of the receipt of a Paragraph IV certification automatically prevents the FDA from approving the ANDA until the earlier of 30 months, expiration of the patent, settlement of the lawsuit or a decision in the infringement case that is favorable to the ANDA applicant.

The ANDA application also will not be approved until any applicable non-patent exclusivity listed in the Orange Book for the referenced product has expired.

Purple Book

The FDA maintains lists of biological products, including any biosimilar and interchangeable biological products licensed by the FDA under the PHS Act in a book entitled "Lists of Licensed Biological Products with Reference Product Exclusivity and Biosimilarity or Interchangeability Evaluations" (the "Purple Book"). Unlike the Orange Book, the Purple Book does not list patents for biological products. The Purple Book includes the date a biological product was licensed under section 351(a) of the PHS Act and whether the FDA evaluated the biological product for reference product exclusivity. If the FDA determined that a biological product is protected by a period of reference product exclusivity, the list will identify the date of first licensure and the date that reference product exclusivity (including any attached pediatric exclusivity) will expire. The list will not identify periods of orphan exclusivity and their expiration dates for biological products as those dates are available at the searchable database for Orphan Designated and/or Approved Products. The Purple Book also identifies whether a biological product licensed under section 351(k) of the PHS Act has been determined by the FDA to be biosimilar to or interchangeable with a reference biological product. Biosimilar and interchangeable biological products licensed under section 351(k) of the PHS Act are listed under the reference product to which biosimilarity or interchangeability was demonstrated.

Exclusivity

Exclusivity provisions under the FDC Act also can delay the submission or the approval of certain applications. The FDC Act provides a five-year period of non-patent exclusivity within the United States to the first applicant to gain approval of an NDA for a new chemical entity, or NCE. A drug is entitled to NCE exclusivity if it contains a drug substance no active moiety of which has been previously approved by the FDA. During the exclusivity period, the FDA may not accept for review an ANDA or file a 505(b)(2) NDA submitted by another company for another version of such drug where the applicant does not own or have a legal right of reference to all the data required for approval. However, an application may be submitted after four years if it contains a Paragraph IV certification. The FDC Act also provides three years of market exclusivity for an NDA, including a 505(b)(2) NDA, or supplement to an existing NDA if new clinical investigations, other than bioavailability studies, that were conducted or sponsored by the applicant are deemed by the FDA to be essential to the approval of the application, for example, for new indications, dosages or strengths of an existing drug. This three-year exclusivity covers only the conditions for use associated with the new clinical investigations and does not prohibit the FDA from approving ANDAs for drugs for the original conditions of use, such as the originally approved indication. Five-year and three-year exclusivity will not delay the submission or approval of a full NDA; however, an applicant submitting a full NDA would be required to conduct or obtain a right of reference to all the non-clinical studies and adequate and well-controlled clinical trials necessary to demonstrate safety and effectiveness.

Patent Term Extension

After NDA approval, the owner of relevant drug patent may apply for up to a five-year patent term extension. Only one patent may be extended for each regulatory review period, which is composed of two parts: a testing phase, and an approval phase. The allowable patent term extension is calculated as half of the drug's testing phase – the time between the day the IND becomes effective and NDA submission – and all of the review phase – the time between NDA submission and approval up to a maximum of five years. The time can be shortened if the FDA determines that the applicant did not pursue approval with due diligence. The total patent term after the extension may not exceed 14 years.

For patents that might expire during the application phase, the patent owner may request an interim patent extension. An interim patent extension increases the patent term by one year and may be renewed up to four times. For each interim patent extension granted, the post-approval patent extension is reduced by one year. The director of the U.S. Patent and Trademark Office must determine that approval of the drug covered by the patent for which a patent extension is being sought is likely. Interim patent extensions are not available for a drug for which an NDA has not been submitted.

Section 505(b)(2) New Drug Applications

Most drug products obtain FDA marketing approval pursuant to an NDA or an ANDA. A third alternative is a special type of NDA, commonly referred to as a Section 505(b)(2), or 505(b)(2), NDA, which enables the applicant to rely, in part, on studies not conducted by, or for, the applicant and for which the applicant has not obtained a right of reference or use, such as the FDA's findings of safety and/or effectiveness for a similar previously approved product, or published literature, in support of its application.

505(b)(2) NDAs often provide an alternate path to FDA approval for new or improved formulations or new uses of previously approved products. Section 505(b)(2) permits the filing of an NDA where at least some of the information required for approval comes from studies not conducted by, or for, the applicant and for which the applicant has not obtained a right of reference. If the 505(b)(2) applicant can establish that reliance on the FDA's previous approval is scientifically appropriate, it may eliminate the need to conduct certain preclinical or clinical trials of the new product. The FDA may also require companies to perform additional studies or measurements to support the change from the approved product. The FDA may then approve the new product candidate for all, or some, of the label indications for which the referenced product has been approved, as well as for any new indication sought by the Section 505(b)(2) applicant.

To the extent that the Section 505(b)(2) applicant is relying on studies conducted for an already approved product, the applicant is required to certify to the FDA concerning any patents listed for the approved product in the Orange Book to the same extent that an ANDA applicant would. Thus approval of a 505(b)(2) NDA can be stalled until all the listed patents claiming the referenced product have expired, until any non-patent exclusivity, such as exclusivity for obtaining approval of a new chemical entity, listed in the Orange Book for the referenced product has expired, and, in the case of a Paragraph IV certification and subsequent patent infringement suit, until the earlier of 30 months, settlement of the lawsuit or a decision in the infringement case that is favorable to the Section 505(b)(2) applicant.

Post-Approval Requirements

Once an NDA or BLA is approved, a product will be subject to certain post-approval requirements. For instance, the FDA closely regulates the post-approval marketing and promotion of drugs, including standards and regulations for direct-to-consumer advertising, off-label promotion, industry-sponsored scientific and educational activities and promotional activities involving the internet. Drugs may be marketed only for the approved indications and in accordance with the provisions of the approved labeling.

Adverse event reporting and submission of periodic reports are required following FDA approval of an NDA or BLA. The FDA also may require post-marketing testing, known as Phase 4 testing, REMS, and surveillance to monitor the effects of an approved product, or the FDA may place conditions on an approval that could restrict the distribution or use of the product. In addition, quality-control, drug manufacture, packaging and labeling procedures must continue to conform to cGMPs after approval. Drug manufacturers and certain of their subcontractors are required to register their establishments with the FDA and certain state agencies. Registration with the FDA, subjects entities to periodic unannounced inspections by the FDA, during which the agency inspects manufacturing facilities to assess compliance with cGMPs. Accordingly, manufacturers must continue to expend time, money and effort in the areas of production and quality-control to maintain compliance with cGMPs. Regulatory authorities may withdraw product approvals or request product recalls if a company fails to comply with regulatory standards, if it encounters problems following initial marketing or if previously unrecognized problems are subsequently discovered. In addition, prescription drug manufacturers in the United States must comply with applicable provisions of the Drug Supply Chain Security Act and provide and receive product tracing information, maintain appropriate licenses, ensure they only work with other properly licensed entities, and have procedures in place to identify and properly handle suspect and illegitimate products.

Failure to comply with the applicable FDA requirements may subject manufacturers and distributors to administrative or judicial sanctions. These sanctions could include, among other things, warning letters, product seizures, total or partial suspension of production or distribution, injunctions, civil money penalties, fines, restitution, disgorgement, or civil or criminal penalties. Further, the FDA has authority to issue mandatory recalls for medical devices and biologics, and we may need to undertake a voluntary recall for any of our products.

In addition to regulations enforced by the FDA, we are also subject to regulation under the Occupational Safety and Health Act, the Environmental Protection Act, the Toxic Substances Control Act, the Resource Conservation and Recovery Act and other federal, state and local regulations. Our research and development activities involve the controlled use of hazardous materials, chemicals, biological materials and radioactive compounds.

Biologics

Biological products, often referred to as biologics, are, for example, drugs or vaccines made from living organisms that used for the prevention, treatment or cure of a disease or condition of a human being. Such biological products are subject to regulation under the FDC Act, except the section of the FDC Act which governs the approval of NDAs. Biological products are approved for marketing under provisions of the Public Health Service Act, or PHSA, via a BLA. However, the application process and requirements for approval of BLAs are very similar to those for NDAs, and biologics are associated with similar approval risks and costs as drugs. To help reduce the increased risk of the introduction of adventitious agents, the PHSA emphasizes the importance of manufacturing controls for products whose attributes cannot be precisely defined. The PHSA also provides authority to the FDA to immediately suspend licenses in situations where there exists a danger to public health, to prepare or procure products in the event of shortages and critical public health needs, and to authorize the creation and enforcement of regulations to prevent the introduction or spread of communicable diseases in the US and between states.

After a BLA is approved, the product may also be subject to official lot release as a condition of approval. As part of the manufacturing process, the manufacturer is required to perform certain tests on each lot of the product before it is released for distribution. If the product is subject to official release by the FDA, the manufacturer submits samples of each lot of product to the FDA together with a release protocol showing a summary of the history of manufacture of the lot and the results of all of the manufacturer's tests performed on the lot. The FDA may also perform certain confirmatory tests on lots of some products, such as viral vaccines, before releasing the lots for distribution by the manufacturer. In addition, the FDA conducts laboratory research related to the regulatory standards on the safety, purity, potency, and effectiveness of biological products. As with drugs, after approval of biologics, manufacturers must address any safety issues that arise, are subject to recalls or a halt in manufacturing, and are subject to periodic inspection after approval.

The Biologics Price Competition and Innovation Act of 2009, or BPCIA, creates an abbreviated approval pathway for biological products shown to be highly similar to or interchangeable with an FDA-licensed reference biological product. Biosimilarity sufficient to reference a prior FDA-approved product requires that there be no differences in conditions of use, route of administration, dosage form, and strength, and no clinically meaningful differences between the biological product and the reference product in terms of safety, purity and potency. Biosimilarity must be shown through analytical studies, animal studies, and at least one clinical trial, absent a waiver by the Secretary. A biosimilar product may be deemed interchangeable with a prior approved product if it meets the higher hurdle of demonstrating that it can be expected to produce the same clinical results as the reference product and, for products administered multiple times, the biologic and the reference biologic may be switched after one has been previously administered without increasing safety risks or risks of diminished efficacy relative to exclusive use of the reference biologic. To date, only twenty-five biosimilar products and no interchangeable products have been approved under the BPCIA. Complexities associated with the larger, and often more complex, structures of biological products, as well as the process by which such products are manufactured, particularly with respect to interchangeability, are still being evaluated by the FDA.

A reference biologic is granted twelve years of exclusivity from the time of first licensure of the reference product, and no application for a biosimilar can be submitted for four years from the date of licensure of the reference product. The first biologic product submitted under the abbreviated approval pathway that is determined to be interchangeable with the reference product has exclusivity against a finding of interchangeability for other biologics for the same condition of use for the lesser of (i) one year after first commercial marketing of the first interchangeable biosimilar, (ii) eighteen months after the first interchangeable biosimilar is approved if there is no patent challenge, (iii) eighteen months after resolution of a lawsuit over the patents of the reference biologic in favor of the first interchangeable biosimilar applicant, or (iv) 42 months after the first interchangeable biosimilar's application has been approved if a patent lawsuit is ongoing within the 42-month period.

Regulation Outside the United States

In order to market any product outside of the United States, a company must also comply with numerous and varying regulatory requirements of other countries and jurisdictions regarding quality, safety and efficacy and governing, among other things, clinical trials, marketing authorization, commercial sales and distribution of drug products. Whether or not it obtains FDA approval for a product, the company would need to obtain the necessary approvals by the comparable foreign regulatory authorities before it can commence clinical trials or marketing of the product in those countries or jurisdictions. The approval process ultimately varies between countries and jurisdictions and can involve additional product testing and additional administrative review periods. The time required to obtain approval in other countries and jurisdictions might differ from and be longer than that required to obtain FDA approval. Regulatory approval in one country or jurisdiction does not ensure regulatory approval in another, but a failure or delay in obtaining regulatory approval in one country or jurisdiction may negatively impact the regulatory process in others.

Regulation and Marketing Authorization in the European Union

The process governing approval of medicinal products in the European Union follows essentially the same lines as in the United States and, likewise, generally involves satisfactorily completing each of the following:

- preclinical laboratory tests, animal studies and formulation studies all performed in accordance with the applicable EU Good Laboratory Practice regulations;
- submission to the relevant national authorities of a clinical trial application, or CTA, which must be approved before human clinical trials may begin;
- performance of adequate and well-controlled clinical trials to establish the safety and efficacy of the product for each proposed indication;
- submission to the relevant competent authorities of a marketing authorization application, or MAA, which includes the data supporting safety and efficacy as well as detailed information on the manufacture and composition of the product in clinical development and proposed labeling;
- satisfactory completion of an inspection by the relevant national authorities of the manufacturing facility or facilities, including those of third parties, at which the product is produced to assess compliance with strictly enforced current cGMP;
- potential audits of the non-clinical and clinical trial sites that generated the data in support of the MAA; and
- review and approval by the relevant competent authority of the MAA before any commercial marketing, sale or shipment of the product.

Preclinical Studies

Preclinical tests include laboratory evaluations of product chemistry, formulation and stability, as well as studies to evaluate toxicity in animal studies, in order to assess the potential safety and efficacy of the product. The conduct of the preclinical tests and formulation of the compounds for testing must comply with the relevant EU regulations and requirements. The results of the preclinical tests, together with relevant manufacturing information and analytical data, are submitted as part of the CTA.

Clinical Trial Approval

Requirements for the conduct of clinical trials in the European Union including GCP are implemented in the Clinical Trials Directive 2001/20/EC and the GCP Directive 2005/28/EC. Pursuant to Directive 2001/20/EC and Directive 2005/28/EC, as amended, a system for the approval of clinical trials in the European Union has been implemented through national legislation of the member states. Under this system, approval must be obtained from the competent national authority of an EU member state in which a study is planned to be conducted, or in multiple member states if the clinical trial is to be conducted in a number of member states. To this end, a CTA is submitted, which must be supported by an investigational medicinal product dossier, or IMPD, and further supporting information prescribed by Directive 2001/20/EC and Directive 2005/28/EC and other applicable guidance documents. Furthermore, a clinical trial may only be started after a competent ethics committee has issued a favorable opinion on the clinical trial application in that country.

In April 2014, the EU legislators passed the new Clinical Trials Regulation, (EU) No 536/2014, which will replace the current Clinical Trials Directive 2001/20/EC. To ensure that the rules for clinical trials are identical throughout the European Union, the new EU clinical trials legislation was passed as a regulation that is directly applicable in all EU member states. All clinical trials performed in the European Union are required to be conducted in accordance with the Clinical Trials Directive 2001/20/EC until the new Clinical Trials Regulation (EU) No 536/2014 becomes applicable. According to the current plans of the European Medicines Agency, or EMA, the new Clinical Trials Regulation will become applicable in 2019. The Clinical Trials Directive 2001/20/EC will, however, still apply three years from the date of entry into application of the Clinical Trials Regulation to (i) clinical trials applications submitted before the entry into application and (ii) clinical trials applications submitted within one year after the entry into application if the sponsor opts for old system.

The new Regulation (EU) No 536/2014 aims to simplify and streamline the approval of clinical trial in the European Union. The main characteristics of the regulation include:

- A streamlined application procedure via a single-entry point, the EU portal.
- A single set of documents to be prepared and submitted for the application as well as simplified reporting procedures that will spare sponsors from submitting broadly identical information separately to various bodies and different member states.
- A harmonized procedure for the assessment of applications for clinical trials, which is divided in two parts. Part I is assessed jointly by all member states concerned. Part II is assessed separately by each member state concerned.
- Strictly defined deadlines for the assessment of clinical trial application.
- The involvement of the ethics committees in the assessment procedure in accordance with the national law of the member state concerned but within the overall timelines defined by the Regulation (EU) No 536/2014.

Marketing Authorization

Authorization to market a product in the member states of the European Union proceeds under one of four procedures: a centralized authorization procedure, a mutual recognition procedure, a decentralized procedure or a national procedure.

Centralized Authorization Procedure

The centralized procedure enables applicants to obtain a marketing authorization that is valid in all EU member states based on a single application. Certain medicinal products, including products developed by means of biotechnological processes, must undergo the centralized authorization procedure for marketing authorization, which, if granted by the European Commission, is automatically valid in all 28 EU member states. The EMA and the European Commission administer this centralized authorization procedure pursuant to Regulation (EC) No 726/2004.

Pursuant to Regulation (EC) No 726/2004, this procedure is mandatory for:

- medicinal products developed by means of one of the following biotechnological processes:
- recombinant DNA technology;
- controlled expression of genes coding for biologically active proteins in prokaryotes and eukaryotes including transformed mammalian cells; and
- hybridoma and monoclonal antibody methods;
- advanced therapy medicinal products as defined in Article 2 of Regulation (EC) No. 1394/2007 on advanced therapy medicinal products;
- medicinal products for human use containing a new active substance that, on the date of effectiveness of this regulation, was not authorized in the European Union, and for which the therapeutic indication is the treatment of any of the following diseases:
- acquired immune deficiency syndrome;
- cancer;
- neurodegenerative disorder;
- diabetes;
- auto-immune diseases and other immune dysfunctions; and
- viral diseases;
- medicinal products that are designated as orphan medicinal products pursuant to Regulation (EC) No 141/2000.

The centralized authorization procedure is optional for other medicinal products if they contain a new active substance or if the applicant shows that the medicinal product concerned constitutes a significant therapeutic, scientific or technical innovation or that the granting of authorization is in the interest of patients in the European Union.

Administrative Procedure

Under the centralized authorization procedure, the EMA's Committee for Human Medicinal Products, or CHMP, serves as the scientific committee that renders opinions about the safety, efficacy and quality of medicinal products for human use on behalf of the EMA. The CHMP is composed of experts nominated by each member state's national authority for medicinal products, with an expert appointed to act as Rapporteur for the co-ordination of the evaluation with the possible assistance of a further member of the Committee acting as a Co-Rapporteur. After approval, the Rapporteur(s) continue to monitor the product throughout its life cycle. The CHMP has 210 days to adopt an opinion as to whether a marketing authorization should be granted. The process usually takes longer in case additional information is requested, which triggers clock-stops in the procedural timelines. The process is complex and involves extensive consultation with the regulatory authorities of member states and a number of experts. When an application is submitted for a marketing authorization in respect of a drug that is of major interest from the point of view of public health and in particular from the viewpoint of therapeutic innovation, the applicant may pursuant to Article 14(9) Regulation (EC) No 726/2004 request an accelerated assessment procedure. If the CHMP accepts such request, the time-limit of 210 days will be reduced to 150 days but it is possible that the CHMP can revert to the standard time-limit for the centralized procedure if it considers that it is no longer appropriate to conduct an accelerated assessment. Once the procedure is completed, a European Public Assessment Report, or EPAR, is produced. If the opinion is negative, information is given as to the grounds on which this conclusion was reached. After the adoption of the CHMP opinion, a decision on the MAA must be adopted by the European Commission, after consulting the E.U. member states, which in total can take more than 60 days.

Conditional Approval

In specific circumstances, EU legislation (Article 14(7) Regulation (EC) No 726/2004 and Regulation (EC) No 507/2006 on Conditional Marketing Authorizations for Medicinal Products for Human Use) enables applicants to obtain a conditional marketing authorization prior to obtaining the comprehensive clinical data required for an application for a full marketing authorization. Such conditional approvals may be granted for product candidates (including medicines designated as orphan medicinal products) if (1) the risk-benefit balance of the product candidate is positive, (2) it is likely that the applicant will be in a position to provide the required comprehensive clinical trial data, (3) the product fulfills unmet medical needs and (4) the benefit to public health of the immediate availability on the market of the medicinal product concerned outweighs the risk inherent in the fact that additional data are still required. A conditional marketing authorization may contain specific obligations to be fulfilled by the marketing authorization holder, including obligations with respect to the completion of ongoing or new studies, and with respect to the collection of pharmacovigilance data. Conditional marketing authorizations are valid for one year, and may be renewed annually, if the risk-benefit balance remains positive, and after an assessment of the need for additional or modified conditions and/or specific obligations. The timelines for the centralized procedure described above also apply with respect to the review by the CHMP of applications for a conditional marketing authorization.

Marketing Authorization under Exceptional Circumstances

Under Article 14(8) Regulation (EC) No 726/2004, products for which the applicant can demonstrate that comprehensive data (in line with the requirements laid down in Annex I of Directive 2001/83/EC, as amended) cannot be provided (due to specific reasons foreseen in the legislation) might be eligible for marketing authorization under exceptional circumstances. This type of authorization is reviewed annually to reassess the risk-benefit balance. The fulfillment of any specific procedures/obligations imposed as part of the marketing authorization under exceptional circumstances is aimed at the provision of information on the safe and effective use of the product and will normally not lead to the completion of a full dossier/approval.

Market Authorizations Granted by Authorities of E.U. Member States

In general, if the centralized procedure is not followed, there are three alternative procedures as prescribed in Directive 2001/83/EC:

- The decentralized procedure allows applicants to file identical applications to several EU member states and receive simultaneous national approvals based on the recognition by EU member states of an assessment by a reference member state.
- The national procedure is only available for products intended to be authorized in a single EU member state.
- A mutual recognition procedure similar to the decentralized procedure is available when a marketing authorization has already been obtained in at least one E.U. member state.

A marketing authorization may be granted only to an applicant established in the European Union.

Pediatric Studies

Prior to obtaining a marketing authorization in the European Union, applicants have to demonstrate compliance with all measures included in an EMA-approved Pediatric Investigation Plan, or PIP, covering all subsets of the pediatric population, unless the EMA has granted a product-specific waiver, a class waiver, or a deferral for one or more of the measures included in the PIP. The respective requirements for all marketing authorization procedures are set forth in Regulation (EC) No 1901/2006, which is referred to as the Pediatric Regulation. This requirement also applies when a company wants to add a new indication, pharmaceutical form or route of administration for a medicine that is already authorized. The Pediatric Committee of the EMA, or PDCO, may grant deferrals for some medicines, allowing a company to delay development of the medicine in children until there is enough information to demonstrate its effectiveness and safety in adults. The PDCO may also grant waivers when development of a medicine in children is not needed or is not appropriate, such as for diseases that only affect the elderly population.

Before a marketing authorization application can be filed, or an existing marketing authorization can be amended, the EMA determines that companies actually comply with the agreed studies and measures listed in each relevant PIP.

Periods of Authorization and Renewals

A marketing authorization is valid for five years in principle and the marketing authorization may be renewed after five years on the basis of a re-evaluation of the risk-benefit balance by the EMA or by the competent authority of the authorizing member state. To this end, the marketing authorization holder must provide the EMA or the competent authority with a consolidated version of the file in respect of quality, safety and efficacy, including all variations introduced since the marketing authorization was granted, at least six months before the marketing authorization ceases to be valid. Once renewed, the marketing authorization is valid for an unlimited period, unless the European Commission or the competent authority decides, on justified grounds relating to pharmacovigilance, to proceed with one additional five-year renewal. Any authorization which is not followed by the actual placing of the drug on the EU market (in case of centralized procedure) or on the market of the authorizing member state within three years after authorization ceases to be valid (the so-called sunset clause).

Regulatory Data Protection

EU legislation also provides for a system of regulatory data and market exclusivity. According to Article 14(11) of Regulation (EC) No 726/2004, as amended, and Article 10(1) of Directive 2001/83/EC, as amended, upon receiving marketing authorization, new chemical entities approved on the basis of complete independent data package benefit from eight years of data exclusivity and an additional two years of market exclusivity. Data exclusivity prevents regulatory authorities in the European Union from referencing the innovator's data to assess a generic (abbreviated) application. During the additional two-year period of market exclusivity, a generic marketing authorization can be submitted, and the innovator's data may be referenced, but no generic medicinal product can be marketed until the expiration of the market exclusivity. The overall ten-year period will be extended to a maximum of 11 years if, during the first eight years of those ten years, the marketing authorization holder, or MAH, obtains an authorization for one or more new therapeutic indications which, during the scientific evaluation prior to their authorization, are held to bring a significant clinical benefit in comparison with existing therapies. Even if a compound is considered to be a new chemical entity and the innovator is able to gain the period of data exclusivity, another company nevertheless could also market another version of the drug if such company obtained marketing authorization based on an MAA with a complete independent data package of pharmaceutical test, preclinical tests and clinical trials. However, products designated as orphan medicinal products enjoy, upon receiving marketing authorization, a period of ten years of orphan market exclusivity. Depending upon the timing and duration of the EU marketing authorization process, products may be eligible for up to five years' supplementary protection certificates, or SPCs, pursuant to Regulation (EC) No 469/2009. Such SPCs extend the rights under the basic patent for the drug.

Regulatory Requirements After a Marketing Authorization has been Obtained

If we obtain authorization for a medicinal product in the European Union, we will be required to comply with a range of requirements applicable to the manufacturing, marketing, promotion and sale of medicinal products:

Pharmacovigilance and other requirements

We will, for example, have to comply with the EU's stringent pharmacovigilance or safety reporting rules, pursuant to which post-authorization studies and additional monitoring obligations can be imposed. Other requirements relate, for example, to the manufacturing of products and APIs in accordance with good manufacturing practice standards. EU regulators may conduct inspections to verify our compliance with applicable requirements, and we will have to continue to expend time, money and effort to remain compliant. Non-compliance with EU requirements regarding safety monitoring or pharmacovigilance, and with requirements related to the development of products for the pediatric population, can also result in significant financial penalties in the European Union. Similarly, failure to comply with the EU's requirements regarding the protection of individual personal data can also lead to significant penalties and sanctions. Individual EU member states may also impose various sanctions and penalties in case we do not comply with locally applicable requirements.

Manufacturing

The manufacturing of authorized drugs, for which a separate manufacturer's license is mandatory, must be conducted in strict compliance with the EMA's Good Manufacturing Practices, or GMP, requirements and comparable requirements of other regulatory bodies in the European Union, which mandate the methods, facilities and controls used in manufacturing, processing and packing of drugs to assure their safety and identity. The EMA enforces its current GMP requirements through mandatory registration of facilities and inspections of those facilities. The EMA may have a coordinating role for these inspections while the responsibility for carrying them out rests with the member states competent authority under whose responsibility the manufacturer falls. Failure to comply with these requirements could interrupt supply and result in delays, unanticipated costs and lost revenues, and could subject the applicant to potential legal or regulatory action, including but not limited to warning letters, suspension of manufacturing, seizure of product, injunctive action or possible civil and criminal penalties.

Marketing and Promotion

The marketing and promotion of authorized drugs, including industry-sponsored continuing medical education and advertising directed toward the prescribers of drugs and/or the general public, are strictly regulated in the European Union under Directive 2001/83/EC. The applicable regulations aim to ensure that information provided by holders of marketing authorizations regarding their products is truthful, balanced and accurately reflects the safety and efficacy claims authorized by the EMA or by the competent authority of the authorizing member state. Failure to comply with these requirements can result in adverse publicity, warning letters, corrective advertising and potential civil and criminal penalties.

Patent Term Extension

In order to compensate the patentee for delays in obtaining a marketing authorization for a patented product, a supplementary certificate, or SPC, may be granted extending the exclusivity period for that specific product by up to five years. Applications for SPCs must be made to the relevant patent office in each E.U. member state and the granted certificates are valid only in the member state of grant. An application has to be made by the patent owner within six months of the first marketing authorization being granted in the European Union (assuming the patent in question has not expired, lapsed or been revoked) or within six months of the grant of the patent (if the marketing authorization is granted first). In the context of SPCs, the term "product" means the active ingredient or combination of active ingredients for a medicinal product and the term "patent" means a patent protecting such a product or a new manufacturing process or application for it. The duration of an SPC is calculated as the difference between the patent's filing date and the date of the first marketing authorization, minus five years, subject to a maximum term of five years.

A six-month pediatric extension of an SPC may be obtained where the patentee has carried out an agreed pediatric investigation plan, the authorized product information includes information on the results of the studies and the product is authorized in all member states of the European Union.

Brexit and the Regulatory Framework in the United Kingdom

On June 23, 2016, the electorate in the United Kingdom, or U.K. voted in favor of leaving the E.U., which is commonly referred to as "Brexit." Thereafter, on March 29, 2017, the country formally notified the E. U. of its intention to withdraw pursuant to Article 50 of the Lisbon Treaty. The withdrawal of the U.K. from the E.U. took effect on January 31, 2020. Since the regulatory framework for pharmaceutical products in the U.K. covering quality, safety and efficacy of pharmaceutical products, clinical trials, marketing authorization, commercial sales and distribution of pharmaceutical products is derived from E.U. directives and regulations, Brexit could materially impact the future regulatory regime which applies to products and the approval of product candidates in the U.K. It remains to be seen how, if at all, Brexit will impact regulatory requirements for product candidates and products in the U.K.

Pharmaceutical Coverage, Pricing and Reimbursement

Significant uncertainty exists as to the coverage and reimbursement status of products approved by the FDA and other government authorities. Sales of products will depend, in part, on the extent to which the costs of the products will be covered by third-party payors, including government health programs in the United States such as Medicare and Medicaid, commercial health insurers and managed care organizations. The process for determining whether a payor will provide coverage for a product may be separate from the process for setting the price or reimbursement rate that the payor will pay for the product once coverage is approved. Third-party payors may limit coverage to specific products on an approved list, or formulary, which might not include all of the approved products for a particular indication.

In order to secure coverage and reimbursement for any product that might be approved for sale, a company may need to conduct expensive pharmacoeconomic studies in order to demonstrate the medical necessity and cost-effectiveness of the product, in addition to the costs required to obtain FDA or other comparable regulatory approvals. A payor's decision to provide coverage for a drug product does not imply that an adequate reimbursement rate will be approved. Third-party reimbursement may not be sufficient to maintain price levels high enough to realize an appropriate return on investment in product development.

There has been an increased focus on drug pricing in recent years in the United States. Although there are no direct government price controls over private sector purchases in the United States, there are rebates and other financial requirements for federal and state health care programs. The Medicare Modernization Act, enacted in December 2003, established the Medicare Part D outpatient prescription drug benefit, which is provided primarily through private entities that attempt to negotiate price concessions from pharmaceutical manufacturers. The health care reform legislation enacted in 2010, known as the Affordable Care Act, requires drug manufacturers to pay 50% of the Medicare Part D coverage gap, also known as the "donut hole," on prescriptions for branded products filled when the beneficiary reaches this coverage. The Deficit Reduction Act of 2005 resulted in changes to the way drug prices are reported to the government and the formula using such information to calculate the required Medicaid rebates. The Affordable Care Act increased the minimum basic Medicaid rebate for branded prescription drugs from 15.1% to 23.1% and requires pharmaceutical manufacturers to pay states rebates on prescription drugs dispensed to Medicaid managed care enrollees. In addition, the Affordable Care Act increased the additional Medicaid rebate on "line extensions" (such as extended release formulations) of solid oral dosage forms of branded products, revised the definition of average manufacturer price by changing the classes of purchasers included in the calculation, and expanded the entities eligible for discounted pricing under the federal 340B drug pricing program. Current orphan drugs are excluded from the expanded 340B hospitals eligible for discounts.

The Affordable Care Act imposes a significant annual fee on companies that manufacture or import branded prescription drug products. The fee (which is not deductible for federal income tax purposes) is based on the manufacturer's market share of sales of branded drugs and biologics (excluding orphan drugs) to, or pursuant to coverage under, specified U. S. government programs. The Affordable Care Act also contains a number of provisions, including provisions governing the way that health care is financed by both governmental and private insurers, enrollment in federal health care programs, reimbursement changes, the increased use of comparative effectiveness research in health care decision-making, and enhancements to fraud and abuse requirements and enforcement, that are affecting existing government health care programs and will result in the development of new programs. The Affordable Care Act also contains requirements for manufacturers to publicly report certain payments or other transfers of value made to physicians and teaching hospitals. We are unable to predict the future course of federal or state health care legislation and regulations, including regulations that will be issued to implement provisions of the Affordable Care Act. The Affordable Care Act and further changes in the law or regulatory framework that reduce our revenues or increase our costs could also have a material adverse effect on our business, financial condition and results of operations and cash flows.

Public and private health care payers control costs and influence drug pricing through a variety of mechanisms, including through negotiating discounts with the manufacturers and through the use of tiered formularies and other mechanisms that provide preferential access to certain drugs over others within a therapeutic class. Payers also set other criteria to govern the uses of a drug that will be deemed medically appropriate and therefore reimbursed or otherwise covered. Payers may require physicians to seek approval from them before a product will be reimbursed or covered, commonly referred to as prior authorization. In particular, many public and private health care payers limit reimbursement and coverage to the uses of a drug that are either approved by the FDA or appear in a recognized drug compendium. Drug compendia are publications that summarize the available medical evidence for particular drug products and identify which uses of a drug are supported or not supported by the available evidence, whether or not such uses have been approved by the FDA. For example, in the case of Medicare Part D coverage for oncology drugs, the Medicare Modernization Act, with certain exceptions, provides for Medicare coverage of unapproved uses of an FDA-approved drug if the unapproved use is reasonable and necessary and is supported by one or more citations in CMS-approved compendia, such as the National Comprehensive Cancer Network Drugs and Biologics Compendium. Different pricing and reimbursement schemes exist in other countries. For example, in the European Union, governments influence the price of pharmaceutical products through their pricing and reimbursement rules and control of national health care systems that fund a large part of the cost of such products to consumers. The approach taken varies from member state to member state. Some jurisdictions operate positive or negative list systems under which products may only be marketed once a reimbursement price has been agreed. Other member states allow companies to fix their own prices for medicines, but monitor and control company profits and may limit or restrict reimbursement. The downward pressure on health care costs in general, and prescription drugs in particular, has become very intense. As a result, increasingly high barriers are being erected to the entry of new products, as exemplified by the actions of the National Institute for Clinical Excellence in the United Kingdom, which evaluates the data supporting new medicines and passes reimbursement recommendations to the government. In addition, in some countries cross-border imports from low-priced markets (parallel imports) exert a commercial pressure on pricing within a country.

In the European Union, pricing and reimbursement schemes vary widely from country to country. Some countries provide that drug products may be marketed only after a reimbursement price has been agreed. Some countries may require the completion of additional studies that compare the cost-effectiveness of our drug candidate to currently available therapies (so called health technology assessment) in order to obtain reimbursement or pricing approval. For example, the European Union provides options for its member states to restrict the range of drug products for which their national health insurance systems provide reimbursement and to control the prices of medicinal products for human use. E.U. member states may approve a specific price for a drug product or it may instead adopt a system of direct or indirect controls on the profitability of the company placing the drug product on the market. Other member states allow companies to fix their own prices for drug products, but monitor and control prescription volumes and issue guidance to physicians to limit prescriptions. The downward pressure on health care costs in general, particularly prescription drugs, has become intense. As a result, increasingly high barriers are being erected to the entry of new products. In addition, there can be considerable pressure by governments and other stakeholders on prices and reimbursement levels, including as part of cost containment measures. Political, economic and regulatory developments may further complicate pricing negotiations, and pricing negotiations may continue after reimbursement has been obtained. Reference pricing used by various E.U. member states, and parallel distribution (arbitrage between low-priced and high-priced member states), can further reduce prices. Any country that has price controls or reimbursement limitations for drug products may not allow favorable reimbursement and pricing arrangements.

Healthcare Law and Regulation

Healthcare providers, physicians and third-party payors play a primary role in the recommendation and prescription of drug products that are granted marketing approval. Arrangements with third-party payors and customers are subject to broadly applicable fraud and abuse and other healthcare laws and regulations. Such restrictions under applicable federal and state healthcare laws and regulations, include the following:

- the federal Anti-Kickback Statute prohibits, among other things, persons from knowingly and willfully soliciting, offering, receiving or providing remuneration, directly or indirectly, in cash or in kind, to induce or reward either the referral of an individual for, or the purchase, order or recommendation of, any good or service, for which payment may be made, in whole or in part, under a federal healthcare program such as Medicare and Medicaid;

- the federal False Claims Act imposes civil penalties, and provides for civil whistleblower or qui tam actions, against individuals or entities for knowingly presenting, or causing to be presented, to the federal government, claims for payment that are false or fraudulent or making a false statement to avoid, decrease or conceal an obligation to pay money to the federal government;

- the federal Health Insurance Portability and Accountability Act of 1996, or HIPAA, imposes criminal and civil liability for 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 its implementing regulations, also imposes obligations, including mandatory contractual terms, with respect to safeguarding the privacy, security and transmission of individually identifiable health information;

- the federal false statements statute prohibits knowingly and willfully falsifying, concealing or covering up a material fact or making any materially false statement in connection with the delivery of or payment for healthcare benefits, items or services;

- the federal transparency requirements under the Health Care Reform Law requires manufacturers of drugs, devices, biologics and medical supplies to report to the Department of Health and Human Services information related to payments and other transfers of value to physicians and teaching hospitals and physician ownership and investment interests; and

- analogous state and foreign laws and regulations, such as state anti-kickback and false claims laws, may apply to sales or marketing arrangements and claims involving healthcare items or services reimbursed by non-governmental third-party payors, including private insurers.

An increasing number of states have enacted legislation requiring pharmaceutical and biotechnology companies to file periodic reports of expenses relating to the marketing and promotion of drug products and gifts and payments to individual healthcare practitioners in these states; to make periodic public disclosures on sales, marketing, pricing, clinical trials and other activities; to report information pertaining to and justifying price increases; or to register their sales representatives. Other states prohibit various marketing-related activities, such as the provision of certain kinds of gifts or meals; price gouging; or pharmacies and other healthcare entities from providing certain physician prescribing data to pharmaceutical and biotechnology companies for use in sales and marketing. In addition, states such as California, Connecticut, Nevada, and Massachusetts require pharmaceutical companies to implement compliance programs and/or marketing codes. State and foreign laws also govern the privacy and security of health information in some circumstances, many of which differ from each other in significant ways and often are not preempted by HIPAA, thus complicating compliance efforts.

Environmental, Health and Safety Matters

The manufacturing facilities of the third-parties that develop our product candidates are subject to extensive environmental, health and safety laws and regulations in a number of jurisdictions, governing, among other things: the use, storage, registration, handling, emission and disposal of chemicals, waste materials and sewage; chemicals, air, water and ground contamination; air emissions and the cleanup of contaminated sites, including any contamination that results from spills due to our failure to properly dispose of chemicals, waste materials and sewage.

These laws, regulations and permits could potentially require the expenditure by us of significant amounts for compliance or remediation. If the third-party manufacturers fail to comply with such laws, regulations or permits, we may be subject to fines and other civil, administrative or criminal sanctions, including the revocation of permits and licenses necessary to continue our business activities. In addition, we may be required to pay damages or civil judgments in respect of third-party claims, including those relating to personal injury (including exposure to hazardous substances we use, store, handle, transport, manufacture or dispose of), property damage or contribution claims. Some environmental, health and safety laws allow for strict, joint and several liability for remediation costs, regardless of comparative fault. We may be identified as a responsible party under such laws. Such developments could have a material adverse effect on our business, financial condition and results of operations.

In addition, laws and regulations relating to environmental, health and safety matters are often subject to change. In the event of any changes or new laws or regulations, we could be subject to new compliance measures or to penalties for activities that were previously permitted.

Our Intellectual Property

We rely upon a combination of licenses, patents, trade secrets, know-how, and licensing opportunities to develop our business. Our future prospects depend on our ability to protect our intellectual property. We also need to operate without infringing the proprietary rights of third parties.

Patents

We attempt to protect our technology and products through patents and patent applications pursuant to the terms of our license agreements. We have a nonexclusive, worldwide license from the NIAID, an Institute of the NlH, to use certain intellectual property and biological materials relating to coronavirus spike proteins to develop a vaccine product candidate for SARS-CoV-2. We have an exclusive, worldwide license from ILH Holdings Inc. (as an assignee of Precigen) to use its technology to develop lantibiotics. We also have an exclusive worldwide license from Precigen's wholly owned subsidiaries, ActoBio Therapeutics, Inc. and Actobiotics NV to use their intellectual property to develop AG013 for the treatment of oral mucositis.

We co-own the intellectual property for certain homologs of our MU1140 product candidate with the Texas A&M University System. Following a review of our research and development activities and a determination to focus our financial resources on our research activities for OG716 and AG013, we provided a notice to Texas A&M of the termination of our license agreement with Texas A&M which took effect in January 2019. We retain co-ownership of the intellectual property relating to the Texas A&M license agreement.

The effect of issued patents is that they provide patent protection for the claims covered by the patents. While the expiration of a product patent normally results in a loss of market exclusivity for the covered product or product candidate, commercial benefits may continue to be derived from: (i) later-granted patents on processes and intermediates related to the most economical method of manufacture of the active ingredient of such product; (ii) patents relating to the use of such product; (iii) patents relating to novel compositions and formulations; and (iv) in the United States and certain other countries, market exclusivity that may be available under relevant law. The effect of patent expiration on products or product candidates also depends upon many other factors such as the nature of the market and the position of the product in it, the growth of the market, the complexities and economics of the process for manufacture of the active ingredient of the product and the requirements of new drug provisions of the Federal Food, Drug and Cosmetic Act or similar laws and regulations in other countries.

We believe that protection of discoveries in connection with our development activities, our proprietary products, technologies, processes and know-how and all of our intellectual property are important to our business. To achieve a competitive position, we rely on trade secrets, non-patented proprietary know-how and continuing technological innovation, where patent protection is not believed to be appropriate or attainable. In addition, as outlined above, we have a number of patent licenses from third parties, some of which may be important to our business. There can be no assurance that any of our patents, licenses or other intellectual property rights will afford us any protection from competition.

Trademarks

Our trademarks are important to our business. We currently use the following unregistered trademarks: SMaRT Replacement Therapy™, MU1140™, and LPT3-04™. We currently have pending with the U.S. PTO, applications for registration of the mark of ORAGENICS™ (therapeutic products; anti-infectives. We also have rights to use other names essential to our business. Federally registered trademarks have a perpetual life, as long as they are maintained and renewed on a timely basis and used properly as trademarks, subject to the rights of third parties to seek cancellation of the trademarks if they claim priority or confusion of usage. We regard our trademarks and other proprietary rights as valuable assets and believe they have significant value to us.

Protection of Trade Secrets

We attempt to protect our trade secrets, including the processes, concepts, ideas and documentation associated with our technologies, through the use of confidentiality agreements and non-competition agreements with our current employees and with other parties to whom we have divulged such trade secrets. There can be no assurance that these agreements will not be breached, that we will have adequate remedies for any breach, that others will not independently develop equivalent proprietary information or that other third parties will not otherwise gain access to our trade secrets and other intellectual property. If our employees or other parties breach our confidentiality agreements and non-competition agreements or if these agreements are not sufficient to protect our technology or are found to be unenforceable, our competitors could acquire and use information that we consider to be our trade secrets and we may not be able to compete effectively. Most of our competitors have substantially greater financial, marketing, technical and manufacturing resources than we have and we may not be profitable if our competitors are also able to take advantage of our trade secrets.

We may find it necessary to initiate litigation to enforce our patent rights, to protect our intellectual property or to determine the scope and validity of the proprietary rights of others. Litigation is costly and time-consuming, and there can be no assurance that our litigation expenses will not be significant in the future or that we will prevail in any such litigation.

Government Grants

We have previously received funding from government agencies under the National Science Foundation's and National Institute of Health's Small Business Innovation Research, or SBIR, grants. Eligibility of public companies to receive such grants is based on size and ownership criteria which are under review by the Small Business Administration, or SBA. As a result, our eligibility may change in the future and additional funding from this source may not be available. Contracts and grants funded by the U.S. government, including to a certain extent, our newly-acquired license with the NIH, may include provisions granting the government substantial rights and remedies, many of which are not typical to nongovernmental commercial contracts, including termination rights, intellectual property claims entitlement, domestic manufacturing and export control requirements, expanded civil or criminal remedies under the False Claims Act, False Statements Act and similar remedial statutes specific to government agreements, and limitations on the government's financial liability due to uncertainty in Congressional appropriations and the legal particularities related to enforcing the government's contractual obligations.

In addition, although we seek to protect the competitive benefits we derive from our patents, proprietary information, and other intellectual property, we may not have the right to prohibit the U.S. government from using certain technologies developed or acquired by us due to federal research grants or to prohibit third-party companies, including our competitors, from using those technologies in providing products and services to the U.S. government. The U.S. government could have the right to royalty-free use of technologies that we may develop under such grants. We may commercially exploit those government-funded technologies and may assert our intellectual property rights against other non-government users of technology developed by us, but we may not be successful in our efforts to do so.

Employees

We have seven full-time employees. We enjoy good relations with our employees. None of our employees are a member of any labor union, and we are not a party to any collective bargaining agreement. We also have a number of consulting agreements with a leading academic scientist, clinicians and regulatory experts. These individuals serve as key consultants with respect to our research and development programs. Dr. David Zarley serves as our Director of Research and Development in a consulting capacity for our vaccine product candidate. We retain consultants according to the terms of consulting agreements. Under such agreements, we pay them a consulting fee and reimburse them for out-of-pocket expenses incurred in performing their services for us. Our consultants may be employed by other entities and therefore may have commitments to their employer, or may have other consulting or advisory agreements that may limit their availability to us.

Corporate Information

We were incorporated in November 1996 and commenced operations in 1999. We consummated our initial public offering in June 2003. Our corporate office is located at 4902 Eisenhower Boulevard, Suite 125, Tampa, Florida 33634.

Available Information

Our website is www.oragenics.com. On our website we make available at no cost our annual reports on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K and amendments to those reports filed or furnished as soon as reasonably practicable after we electronically file such material with, or furnish them to, the United States Securities and Exchange Commission ("SEC"). The information contained on our website is not a part of this annual report on Form 8-K.

RISK FACTORS

As used in this section entitled "Risk Factors," references to "we," "our," "us," "the Company" and "Oragenics" refer to Oragenics, Inc. and includes, where appropriate, its wholly-owned subsidiaries, unless context requires otherwise.

Risks Related to Our Business

We have incurred significant losses since our inception and expect to continue to experience losses for the foreseeable future.

We have incurred significant net losses and negative cash flow in each year since our inception, including net losses of approximately $15.6 million and $9.9 million for the years ended December 31, 2019, and 2018, respectively. As of December 31, 2019, our accumulated deficit was approximately $127.4 million. We have devoted a significant amount of our financial resources to research and development, including our nonclinical development activities and clinical trials, as well as licensing and acquisitions related to our product candidates. We expect that the costs associated with our plans to begin preclinical research, contract manufacturing and file an IND for our TerraCoV2 vaccine product candidate and the research and development of our product candidates pursuant to our exclusive channel partnerships with ILH Holdings, Inc. (an assignee of Precigen) in the area of lantibiotics ("Lantibiotics Program") and with Precigen's subsidiary ActoBio Therapeutics, Inc. in the area of Oral Mucositis ("Oral Mucositis Program") will continue to increase the level of our overall expenses significantly going forward. Additionally, our NIH license also requires the payment of certain recurring and performance-based royalties that may negatively impact our financial capabilities. As a result, we expect to continue to incur substantial net losses and negative cash flow for the foreseeable future. These losses and negative cash flows have had, and will continue to have, an adverse effect on our shareholders' equity and working capital. Although our application for certain Biomedical Advanced Research and Development Authority ("BARDA") funding is pending, we cannot predict our ability to obtain such funding, and you should not rely upon our obtaining such funding to finance the development of our TerraCoV2 vaccine product candidate. Because of the numerous risks and uncertainties associated with product development and commercialization, we are unable to accurately predict the timing or amount of substantial expenses or when, or if, we will be able to generate the revenue necessary to achieve or maintain profitability.

We will need to raise additional capital in the future to complete the development and commercialization of our product candidates and operate our business.

Developing and commercializing biopharmaceutical products, including conducting nonclinical studies and clinical trials and establishing manufacturing capabilities, is expensive, and the progress of our efforts to develop and commercialize our product candidates, including our acquisition of a vaccine product candidate, can cause us to use our limited, available capital resources faster than we currently anticipate. Our actual costs may ultimately vary from our current expectations, which could materially impact our use of capital and our forecast of the period of time through which our financial resources will be adequate to support our operations. Our current cash, cash equivalents and short-term investments are not sufficient to fully implement our business strategy and sustain our operations beyond the end of the first quarter of 2021. Accordingly, we will need to seek additional sources of financing and such additional financing may not be available on favorable terms, if at all. Until we can generate a sufficient amount of product revenue, if ever, we expect to finance future cash needs through public or private equity offerings, debt financings or corporate or government collaboration and licensing arrangements. If we do not succeed in raising additional funds on acceptable terms, we may be unable to complete existing nonclinical and planned clinical trials or obtain approval of our product candidates from the FDA and other regulatory authorities. We expect capital outlays and operating expenditures to increase over the next several years as we expand our infrastructure, and research and development activities. Specifically, we need to raise additional capital to, among other things:

- conduct preclinical research for our TerraCoV2 vaccine product candidate, file an IND with the FDA and, if approved, engage in Phase 1 clinical trials;
- engage in GMP and non-GMP manufacturing for our product candidates at the preclinical research and clinical trial stages;

- expand our clinical laboratory operations;
- fund our clinical validation study activities;
- expand our research and development activities; and
- finance our capital expenditures and general and administrative expenses.

Our present and future funding requirements will depend on many factors, including:

- the current and continued microeconomic impact of the COVID-19 pandemic on our ability, the ability of our third-party contractors and suppliers, and the ability of government regulators to conduct ordinary business operations in a timely and efficient manner, as well as the pandemic's broader, macroeconomic impact on the U.S., foreign and global economic markets;
- the level of research and development investment budgeted to develop our current and future product candidates;
- costs of filing, prosecuting, defending and enforcing patent claims and other intellectual property rights;
- our need or decision to acquire or license complementary technologies or acquire complementary businesses;
- changes in test development plans needed to address any difficulties in product candidate selection for commercialization;
- competing technological and market developments;
- our interaction and relationship with the FDA, or other, regulatory agencies; and
- changes in regulatory policies or laws that affect our operations.

Additional capital may not be available on satisfactory terms, or at all. Furthermore, if we raise additional funds by issuing equity securities, dilution to our existing stockholders would result. Any equity securities issued also may provide for rights, preferences or privileges senior to those of holders of our common stock. If we raise additional funds by issuing debt securities, these debt securities would have rights, preferences and privileges senior to those of holders of our common stock, and the terms of the debt securities issued could impose significant restrictions on our operations. If we raise additional funds through collaborations and licensing arrangements, we might be required to relinquish significant rights to our technologies or our products under development, or grant licenses on terms that are not favorable to us, which could lower the economic value of those programs to us. If adequate funds are not available, we may have to scale back our operations or limit our research and development activities, which may cause us to grow at a slower pace, or not at all, and our business could be adversely affected.

In addition, we could be forced to discontinue product development and commercialization of one or more of our product candidates, forego sales and marketing efforts, and/or forego licensing attractive business opportunities.

We have limited vaccine-specific research, development, manufacturing, testing, regulatory, commercialization, sales, distribution, and marketing experience, and we may need to invest significant financial and management resources to establish these capabilities. Despite such investments and our best efforts, our strategic acquisition of Noachis Terra may turn out to be unsuccessful.

As part of our business strategy, we monitor and analyze strategic acquisition opportunities that we believe will be strategic fits for the Company and beneficial to the Company's shareholders. As demonstrated by our acquisition of Noachis Terra, we may acquire companies, businesses, products and technologies that complement, augment or transform our existing business. However, such acquisitions could involve numerous risks that may prevent us from fully realizing the benefits that we anticipated as a result of such transactions.

Prior to our acquisition of Noachis Terra, we had little-to-no experience in the development and commercialization of vaccines. Although, in connection with the acquisition, we added experienced vaccine researchers and consultants and appointed an experienced vaccine industry professional to our board of directors, given our size and current stage of development, we still have limited vaccine-specific research, development, manufacturing, testing, regulatory, commercialization, sales, distribution, and marketing experience. To successfully develop our TerraCoV2 vaccine product candidate, we will need to dedicate significant amounts of our limited financial and management resources to bolster our expertise in this area. Our success depends significantly on the continued contributions of our executive officers, financial, scientific and technical personnel and consultants, and on our ability to attract additional personnel.

During our operating history, many essential responsibilities have been assigned to a relatively small number of individuals, and we currently depend heavily upon the efforts and abilities of our management team. However, as we advance into vaccine development, the demands on our key employees will expand and we will need to recruit additional qualified employees for our Company. The competition for such qualified personnel is intense, particularly in light of the demand for a vaccine or other treatment for SARS-CoV-2 and/or COVID-19. The loss of services of any of our existing consultants or our inability to attract additional personnel to fill critical positions could adversely affect our ability to efficiently develop our TerraCoV2 vaccine product candidate. The loss or unavailability of the services of any of these individuals could have a material adverse effect on our business, prospects, financial condition and results.

Alternatively, or in addition to the above, we may enter into strategic alliances or partnership with other vaccine industry entities to utilize their research, development, manufacturing testing, regulatory or commercialization skills, but we may be unable to enter into such agreements on favorable terms, if at all. If our future strategic collaborators do not commit sufficient resources to our alliances or partnerships and the progress of our vaccine development, if any, and we are unable to develop the necessary capabilities on our own, we may be unable to advance the development of our TerraCoV2 vaccine product candidate to the point of commercialization, even if we obtain regulatory approval. We will be competing with many companies that currently have existing, extensive and well-funded operations, and without a significant internal team or the support of a third party to perform essential functions related to vaccine research, development, manufacturing, testing, regulatory approval, and commercialization, we may be unable to compete successfully against these more established companies and our TerraCoV2 vaccine product candidate may fail.

Any failure by us to effectively limit such risks as we implement our strategic acquisition could have a material adverse effect on our business, financial condition or results of operations and cause the price of our securities to fall.

We have limited financial resources and we may not be able to maintain our current level of operations or be able to fund the further development of our new TerraCoV2 vaccine product candidate.

To date, Oragenics has never developed a vaccine product candidate, and we cannot assure investors that we will be able to successfully develop a vaccine to prevent SARS-CoV-2 or COVID-19 with our current resources and capabilities. Because our new TerraCoV2 vaccine product candidate is in early stages of development, it will require extensive preclinical and clinical testing, and we will need significant additional funding to conduct such research and testing. We do not expect to generate revenue from product sales, licensing fees, royalties, milestones, contract research or other sources in amounts sufficient to fully fund our operations for the foreseeable future, and we will therefore use our cash resources, and expect to require additional funds, to maintain our existing operations, continue our research and development programs, commence future preclinical studies and clinical trials for our TerraCoV2 vaccine product candidate, and to seek regulatory approvals.

We anticipate seeking such additional funds through a combination of public or private equity or debt financings, as well as potential collaborations, strategic alliances and marketing, distribution or licensing arrangements and non-dilutive funding from government and nongovernment funding entities, as well as other sources; for example, grant funding from BARDA to further the research, development, manufacturing, testing, and regulatory approval of vaccine product candidates. While we may continue to apply for contracts or grants from academic institutions, nonprofit organizations and governmental entities, we may not be successful. Adequate additional funding may not be available to us on acceptable terms, if at all. If we cannot raise the additional funds required for our anticipated operations or to support our development efforts, we may be required to delay significantly, reduce the scope of or eliminate one or more of our research or development programs, downsize our organization, or seek alternative measures to avoid insolvency, including arrangements with collaborative partners or others that may require us to relinquish rights to certain of our technologies or our vaccine candidate. If we raise additional funds through future offerings of shares of our common stock or other debt or equity securities, such offerings would cause dilution of current stockholders' percentage ownership in the Company, which could be substantial. Additionally, future offerings also could have a material and adverse effect on the price of our common stock.

We may be unable to win any government contracts, grants, agreement or other funding. Even if we are successful in obtaining such contracts, grants, agreements or other funding, we cannot assure the success of our TerraCoV2 vaccine product candidate, that it will be approved by the FDA or other public health regulatory authority or that any funding provided will be sufficient to complete development and successful commercialization.

From time to time, we may apply for contracts, grants, agreements or other funding from government agencies, academic institutions and non-profit organizations. Such contracts or grants can be highly attractive because they provide capital to fund the ongoing development of our technologies and vaccine candidates without diluting our stockholders. However, significant competition exists for these contracts, grants, agreements or other funding. Entities offering such contracts, grants, agreements or other funding may have requirements to apply for or to otherwise be eligible to receive such contracts, grants, agreements or other funding that our competitors may be able to satisfy that we cannot. In addition, such entities have limited funding available to award and may make arbitrary decisions as to whether to offer contracts or make grants, to whom the contracts or grants will be awarded and the size of the contracts or grants to each awardee. Even if we are able to satisfy the award requirements, we may not be a successful awardee. Therefore, we may not be able to win any contracts or grants in a timely manner, if at all.

Even if we receive a financing through one of the aforementioned mechanisms, the success of our TerraCoV2 vaccine product candidate cannot be assured solely by our ability to obtain such financing, nor can it assure that any vaccine product candidate so financed will succeed in clinical trials and receive regulatory approval from the FDA or other public health regulatory authorities. Moreover, we cannot guarantee that our receipt of such financing will obviate the need for future financial resources to support the further development of our TerraCoV2 vaccine product candidate, as additional development activities may be needed, and the vaccine approval and development process can be costly and unpredictable. 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. Accordingly, our receipt of such funding cannot be relied upon solely as an indicator or guarantee of the success of our TerraCoV2 vaccine product candidate.

We may rely on government funding and collaboration with government entities for our vaccine development, which adds uncertainty to our research and development efforts and may impose requirements that increase the costs of development, commercialization and production of any programs developed under those government-funded programs.

Because we anticipate the resources necessary to develop our new TerraCoV2 vaccine product candidate will be substantial, we may explore funding and development collaboration opportunities with the U.S. government and its agencies. For example, we may continue to apply for certain grant funding from BARDA, the NIH or other government agencies to further the research, development, manufacture, testing, and regulatory approval of our TerraCoV2 vaccine product candidate. We have no control or input over whether an application for BARDA grant funding will be accepted or approved, in full or in part, and we cannot provide investors with any assurances that we will receive such funding.

Similar to the requirements imposed by our new NIH license, contracts and grants funded by the U.S. government and its agencies, including any agreements funded by BARDA, contain provisions that reflect the government's substantial rights and remedies, many of which are not typically found in commercial contracts, including powers of the government to:

- reduce or modify the government's obligations under such agreements without the consent of the other party;
- claim rights, including IP rights, in products and data developed under such agreements;
- audit contract-related costs and fees, including allocated indirect costs;
- suspend the contractor or grantee from receiving new contracts pending resolution of alleged violations of procurement laws or regulations.
- impose U.S. manufacturing requirements for products that embody inventions conceived or first reduced to practice under such agreements;
- suspend or debar the contractor or grantee from doing future business with the government;
- control and potentially prohibit the export of products;
- pursue criminal or civil remedies under the False Claims Act, False Statements Act, and similar remedy provisions specific to government agreements; and
- limit the government's financial liability to amounts appropriated by the U.S. Congress on a fiscal-year basis, thereby leaving some uncertainty about the future availability of funding for a program even after it has been funded for an initial period.

In addition, government contracts and grants, ordinarily contain additional requirements that may increase our costs of doing business, reduce our profits, and expose us to liability for failure to comply with these terms and conditions, including the following:

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

If we received such grants or agreements, we may not have the right to prohibit the U.S. government from using certain technologies developed by us, and we may not be able to prohibit third-parties, including our competitors, from using those technologies in providing products and services to the U.S. government. Further, under such agreements we could be subject to obligations to and the rights of the U.S. government set forth in the Bayh-Dole Act of 1980, meaning the U.S. government may have rights in certain inventions developed under these government-funded agreements, including a non-exclusive, non-transferable, irrevocable worldwide license to use inventions for any governmental purpose. In addition, the U.S. government could have the right to require us to grant exclusive, partially exclusive, or nonexclusive licenses to any of these inventions to a third party if it determines that: (i) adequate steps have not been taken to commercialize the invention; (ii) government action is necessary to meet public health or safety needs; or (iii) government action is necessary to meet requirements for public use under federal regulations, also referred to as "march-in rights." Although the U.S. government's historic restraint with respect to these rights indicates they are unlikely to be used, any exercise of the march-in rights could harm our competitive position, business, financial condition, results of operations, and prospects. In the event we would be subject to the U.S. government's exercise such march-in rights, we may receive compensation that is deemed reasonable by the U.S. government in its sole discretion, which may be less than what we might be able to obtain in the open market.

Additionally, as is the case under our new NIH license, the U.S. government requires that any products embodying any invention generated through the use of U.S. government funding be manufactured substantially in the United States. The manufacturing preference requirement can be waived if the owner of the intellectual property can show that reasonable but unsuccessful efforts have been made to grant licenses on similar terms to potential licensees that would be likely to manufacture substantially in the United States or that under the circumstances domestic manufacture is not commercially feasible. This preference for U.S. manufacturers may limit our ability to contract with non-U.S. manufacturers for products covered by such intellectual property.

Although we will need to comply with some of these obligations in relation to our NIH license, not all of the aforementioned obligations may be applicable to us unless and only to the extent that we receive a government grant, contract or other agreement. However, as an organization, we are relatively new to government contracting and new to the regulatory compliance obligations that such contracting entails. If we were to fail to maintain compliance with those obligations, we may be subject to potential liability and to termination of our contracts, including the NIH license, which may have a materially adverse effect on our ability to develop our TerraCoV2 vaccine product candidate.

Our auditor has previously expressed substantial doubt about our ability to continue as a going concern and absent additional financing we may be unable to remain a going concern.

In light of our recurring losses, accumulated deficit and negative cash flow as described in our notes to our audited financial statements, the report of our independent registered public accounting firm on our financial statements for the year ended December 31, 2017 contained an explanatory paragraph raising substantial doubt about our ability to continue as a going concern. Our financial statements did not include any adjustments that may have been necessary in the event we were unable to continue as a going concern. Had we been unable to establish to the satisfaction of our independent registered public accounting firm that the net proceeds from our financing efforts will be sufficient to allow for the removal of this going concern qualification, we may need to significantly modify our operational plans for us to continue as a going concern. Absent sufficient additional financing, we may be unable to remain a going concern.

Our vaccine product candidate is at the preclinical stage and has not been approved for sale. We may not develop a commercially successful vaccine product.

Our TerraCoV2 vaccine development program is in the early stages of research and development, and currently includes only one product candidate, which is in the preclinical stage. Limited data exist regarding the safety and efficacy of our vaccine product candidate, and we must conduct a substantial amount of additional research, development and clinical testing before any regulatory authority will approve our vaccine product candidate. 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 or unsatisfactory clinical trial results.

In addition, adverse events, or the perception of adverse events, relating to vaccine product 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 other ailments. Regardless of the veracity of or the data supporting these claims, these and other claims may influence public perception of the use of vaccine product candidates and could result in greater governmental regulation, stricter labeling requirements and potential regulatory delays in the testing or approval of our potential vaccine product candidate. Such greater government regulation could have a material effect on our ability to develop and market our TerraCoV2 vaccine product candidate.

Our pursuit of a vaccine product candidate for SARS-CoV-2 is at an early stage. We have not conducted substantial research and development for a vaccine product candidate, and we may be unable to produce a vaccine that successfully prevents the virus in a timely and economical manner, if at all.

We have not conducted substantial research on the TerraCoV2 vaccine product candidate and the development of our vaccine product candidate is at an early state. We lack experience in the research, development, manufacture, regulatory approval, marketing, commercialization and implementation of a vaccine product candidate. Limited data exist regarding the safety and efficacy of our vaccine product candidate, and we must conduct a substantial amount of additional research and development before any regulatory authority will approve our vaccine product candidate. Also, uncertainties exist surrounding the longevity and severity of COVID-19 as a global health concern. The success of our efforts to develop and commercialize our product candidates could fail for a number of reasons. Accordingly, we may be unable to produce a vaccine that successfully targets SARS-CoV-2 in a timely and economical manner, if at all.

For example, we expect committing significant financial resources and personnel to the development of our TerraCoV2 vaccine product candidate, which may cause delays in or otherwise negatively impact our other product candidate development programs. The outcome of any research and development program is highly uncertain. Only a small fraction of biotechnology and vaccine development programs ultimately result in commercial products or even product candidates and a number of events could delay our development efforts and negatively impact our ability to obtain regulatory approval for, and to manufacture, market and sell, a vaccine. Additionally, our ability to develop an effective vaccine will depend on our ability to work on an accelerated timeline, with limited access to financial resources beyond those that we currently possess, and in competition with a significant number of better-funded and more experienced vaccine-development companies. Moreover, if the COVID-19 pandemic is effectively contained or the risk of further spread is diminished or eliminated before we can successfully develop, manufacture and commercialize TerraCoV2, we may be unable to identify strategic partners willing to work with and support us in our development efforts and, even if we obtain regulatory approval, the market that we anticipate for this product candidate may not exist or may be much smaller than we previously anticipated. Alternatively, even if a market exists, our vaccine product candidate could be found to be ineffective or unsafe, or otherwise fail to receive necessary regulatory clearances. In addition, another party may be successful in producing a safer or more effective vaccine or other treatment for SARS-CoV-2, which may also lead to the diversion of governmental and nongovernmental resources away from us and toward our competitors. Our vaccine product candidate, even 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. Accordingly, our inability to develop a commercially-successful vaccine product will materially harm our business.

The market opportunities for our vaccine product candidate may be smaller than we believe them to be. Moreover, any pandemic threat may abate, or alternative vaccines or technologies may be adopted, before our vaccines achieve regulatory approval.

The primary area of focus for our future research and product development activities is the development of a vaccine candidate to prevent SARS-CoV-2 and the disease it principally causes, COVID-19. Our current projections of both the number of people who are or will be affected this disease, as well as the subset of people who may be affected by this disease and who have the potential to benefit from immunity through our TerraCoV2 vaccine product candidate, are based on estimates. These estimates have been derived from a variety of sources, including scientific literature, surveys of clinics, patient foundations, or market research, and may prove to be incorrect. Further, because coronaviruses have evolved in recent decades and research on SARS-CoV-2 and COVID-19 are continuously changing due to the complicated nature of the virus, new studies may change the estimated incidence or prevalence of COVID-19. The number of clinical trial participants in the United States, Europe, and elsewhere may turn out to be lower than expected, potential clinical trial participants may not be otherwise amenable to treatment with our products, or new clinical trial participants may become increasingly difficult to identify or gain access to, all of which would adversely affect our ability to conduct the research and development necessary to complete the vaccine product candidate.

Moreover, the threat of the COVID-19 pandemic outbreak may subside before we are able to complete research and development for our TerraCoV2 vaccine product candidate, obtain regulatory approval for the vaccine product candidate and realize any return on our investment in the research and development. Other organizations may obtain licenses for their own pandemic vaccines, or government health organizations may acquire adequate stockpiles of pandemic vaccines or adopt other technologies or strategies to prevent or limit outbreaks our TerraCoV2 vaccine product candidate reaches the marketplace. We may not achieve a return on our investment before the threat of the COVID-19 pandemic subsides or a competing product is adopted.

If we are unable to successfully develop our product candidates, our operating results and competitive position could be harmed. Research and development involves a lengthy and complex process, and we may not be successful in our efforts to develop and commercialize our product candidates. The further development and ultimate commercialization of product candidates for SARS-CoV-2 and COVID-19, as well as our other product candidates, are keys to our growth strategy.

A key element of our revised business strategy is to discover, develop, validate and commercialize a vaccine product candidate to provide specific lifetime immunity from SARS-CoV-2, which we aim to market globally to both public and private payers. Previously, our focused concerned the development of a portfolio of additional antibiotic product candidates to combat multi drug resistant organism, or MDRO, outbreaks and the associated costs to patients, inpatient facilities and the health care industry and to develop, validate and commercialize a product candidate. We cannot assure you that we will be able to successfully complete development of, or commercialize any or all of our planned future product candidates, or that they will be clinically usable. The product development process involves a high degree of risk and may take up to several years or more. Our new product development efforts may fail for many reasons, including:

- our recent entry into the vaccine research and development industry;
- failure of future tests at the research or development stages;
- lack of clinical validation data to support effectiveness;
- delays resulting from the failure of third-party suppliers or contractors to meet their obligations in a timely and cost-effective manner;
- regulatory delays at the FDA or from other independent oversight authorities, particularly in light of the demands placed on public health resources during and following the COVID-19 pandemic;
- failure to obtain or maintain necessary certifications, licenses, clearances or approvals to market or perform the test; or
- lack of commercial acceptance by the health care marketplace.

Few research and development projects result in commercial products, and success in early clinical trials often is not replicated in later trials. At any point, we may abandon development of products in favor of the development or acquisition of new products, or we may be required to expend considerable resources repeating clinical studies or trials, which would adversely impact the timing for generating potential revenues from those new products. In addition, as we advance the development of new products through to the commercialization stage, we will have to make additional investments in our sales and marketing operations, which may be prematurely or unnecessarily incurred if the commercial launch of a product is abandoned or delayed.

Our vaccine research and development efforts are to a large extent dependent upon our intellectual property and biologicals materials license with the NIAID and the NIH.

An important element of our intellectual property portfolio is our license with the NIAID and the NIH. Pursuant to the Patent License and Biological Materials License Agreement, we hold a nonexclusive, worldwide license to certain specified patent rights (including patent applications, provisional patent applications and Patent Cooperation Treaty ("PCT") patent applications) and biological materials relating to the use of prefusion coronavirus spike proteins for the purpose of developing and commercializing a vaccine product candidate for SARS-CoV-2. This intellectual property and biological materials license is essential to our operations and our ability to research and develop our TerraCoV2 vaccine product candidate. The terms of the license agreement will terminate upon the earlier of (a) twenty (20) years from the first commercial sale where no licensed patent rights exist or have ceased to exist or (b) the expiration of the last to expire of any licensed patent rights. Additionally, we must use reasonable commercial efforts to develop, manufacture, and commercialize our vaccine product candidate, to manufacture our vaccine product candidate substantially within the United States and provide the United States public with reasonable access to our vaccine, if approved for commercialization by the FDA. If we breach the terms of the license agreement, including any failure to make minimum royalty payments required thereunder or failure to reach certain developmental milestones, using best efforts to introduce a licensed product or practice a licensed process in certain territories by certain dates, the NIAID has the right to terminate the license.

If we were to lose or otherwise be unable to maintain the NIH license on acceptable terms, or find that it is necessary or appropriate to secure new licenses from other third parties, it would halt our ability to develop and market our TerraCoV2 vaccine product candidate, which would have an immediate material adverse effect on our business, operating results and financial condition. Thus, our inability to retain the rights and technologies identified by the license, or those that we may in the future identify, could have a material adverse impact on our ability to complete the development of our vaccine product candidate. No assurance can be given that we will be successful in licensing any additional rights or technologies from the NIAID, the NIH or others. If we fail to retain the NIH license or if we fail to obtain additional rights and licenses necessary to further the development and commercialization of our vaccine product candidate, our planned development for our vaccine product candidate may be materially impacted and the costs associated with the development may increase significantly, and we may be entirely unable to complete development of a SARS-CoV-2 vaccine product candidate.

We may incur additional expenses and obligations in connection our NIH license.

We must use reasonable commercial efforts to bring to market a vaccine product candidate covered by the license, which means we must adhere to an existing commercial development plan and existing performance benchmarks. Additionally, we are obliged to pay to the NIAID certain minimum annual royalties, certain benchmark-related royalties and royalties based upon a share of any net sales of our vaccine product candidate, following regulatory approval and the first commercial sale. Additionally, among other obligations, we must provide regular written reports to the NIAID on the development status of our vaccine product candidate and pay for our pro rata share of the NIH's patent prosecution-related expenses and fees. Moreover, we must use reasonable commercial efforts to develop, manufacture, and commercialize the vaccine product candidate, to manufacture the vaccine product candidate substantially within the United States and provide the United States public with reasonable access to the vaccine, if approved for commercialization by the FDA. All of these additional obligations beyond ordinary research and development and regulatory compliance related to the approval of our vaccine product candidate may impose delays or greater costs upon our ability to timely develop our vaccine product candidate.

Although our forecasts for expenses and the sufficiency of our capital resources will take into account the funds available for the research and development of our vaccine product candidate development, our actual cash requirements may vary materially from our current expectations for a number of other factors that may include, but are not limited to, changes in the focus and direction of our development programs, competitive and technical advances, costs associated with the development of our product candidates and the our share of the costs of filing, prosecuting, defending and enforcing the intellectual property rights covered by the NIH license. If we exhaust the funds available for the development of TerraCoV2 more quickly than anticipated, regardless of the reason, and we are unable to obtain additional financing on terms acceptable to us or at all, we may be unable to meet our obligations under the NIH license, which may be terminated, and we will be unable to proceed with development of our product candidates on expected timelines and will be forced to prioritize among them.

The intellectual property covered by our NIH license concerns patent applications and provisional applications. We cannot assure investors that any of the currently pending or future patent applications will result in granted patents, nor can we predict how long it will take for such patents to be granted.

The intellectual property covered by our NIH license concerns certain, specified patent rights (including patent applications, provisional patent applications and PCT patent applications). Although the NIAID has agreed to assume responsibility for the preparation, filing, prosecution and maintenance of all patent applications covered by the licensed patent rights, we cannot be certain as to when or if final patents will be issued for those patent applications covered by the licensed patent rights. However, the NIH may not successfully prosecute certain patent applications, the prosecution of which they control, under which we are only a licensee and on which our business substantially depends. Even if patents issue from these applications, the NIH may fail to maintain these patents, may decide not to pursue litigation against third-party infringers, may fail to prove infringement or may fail to defend against counterclaims of patent invalidity or unenforceability.

Moreover, it is possible that the licensed pending patent applications will not result in granted patents, and even if such pending patent applications grant as patents, they may not provide a basis for intellectual property protection of commercially viable vaccine products or may not provide us with any competitive advantages. Further, it is possible that, for any of the patents that may be granted in the future, others will design around the licensed patent rights or identify methods for preventing or treating SARS-CoV-2 that do not concern the rights covered by our NIH license. Further, we cannot assure investors that other parties will not challenge any patents granted to the NIH or that courts or regulatory agencies will hold NIH's patents to be valid or enforceable. We cannot guarantee investors that, if required to defend the covered patents, we will be successful in defending challenges made against the NIH patents and patent applications. Any successful third-party challenge to the NIH patents could result in the unenforceability or invalidity of such patents, or to such patents being interpreted narrowly or otherwise in a manner adverse to our interests. Our ability to establish or maintain a technological or competitive advantage over our competitors may be diminished because of these uncertainties.

Risks with respect to the NIH and our NIH license may also arise out of circumstances beyond our control. In spite of our best efforts, the NIH may conclude that we have materially breached the license agreement and may therefore terminate the agreement, thereby removing our ability to market vaccine product candidates covered by the agreement. If the NIH license agreement is terminated, or if the underlying patents fail to provide the intended market protection, competitors would have the freedom to seek regulatory approval of, and to market, products similar or identical to ours. Moreover, if the NIH license agreement is terminated, the NIH may be able to prevent us from utilizing the technology covered by the licensed patent rights. This could have a material adverse effect on our competitive business position and our financial condition, results of operations and our business prospects.

We cannot prevent the NIH or other companies, including our competitors, from licensing the same intellectual property and biological materials that we have licensed or from otherwise duplicating our business model and operations.

Our NIH license is a nonexclusive license and we are not permitted to sublicense the intellectual property or biological materials covered by the license. Therefore, we cannot be certain that the NIH has not previously licensed, or that the NIH will not, in the future, license the intellectual property or biological materials to other biotechnology companies, including those who intend to develop a vaccine product candidate for SARS-CoV-2, some or all of the nonexclusive intellectual property and biological materials available to us under the NIH license. Moreover, we do not currently own any exclusive rights or licenses necessary to fully develop our TerraCoV2 vaccine product candidate, and such rights or licenses, if in existence, could be held by our competitors or used by other third parties to otherwise directly compete against us. If our competitors or others have or acquire exclusive rights or licenses that they could enforce against us, then we may be required to alter our products, pay licensing fees or cease activities. If our products conflict with rights or licenses of others, third parties could bring legal actions against us or our collaborators, licensees, suppliers or customers, claiming damages and seeking to enjoin manufacturing and marketing of the affected products. If these legal actions are successful, in addition to any potential liability for damages, we could be required to obtain a license in order to continue to manufacture or market the affected products. We may not prevail in any legal action and a required license under the patent may not be available on acceptable terms or at all. Accordingly, while we may develop, acquire or license the additional technologies necessary to the development of our vaccine candidate we cannot assure you that we will be able to develop, acquire or license such technologies or that alternatives will be sufficient to enable development of our TerraCoV2 vaccine product candidate or to prevent others from competing with us and developing substantially-similar products.

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

We or the NIH may be subject to claims that former employees, collaborators or other third parties have an interest in the licensed patents or other intellectual property as an inventor or co-inventor. For example, we or the NIH may have inventorship disputes arise from conflicting obligations of employees, consultants or others who are involved in developing the intellectual property covered by the NIH license or our product candidates. Litigation may be necessary to defend against these and other claims challenging inventorship or our license or the NIH's ownership, as applicable, of the licensed patents, trade secrets or other intellectual property. If we or our licensors fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights, such as our right to use intellectual property that is important to our TerraCoV2 vaccine product candidate. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management and other employees. Any of the foregoing could have a material adverse effect on our business, financial condition, results of operations and prospects.

We may be unable to refine a method to produce MU1140 homologs in large-scale commercial quantities. If we cannot, we will be unable to generate significant revenues from sales of our MU1140 homologs product candidate.

Our antibiotic product candidates, all homologs of MU1140, are produced by our strain of *S. mutans* and variants thereof. In March 2005 we successfully developed a methodology for producing MU1140 in quantities sufficient to undertake its nonclinical testing. In June of 2012 we entered into an exclusive collaboration agreement with Precigen Corporation to use its advanced transgene and cell engineering platforms to achieve sufficient production quantities of MU1140. In 2016 we were able to transition manufacturing of OG716 to a third-party manufacturer capable of fermenting quantities sufficient to conduct nonclinical studies. If we are not able to further adequately scale up fermentation and purification methodologies for large-scale manufacture, we will be unable to partner and generate revenues from this product candidate and our business, financial condition and results of operations will be materially adversely affected. The manufacturing of MU1140 homologs, including OG716 or any other possible antibiotic product candidates based on lantibiotics, is a highly exacting and complex process. Manufacturing MU1140 homologs, including OG716, or any other antibiotic candidates derived from lantibiotics on a commercial scale has not yet been achieved to our knowledge, so there are additional risks that such efforts will not be successful. The Precigen technology may not be feasible to efficiently develop methodologies to enable large scale manufacturing of a MU1140 homolog or other antibiotic product candidates. Third-party manufacturers must have additional technical skills and must take multiple steps to attempt to control the manufacturing processes. If we are unable to produce MU1140 homologs in large-scale commercial quantities, we will be unable to generate significant revenues from sales of our MU1140 product candidate and our financial condition and results of operations will be materially adversely affected.

Our success will depend on our ability to obtain regulatory approval of our product candidates under our Lantibiotics Program and our Oral Mucositis Program and their successful commercialization.

Our product candidates under our Lantibiotics Program and Oral Mucositis Program have not received regulatory approval in any jurisdiction and they may never receive approval or, if approvals are obtained, may never be commercialized successfully. We have incurred and will continue to incur significant costs relating to the nonclinical and clinical development of our antibiotic product candidates (including MU1140 homologs we may develop) and oral mucositis product candidate, respectively. We have performed extensive nonclinical testing using native MU1140 and entered into an Exclusive Channel Collaboration Agreement with Precigen (which was assigned to ICH Holdings, Inc.). We began nonclinical activities on homologs of MU1140 in the second half of 2014. Those activities include toxicity results, physicochemical characterizations, and efficacy studies in animals. This work will be done solely by us through the use of outside contractors. If our nonclinical work is successful, we would expect the IND for a first-in-human clinical trial of OG716 to be filed with the FDA based on our ability to complete the requisite studies, contingent on sufficient funding.

We initiated a Phase 2 clinical trial on our AG013 product candidate in 2017. We received the top-line results from the Phase 2 clinical trial in April 2020, which did not demonstrate statistical significance on the primary endpoint of severe oral mucositis duration when compared to placebo. While the top-line adverse event information indicated AG013's safety, we continue to analyze the full results of the clinical trial to determine if potential efficacies for sub-patient populations exist. Even if we are able to conduct successful clinical trials or the required regulatory approvals are obtained, we may never be able to generate significant revenues from our product candidates. If our product candidates are unsuccessful, we may be unable to generate sufficient revenues to sustain and grow our business, and our business, financial condition and results of operations will be materially adversely affected.

Our exclusive channel collaboration agreements are based on early stage technologies in their fields.

Our exclusive channel collaboration agreements contemplate the use of ILH's advanced transgene and cell engineering platforms for the development and production of lantibiotics and AG013. Such technologies have a limited history of use in the design and development of active pharmaceutical ingredients and drug products involving direct administration and may therefore involve unanticipated risks or delays.

We will incur additional expenses in connection with our exclusive channel collaboration arrangements.

Pursuant to our exclusive channel collaborations, we are responsible for future research and development expenses of product candidates developed under such collaborations, including those incurred by our collaboration partners for research on our behalf as provided in the ECC Agreements. As a result, we expect the level of our overall research and development expenses going forward will increase. The timing and amount of expenses under our ECCs are difficult to predict. Although all manufacturing, nonclinical studies and human clinical trials are expensive and difficult to design and implement, costs associated with the manufacturing, research and development of biologic product candidates are generally greater in comparison to small molecule product candidates. We expect over time to add additional personnel to support our Lantibiotics Program and, subject, at least in part, to our full analysis of the Phase 2 clinical trial results for AG013, our Oral Mucositis Program as we progress in our development efforts.

Because our collaborations pursuant to our ECCS are in the early stage, future development costs associated with this program may be difficult to anticipate and exceed our expectations. Our actual cash requirements may vary materially from our current expectations for a number of other factors that may include, but are not limited to, unanticipated technical challenges, changes in the focus and direction of our development activities or adjustments necessitated by changes in the competitive landscape in which we operate. If we are unable to continue to financially support such collaborations due to our own working capital constraints, we may be forced to delay our activities. If we are unable to obtain additional financing on terms acceptable to us or at all, we may be forced to seek licensing partners or discontinue development, which in turn could lead to the termination of our ECC Agreements.

We may not be able to retain the exclusive rights licensed to us under our ECCs to develop and commercialize lantibiotic products and AG013 related products.

Under our ECCs we are responsible for, among other things, funding the further anticipated development of lantibiotics and AG013 toward the goal of commercialization, conducting nonclinical and clinical development of product candidates, as well as for other aspects of manufacturing and the commercialization of the product(s). Our collaboration partners may terminate such agreements if we do not perform certain specified requirements, including developing therapies identified to us and considered superior by our collaboration partners. There can be no assurance that we will be able to successfully perform under the Oral Mucositis ECC or Lantibiotic ECC and if either ECC is terminated it would prevent us from achieving our business objectives.

Our Collaboration Partners, Precigen and ILH, may not devote sufficient time and resources to successfully carry out their contracted duties or meet expected deadlines, we may not be able to advance our product candidates in a timely manner or at all.

On January 31, 2020, our prior collaboration partner, Intrexon Corporation, pursuant to a restructuring which in part, resulted in a change of Intrexon's name to Precigen, Inc. In addition, pursuant to Precigen's restructuring plan, the Lantibiotic ECC and Lantibiotic Stock Issuance Agreement were assigned to and assumed by ILH Holdings, Inc. ("ILH"), a wholly owned subsidiary of Precigen, Precigen subsequently sold the majority of its bioengineering assets, inclusive of ILH, to TS Biotechnology, an entity managed by Third Security. Our success depends, in part, on the performance by our collaborators of their responsibilities under our collaboration arrangements. Our new collaborator may not perform their obligations in a timely fashion or in a manner satisfactory to us or consistent with how previously performed. Typically, we cannot control the amount of resources or time our collaborators may devote to our programs or potential products that may be developed in collaboration with us. We are currently involved in multiple research and development collaborations with academic and research institutions. These collaborators frequently depend on outside sources of funding to conduct or complete research and development, such as grants or other awards. As a result of these uncertainties, we are unable to control the precise timing and execution of any experiments that may be conducted.

Additionally, our current or future corporate collaborators will retain the ability to pursue other research, product development or commercial opportunities that may be directly competitive with our programs. If these collaborators elect to prioritize or pursue other programs in lieu of ours, we may not be able to advance product development programs in an efficient or effective manner, if at all. If a collaborator is pursuing a competitive program and encounters unexpected financial or capability limitations, they may be motivated to reduce the priority placed on our programs or delay certain activities related to our programs or be unwilling to properly fund their share of the development expenses for our programs. Any of these developments could harm our product and technology development efforts, which could seriously harm our business.

Our success will depend on our ability to partner or sub-license our product candidates and their subsequent successful commercialization.

Our MU1140 homologs and AG013 product candidate are in early stage development and are expected to require partners with substantial financial resources to continue the development of each of these products to commercialization. In addition, none of these product candidates have received regulatory approval in any jurisdiction and they may never receive approval or, if approvals are obtained, may never be commercialized successfully. In addition, we do not know whether any of our clinical trials will be successful or can be completed within our current expected budget. For our MU1140 homologs and other antibiotic product candidates, we have performed nonclinical testing using native MU1140 and expect to continue to pursue the nonclinical testing of our MU1140 homologs and other antibiotic product candidates during 2020 we would expect the IND for a first-in-human clinical trial of OG716 to be filed with the FDA based on our ability to complete the requisite studies, contingent on sufficient funding. Even if we are able to partner and conduct successful clinical trials or the required regulatory approvals are obtained, we may never be able to generate significant revenues from our MU1140 homologs or other antibiotic product candidates or other product candidates. If our MU1140 homologs product candidate or our other product candidates under the Lantibiotics Program and Oral Mucositis Program are unsuccessful, we may be unable to generate sufficient revenues to sustain and grow our business, and our business, financial condition and results of operations will be materially adversely affected.

Our financial results could vary significantly from quarter to quarter and are difficult to predict.

Our operating results could vary significantly from quarter to quarter due to a variety of factors, many of which are outside of our control. As a result, comparing our operating results on a period-to-period basis may not be meaningful. In addition, we may not be able to predict our future revenues or results of operations. We base our current and future expense levels on our internal operating plans and sales forecasts, and our operating costs vary to the extent of our research and development and the candidate of clinical trials. As a result, we may incur significant or unanticipated expenses associated with our research and development efforts of our product candidates under development. In addition to other risk factors discussed in this section, factors that may contribute to the variability of our quarterly results include:

- the timing of release of pre-clinical and clinical trial results and new products and services by our competitors, particularly those that may represent a significant portion of revenues in any given period;
- the popularity of new products, and products released in prior periods;
- changes in pricing policies by us or our competitors;

- our success in entering new geographic markets;
- decisions by us to incur additional expenses, such as commencing a clinical trial or increases in research and development;
- the level of expenses associated with our regulatory applications or compliance and clinical trials; and
- the timing of compensation expense associated with equity compensation grants.

As a result of these and other factors, our quarterly and annual operating results could be materially adversely affected. Moreover, our operating results may not meet the expectations of research analysts or investors, in which case the price of our common stock could decrease significantly.

If our manufacturers in general fail to meet our requirements and the requirements of regulatory authorities, our research and development may be materially adversely affected.

We do not have the internal capability to manufacture our SARS-CoV-2 vaccine, MU1140 homologs, or any other product candidates and all of their constituent parts under GMPs, as required by the FDA and other regulatory agencies. In order to continue to develop and commercialize our product candidates and to apply for regulatory approvals for our product candidates, we will need to contract with third parties that have, or otherwise develop, the necessary manufacturing capabilities in full compliance with applicable regulatory requirements.

There are a limited number of manufacturers that operate under GMPs that are capable of manufacturing our product candidates. Due to the early-stage development of our SARS-CoV-2 vaccine product candidate, we cannot at this time accurately predict the numbers and capabilities of manufacturers that will be required and capable of manufacturing the vaccine product candidate and any of its components. Manufacturing on a commercial scale has not yet been undertaken and there are additional technical skills needed for the manufacture of MU1140 homologs that will further limit the number of potential manufacturers. As such, if we are unable to enter into supply and processing contracts with any of these manufacturers or processors for our TerraCoV2 vaccine product candidate, our MU1140 product candidates, or our other product candidates for the conduct of clinical trials on such product candidate we may incur additional costs and delays in development and commercialization.

Problems with these manufacturing processes such as equipment malfunctions, facility contamination, labor problems, raw material shortages or contamination, natural disasters, power outages, terrorist activities, or disruptions in the operations of our suppliers and even minor deviations from normal procedures, could result in product defects or manufacturing failures that result in lot failures, product recalls, product liability claims and insufficient inventory or supply of product for the conduct of clinical trials. For example, the COVID-19 pandemic and government shutdowns in response have interrupted supply chains, the manufacture and transmission of goods and the regularity with which manufacturers ordinarily operate. Such interruptions, unless remedied entirely, can disrupt our research and development efforts and our clinical trials, and even if remedied, could create delays that materially impact our business.

If we are required to find an additional or alternative source of supply, there may be additional costs and delays in the development, clinical trial timing, or commercialization of our product candidates. Additionally, the FDA and other regulatory agencies routinely inspect manufacturing facilities before approving a New Drug Application, or NDA, or Biologic License Application, or BLA, for a drug or biologic manufactured at those sites. If any of our manufacturers or processors fails to satisfy regulatory requirements, the approval and eventual commercialization of our commercial products and product candidates may be delayed.

All of our contract manufacturers must comply with the applicable GMPs, which include quality control and quality assurance requirements as well as the corresponding maintenance of records and documentation. If our contract manufacturers do not comply with the applicable GMPs and other FDA regulatory requirements, we may be subject to product liability claims, the availability of marketed products for sale could be reduced, our product commercialization could be delayed or subject to restrictions, we may be unable to meet demand for our products and may lose potential revenues and we could suffer delays in the progress of nonclinical testing and clinical trials for products under development. We do not have control over our third-party manufacturers' compliance with these regulations and standards. Moreover, while we may choose to manufacture our products ourselves in the future, we have no experience in the manufacture of pharmaceutical or biological products for clinical trials or commercial purposes. If we decide to manufacture products, we would be subject to the regulatory requirements described above. In addition, we would require substantial additional capital and would be subject to delays or difficulties encountered in manufacturing pharmaceutical or biological products. Regardless of the manufacturer of our products, we will be subject to continuing obligations regarding the submission of safety reports and other post-market information.

We rely on the significant experience and specialized expertise of our senior management and scientific team and the loss of any of our key personnel or our inability to successfully hire their successors could harm our business.

Our performance is substantially dependent on the continued services and on the performance of our senior management and scientific team, who have extensive experience and specialized expertise in our business. Our performance also depends on our ability to retain and motivate our other key employees. In June 2016, we hired Dr. Alan Joslyn as President and Chief Executive Officer and in February 2012 we hired Mr. Michael Sullivan, Certified Public Accountant as our Chief Financial Officer, Mr. Sullivan also served as our Interim Principal Executive Officer from October of 2014 through June of 2016. The loss of the services of senior management or any key employees could harm our ability to develop and commercialize our product candidates. We have no key man life insurance policies.

In connection with our acquisition of Noachis Terra, we added vaccine consultants and advisors, who were engaged in various capacities related to the research and development of a SARS-CoV-2 vaccine product candidate. Our ability to successfully continue the vaccine development depends in large part on our ability to retain certain consultants. Despite our efforts to retain these consultants, one or more may terminate their engagement with us on short notice. The loss of the services of any of these consultants could have substantial negative effects on our research and development efforts, which are necessary to further development of our TerraCoV2 vaccine product candidate.

We need to hire and retain additional qualified scientists and other highly skilled personnel to maintain and grow our business.

Our future success depends on our ability to identify, attract, hire, train, retain and motivate highly skilled technical, managerial and research personnel in all areas within our organization. We plan to continue to grow our business and will need to hire additional personnel to support this growth. We believe that there are only a limited number of individuals with the requisite skills to serve in many of our key positions, and we compete for key personnel with other biotechnology companies, as well as universities and research institutions. It is often difficult to hire and retain these persons, and we may be unable to replace key persons if they leave or be unable to fill new positions requiring key persons with appropriate experience. If we fail to attract, integrate and retain the necessary personnel, our ability to maintain and grow our business could suffer significantly.

If any of our product candidates are shown to be ineffective or harmful in humans, we will be unable to generate revenues from these product candidates.

Before obtaining regulatory approvals for the commercial sale of our product candidates, we must demonstrate through nonclinical testing and clinical trials that our products are safe and effective for use in humans. To date the testing of the antibiotic substance MU1140 homologs has been undertaken solely in the laboratory and in animals. We have not yet conducted human trials with any MU1140 homolog nor have we initiated clinical trials for our TerraCoV2 vaccine product candidate. To date, available clinical data for our AG013 product candidate has been limited to a Phase 1b clinical trial and top-line results from our Phase 2 clinical trial, the latter of which did not demonstrate statistical significance on the primary endpoint of severe oral mucositis when compared to placebo but which is subject to our further analysis of the full results of the Phase II clinical trial. It is possible that when and if future lantibiotic trials and/or our TerraCoV2 vaccine product candidate trials are conducted in humans, they will show that our antibiotic or vaccine candidates are ineffective or harmful in humans. If MU1140 homologs are shown to be ineffective or harmful in humans, we will be unable to commercialize and generate revenues from sales of this compound. Our further analysis of the AG013 Phase 2 clinical trial results could substantiate that our AG013 product candidate is ineffective. If we are unable to generate revenues from the first generation of MU1140 and homologs, or any other product candidates, our business, financial condition and results of operations will be materially adversely affected.

Because we are new to vaccine development, we must identify vaccines for development with our technologies and establish successful third-party relationships.

Because we are new to vaccine development and lack substantial experience in the research and development of vaccines, the near and long-term viability of our SARS-CoV-2 vaccine product candidate will depend in part on our ability to successfully establish new strategic collaborations with biotechnology companies, non-profit organizations. government agencies and other vaccine industry entities. Establishing strategic collaborations and obtaining government funding is difficult and time-consuming. Potential collaborators may reject collaborations based upon their assessment of our financial, regulatory or intellectual property position or based on their internal pipeline; government agencies may reject contract or grant applications based on their assessment of public need, the public interest, our products' ability to address these areas, or other reasons beyond our expectations or control. If we fail to establish a strategic collaborations or government relationships on acceptable terms, we may not be able to develop and commercialize our TerraCoV2 vaccine product candidate or generate sufficient revenue to fund further research and development efforts.

Additionally, we do not have our own clinical research and development facilities dedicated to vaccine development and manufacture. We have in the past and may in the future engage consultants and independent contract research organizations, subject to regulatory considerations, to design and conduct its clinical trials in connection with the development of our SARS-CoV-2 vaccine product candidate. As a result, these important aspects of a product's development will be outside of our direct control. Even if we establish new collaborations or obtain government funding, these relationships may never result in the successful development or commercialization of our vaccine product candidate for several reasons, including the fact that:

- we may not have the ability to control the activities of our partners and cannot provide assurance that they will fulfill their obligations to us, including with respect to the license, development and commercialization of our vaccine product candidate, in a timely manner or at all;
- such partners may not devote sufficient resources to our vaccine product candidate or properly maintain or defend our intellectual property rights;
- any failure on the part of our partners to perform or satisfy their obligations to us could lead to delays in the development or commercialization of our vaccine product candidate and affect our ability to realize product revenue; and
- disagreements, including disputes over the ownership of technology developed with such collaborators, could result in litigation, which would be time consuming and expensive, and may delay or terminate research and development efforts, regulatory approvals and commercialization activities.

Our collaborators will be subject to the same regulatory approval of their manufacturing facility and process as us. Before we could begin commercial manufacturing of any of our vaccine candidates, we and our collaborators must pass a pre-approval inspection before FDA approval and comply with the FDA's GMP regulations. If our collaborators fail to comply with these requirements, our vaccine candidate may not be approved. If our collaborators fail to comply with these requirements after approval, we could be subject to possible regulatory action and may be limited in the jurisdictions in which we are permitted to sell our products. If we or our collaborators fail to establish agreements as necessary, we could be required to undertake research, development, manufacturing and commercialization activities solely at our own expense. These activities would significantly increase our capital requirements and, given our lack of sales, marketing and distribution capabilities, significantly delay the commercialization of our vaccine product candidate.

We intend to rely on third parties to cover a portion of the costs associated with obtaining regulatory approval for, and manufacturing and marketing of, our product candidates. If we are unable to obtain agreements with third parties to fund these costs, we will have to fund such costs ourselves or we may be unable to extract any value from these technologies.

As we continue our development of product candidates, we intend to either license these product candidates to, or partner with, one or more major pharmaceutical companies at the earliest possible time in their product development. If we do so, we intend for these licensees or partners to pay the costs associated with any remaining development work, regulatory submissions, clinical trials and the manufacturing and marketing of our product candidates. If we are unable to license our product candidates or otherwise partner with third parties, we will have to fund the costs of our clinical trials ourselves or we will be unable to extract any value from these technologies. We will also have to establish our own manufacturing facilities and find our own distribution channels. This would greatly increase our future capital requirements and we cannot assure you that we would be able to obtain the necessary financing to pay these costs. If we are unable to cover the associated costs or we cannot obtain financing on acceptable terms or at all, our business, financial condition and results of operations will be materially adversely affected.

Our dependence on collaborative arrangements with third parties subjects us to a number of risks. These collaborative arrangements may not be on terms favorable to us. Agreements with collaborative partners typically allow partners significant discretion in electing whether or not to pursue any of the planned activities. We cannot control the amount and timing of resources our collaborative partners may devote to products based on the collaboration, and our partners may choose to pursue alternative products. Our partners may not perform their obligations as expected. Business combinations or significant changes in a collaborative partner's business strategy may adversely affect a partner's willingness or ability to complete its obligations under the arrangement. Moreover, we could become involved in disputes with our partners, which could lead to delays or termination of the collaborations and time-consuming and expensive litigation or arbitration. Even if we fulfill our obligations under a collaborative agreement, our partner may be able to terminate the agreement under certain circumstances. If any collaborative partner were to terminate or breach our agreement with it, or otherwise fail to complete its obligations in a timely manner, our chances of successfully commercializing our product candidates would be materially and adversely affected.

If our intellectual property rights do not adequately protect our products or product candidates, or if third parties claim we are infringing their intellectual property rights, others could compete against us more directly or we could be subject to significant litigation. Such results could prevent us from marketing our products or product candidates and hurt our profitability.

Our product and product candidates are protected by patents and patent applications. Our success depends in part on our ability to obtain patents or rights to patents, protect trade secrets, operate without infringing upon the proprietary rights of others, and prevent others from infringing on our patents, trademarks and other intellectual property rights. We will be able to protect our intellectual property from unauthorized use by third parties only to the extent that it is covered by valid and enforceable patents, trademarks and licenses. Patent protection generally involves complex legal and factual questions and, therefore, enforceability of patent rights cannot be predicted with certainty. Patents, if issued, may be challenged, invalidated or circumvented. Thus, any patents that we own or license from others may not provide adequate protection against competitors. In addition, any future patent applications may fail to result in patents being issued. Also, those patents that are issued may not provide us with adequate proprietary protection or competitive advantages against competitors with similar product candidates. Moreover, the laws of certain foreign countries do not protect intellectual property rights to the same extent as do the laws of the United States.

In addition to patents and trademarks, we rely on trade secrets and proprietary know-how. We seek protection of these rights, in part, through confidentiality and proprietary information agreements. These agreements may not provide meaningful protection or adequate remedies for violation of our rights in the event of unauthorized use or disclosure of confidential and proprietary information. Failure to protect our proprietary rights could seriously impair our competitive position.

In the event of an infringement or violation, we may face litigation and may be prevented from pursuing product development or commercialization. We may receive in the future, notice of claims of infringement of other parties' proprietary rights. We may not have the financial resources to defend against claims of infringement by other parties or to prosecute third parties for infringement of our intellectual property. Infringement or other claims could be asserted or prosecuted against us in the future and it is possible that past or future assertions or prosecutions could harm our business.

Our product candidates are subject to substantial government regulation, including the regulation of nonclinical testing and clinical trials. If we are unable to obtain regulatory approval for our product candidates, we will be unable to generate revenues.

The production and marketing of products which may be developed from our TerraCov2 vaccine product candidate, our MU1140 homologs, from our Lantibiotics Program and Oral Mucositis Program or otherwise and our research and development, nonclinical testing and clinical trial activities are subject to extensive regulation and review by numerous governmental authorities. Most of the product candidates we are developing must undergo rigorous nonclinical testing and clinical trials and an extensive regulatory approval process before they can be marketed in the United States or internationally.

If we fail to obtain regulatory approval for our product candidates, we may have to cease further development. Clinical trials on our product candidates are expected to take several years to fully complete. The commencement or completion of nonclinical studies or clinical trials can be delayed or prevented for a number of reasons, including:

- limitations directly caused by, or restrictions imposed in response to, the COVID-19 pandemic, including our ability to conduct research and development and clinical trials, to engage or continue to engage with third-party contractors and suppliers or to comply with regulatory obligations relating to our business;
- an inability to raise sufficient capital to commence, conduct, or complete clinical trials;
- difficulties in finding a partner with the resources to support large and expensive clinical development and commercialization costs;
- findings in nonclinical trials;
- difficulties obtaining regulatory approval to commence a clinical trial or complying with conditions imposed by a regulatory authority regarding the scope or term of a clinical trial;
- delays in reaching or failing to reach agreement on acceptable terms with prospective contract research organizations, or CROs, and trial sites, the terms of which can be subject to extensive negotiation and may vary significantly among different CROs and trial sites;
- insufficient or inadequate supply or quality of a product candidate or other materials necessary to conduct our clinical trials;
- difficulties obtaining institutional review board, or IRB, approval to conduct a clinical trial at a prospective site;
- challenges recruiting and enrolling patients to participate in clinical trials for a variety of reasons, including the size and nature of patient population, proximity of patients to clinical sites, eligibility criteria for the trial, nature of the trial protocol, the availability of approved effective treatments for the relevant condition and competition from other clinical trial programs for similar indications;
- severe or unexpected drug or biologic-related side effects experienced by patients in a clinical trial; and
- difficulties retaining patients who have enrolled in a clinical trial but may be prone to withdraw due to rigors of the trial, lack of efficacy, side effects, or personal issues, or who are lost to further follow up.

Clinical trials also may be delayed or terminated as a result of ambiguous or negative interim results. In addition, a clinical trial may be suspended or terminated by us, the FDA, the IRBs at the sites where the IRBs are overseeing a trial, or a data safety monitoring board, or DSMB, overseeing the clinical trial at issue, 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;
- inspection of manufacturing and drug packaging operations by regulatory authorities;
- unforeseen safety issues or lack of effectiveness; and
- lack of adequate funding to continue the clinical trial.

We cannot assure you that clinical trials will demonstrate the safety or effectiveness of any of our product candidates, or will otherwise satisfy regulatory requirements. Our nonclinical studies or clinical trials may produce negative or inconclusive results, there may be inconsistencies between early clinical trial results and results obtained in later clinical trials, and we may decide, or regulators may require us, to conduct additional nonclinical studies or clinical trials. Moreover, nonclinical and clinical data are often susceptible to varying interpretations and analyses, and many companies that have believed their product candidates performed satisfactorily in nonclinical studies and clinical trials have nonetheless failed to obtain FDA approval for their products. If we are unable to resolve the FDA's concerns, we will not be able to obtain regulatory approval for these product candidates.

The pre-marketing approval process can be particularly expensive, uncertain and lengthy, and a number of products for which FDA or other governmental regulatory approval has been sought by other companies have never been approved for marketing. In addition to testing and approval procedures, extensive regulations also govern marketing, manufacturing, distribution, labeling, and record-keeping procedures. If we do not comply with applicable regulatory requirements, such violations could result in warning letters, non-approval, suspensions of regulatory approvals or ongoing clinical trials, civil penalties and criminal fines, product seizures and recalls, operating restrictions, injunctions, and criminal prosecution.

We may encounter such delays and rejection of our product candidates by the FDA or other regulatory authority may also adversely affect our business. Such delays or rejection may be encountered due to, among other reasons, government or regulatory delays, lack of efficacy during clinical trials, unforeseen safety issues, or changes in regulatory policy during the period of product development. More stringent regulatory approval processes in product clearance and enforcement activities could result in our experiencing longer approval cycles, more uncertainty, greater risk, and higher expenses. Even if regulatory approval of a product is granted, this approval may entail limitations on uses for which the product may be labeled and promoted. It is possible, for example, that we may not receive FDA approval to market products based on our licensed, patented product candidates for different indications or to market updated products that represent extensions of our basic product candidates. In addition, we may not receive FDA approval to export our products based on our licensed, patented product candidates in the future, and countries to which products are to be exported may not approve them for import.

From time to time, legislative or regulatory proposals are introduced that could alter the review and approval process relating to our product candidates. It is possible that the applicable regulatory authority will issue additional regulations further restricting the sale of our product candidates. Any change in legislation or regulations that govern the review and approval process relating to our future product candidates could make it more difficult and costlier to obtain approval for new products based on our product candidates, or to produce, market, and distribute such products if approved.

We may be unable to obtain regulatory approval for our SARS-CoV-2 vaccine product candidate, AG013 or other early-stage product candidates under applicable regulatory requirements. The FDA and foreign regulatory bodies have substantial discretion in the approval process, including the ability to delay, limit or deny approval of product candidates. The delay, limitation or denial of any regulatory approval would adversely impact commercialization, our potential to generate revenue, our business and our operating results.

We are not permitted to market any of our current product candidates in the United States until we receive approval of an NDA or BLA from the FDA. We are also not permitted to market any of our current product candidates in any foreign countries until we receive the requisite approval from the applicable regulatory authorities of such countries. Failure to obtain such regulatory approvals will delay or prevent us from commercializing any of our current or future product candidates.

To gain approval to market a new drug such as OG716, or a new biological product such as our SARS-CoV-2 vaccine product candidate or AG013, we must provide the FDA and/or foreign regulatory authorities with, among other things, extensive preclinical and clinical data that adequately demonstrates the safety and efficacy of the drug in its intended indication and information to demonstrate the adequacy of the manufacturing methods to assure the drug's identity, strength, quality and purity. The development and approval of new drug product candidates involves a long, expensive and uncertain process, and delay or failure can occur at any stage. A number of companies in the pharmaceutical and biopharmaceutical industries have suffered significant setbacks in clinical trials, including in Phase 3 clinical development, even after promising results in earlier preclinical studies or clinical trials. These setbacks have been caused by, among other things, observations during clinical trials regarding safety or efficacy, such as previously unreported adverse events. Success in preclinical testing and early clinical trials does not ensure success in later clinical trials, and the results of clinical trials by other parties may not be indicative of the results in trials we may conduct. Further, different results may be achieved depending upon whether the "per protocol", or PP, analysis is used to report data results or whether the "modified intent-to-treat," or MITT, approach is used. Accordingly, regardless of the outcome of any Phase 2 trials, our Phase 3 trials may not be successful.

In the case of our product candidate, AG013, because it is a biological product, in order to ensure product consistency, quality, and purity, we must ensure the manufacturing process remains substantially the same over time. The systems used to produce biological products can be sensitive to very minor changes in the manufacturing process. Small process differences can significantly affect the nature of the finished biological product, and more importantly, the way it functions in the body. We will have to tightly control the source and nature of starting materials, and consistently employ numerous process controls that assure predictable manufacturing outcomes. Our ability to ensure that the manufacturing process remains stable over time may be difficult to establish. In addition, for a novel biological product, there may be uncertainties regarding the size and design of our clinical trials to establish safety, efficacy, purity or potency, and there are no assurances that data generated in any clinical trials we might conduct will be acceptable to the FDA or foreign regulatory bodies to support marketing approval.

The FDA and foreign regulatory bodies have substantial discretion in the drug approval process, including the ability to delay, limit or deny approval of product candidates for many reasons. The FDA or the applicable foreign regulatory body may:

- disagree with the design or implementation of one or more clinical trials;
- decline to deem a product candidate safe and effective for its proposed indication, or deem a product candidate's safety or other perceived risks to outweigh its clinical or other benefits.
- find the data from preclinical studies and clinical trials does not sufficiently support approval, or the results of clinical trials may not meet the level of statistical or clinical significance required for approval;
- disagree with our interpretation of data from preclinical studies or clinical trials performed by us or third parties;
- determine the data collected from clinical trials are insufficient to support the submission or approval of an NDA or other applicable regulatory filing.
- require additional preclinical studies or clinical trials;
- identify deficiencies in the formulation, quality control, labeling or specifications of our current or future product candidates;
- grant approval contingent on the performance of costly additional post-approval clinical trials;

- approve our current or any future product candidates for a more limited indication or a narrower patient population than we originally requested or with strong warnings that may affect marketability;
- decline to approve the labeling that we believe is necessary or desirable for the successful commercialization of our product candidates;
- require a Risk Evaluation and Mitigation Strategy, or REMS, with monitoring requirements or distribution limitations. For example, it is possible that the FDA could require distribution controls in the approval, if any, of our product candidates to prevent inadvertent exposure to pregnant women;
- decline to approve of the manufacturing processes, controls or facilities of third-party manufacturers or testing labs with whom we contract; or
- change its approval policies or adopt new regulations in a manner rendering our clinical data or regulatory filings insufficient for approval.

Any delay, limitation or denial of any regulatory approval would adversely impact commercialization, our potential to generate revenue, our business and our operating results.

Delays or difficulties in the enrollment of patients in clinical trials may result in additional costs and delays in our ability to generate significant revenues, and may delay or prevent our receipt of any regulatory approvals necessary to commercialize our planned and future products.

We may not be able to initiate or continue, or complete in a timely fashion clinical trials for TerraCoV2 or our other product candidates if we are unable to locate and enroll a sufficient number of eligible patients to participate in these trials as required by the FDA or similar regulatory authorities outside the United States. Many companies are currently or will soon be researching, developing and testing therapeutic and vaccine product candidates specifically for or with potential application to SARS-CoV-2 or COVID-19, which may reduce our ability to conduct clinical trials for our SARS-CoV-2 vaccine product candidate. For example, even if we are able to identify potential patients or eligibility criteria for a TerraCoV2 clinical trial, patients who are otherwise eligible for such clinical trials may instead enroll in the clinical trials of our competitors' SARS-CoV-2 product candidates.

Patient enrollment is affected by other factors including:

- the severity of the disease under investigation;
- the eligibility criteria for the study in question;
- the perceived risks and benefits of the product candidate under study;
- the efforts to facilitate timely enrollment in clinical trials;
- the patient referral practices of physicians;
- the ability to monitor patients adequately during and after treatment; and
- the proximity and availability of clinical trial sites for prospective patients.

Our inability to enroll a sufficient number of patients for our clinical trials would result in significant delays, could require us to abandon one or more clinical trials altogether and could delay or prevent our receipt of necessary regulatory approvals. Enrollment delays in our clinical trials may result in increased development costs for our product candidates, which would cause the value of our company to decline and impede our ability to obtain additional financing.

We have limited experience in the conduct of clinical trials. We have never initiated a vaccine-related clinical trial. We have never obtained approval of any product candidates. We may be unable to undertake any of those actions successfully.

As a company, we have limited experience and capacity for the conduct of preclinical research and clinical trials, as well as the progression of a product candidate through to regulatory approval. Because we are in the early stages of development for TerraCoV2 and because the SARS-CoV-2 vaccine landscape continues to evolve, our clinical trials may require more time and incur greater costs than we anticipate. We cannot be certain that planned clinical trials will begin or conclude on time, if at all. Large-scale trials would require significant additional financial and management resources, and reliance on third-party clinical investigators, CROs and/or consultants. Any performance failure on the part of such third parties could delay clinical development or delay or prevent us from obtaining regulatory approval or commercializing our current or future product candidates, depriving us of potential product revenue and resulting in additional losses. By contrast, larger pharmaceutical and biopharmaceutical companies often have substantial staff or departments with extensive experience in conducting clinical trials with multiple product candidates across multiple indications and obtaining regulatory approval in various countries. In addition, these companies may have greater financial resources to compete for the same clinical investigators, sites and patients that we may attempt to recruit or retain for our preclinical research and clinical trials. As a result, we may be at a competitive disadvantage that could delay the initiation, recruitment, timing and completion of our preclinical research and clinical trials and obtaining regulatory, marketing and related approvals, if achieved at all, for our TerraCoV2 vaccine product candidate.

Any product candidates that we commercialize will be subject to ongoing and continued regulatory review.

Even after we achieve U.S. regulatory approval for a product candidate, if any, we will be subject to continued regulatory review and compliance obligations. For example, the FDA may impose significant restrictions on the approved indicated uses for which our product candidates may be marketed or on the conditions of approval. A product candidate's approval may contain requirements for potentially costly post-approval studies and surveillance, including Phase 4 clinical trials or a REMS to monitor the safety and efficacy of the product. We will also be subject to ongoing FDA obligations and continued regulatory review with respect to, among other things, the manufacturing, processing, labeling, packaging, distribution, adverse event reporting, storage, advertising, promotion and recordkeeping for our product candidates. These requirements include submissions of safety and other post-marketing information and reports, registration, continued compliance with the FDA's good clinical practice, or GCP, requirements and good laboratory practice requirements, which are regulations and guidelines the FDA would apply to all of our product candidates in clinical and preclinical development, along with any clinical trials that we conduct post-approval, and continued compliance with the FDA's cGMP requirements pursuant to which manufacturing facilities are subject to continual review and periodic inspections by the FDA. To the extent that a product candidate is approved for sale in other countries, we may be subject to similar restrictions and requirements imposed by laws and government regulators in those countries.

If we, our product candidates or the manufacturing facilities for our product candidates fail to comply with applicable regulatory requirements, a regulatory agency may:

- impose restrictions on the marketing or manufacturing of the product, suspend or withdraw product approvals or revoke necessary licenses;
- issue warning letters, show cause notices or untitled letters describing alleged violations, which may be publicly available;
- mandate modifications to promotional materials or require us to provide corrective information to healthcare practitioners;
- require us to enter into a consent decree, which can include imposition of various fines, reimbursements for inspection costs, required due dates for specific actions and penalties for noncompliance; commence criminal investigations and prosecutions;
- impose injunctions;
- impose other civil or criminal penalties;
- suspend any ongoing clinical trials;

- delay or refuse to approve pending applications or supplements to approved applications filed by us;
- refuse to permit drugs or active ingredients to be imported or exported to or from the United States;
- suspend or impose restrictions on operations, including costly new manufacturing requirements; or
- seize or detain products or require us to initiate a product recall.

The regulations, policies or guidance of the FDA and other applicable government agencies may change and new or additional statutes or government regulations may prevent or delay regulatory approval of our product candidates or further restrict or regulate post-approval activities. We cannot predict the likelihood, nature or extent of adverse government regulation that may arise from future legislation or administrative action, either in the United States or abroad. If we are not able to achieve and maintain regulatory compliance, we may not be permitted to market our product candidates, which would materially and adversely affect our ability to generate revenue and achieve or maintain profitability.

Our product candidates may cause serious or undesirable side effects or possess other unexpected properties that could delay or prevent their regulatory approval, limit the commercial profile of approved labeling or result in post-approval regulatory action.

Unforeseen side effects from any of our product candidates could arise either during clinical development or, if approved, after marketing such product. Undesirable side effects caused by product candidates could cause us or regulatory authorities to interrupt, modify, delay or halt clinical trials and could result in a more restrictive label or the delay or denial of regulatory approval by the FDA or comparable foreign authorities. Results of clinical trials could reveal a high and unacceptable severity and prevalence of side effects. In such an event, trials could be suspended or terminated and the FDA or comparable foreign regulatory authorities could order us to cease further development of or deny approval of product candidates for any or all targeted indications. The drug-related side effects could affect patient recruitment or the ability of enrolled patients to complete the trial or result in product liability claims. Any of these occurrences may harm our business, financial condition, operating results and prospects.

Additionally, if we or others identify undesirable side effects, or other previously unknown problems, caused by our product candidates after obtaining U.S. or foreign regulatory approval or other products with the same or related active ingredients, a number of potentially negative consequences could result, including:

- regulatory authorities may withdraw their approval of the product;
- regulatory authorities may require a recall of the product or we may voluntarily recall a product;
- regulatory authorities may require the addition of warnings or contraindications in the product labeling, narrowing of the indication in the product label or issuance of field alerts to physicians and pharmacies;
- we may be required to create a medication guide outlining the risks of such side effects for distribution to patients or institute a REMS;
- we may be subject to limitations as to how we promote the product;
- we may be required to change the way the product is administered or modify the product in some other way;
- the FDA or applicable foreign regulatory authority may require additional clinical trials or costly post-marketing testing and surveillance to monitor the safety or efficacy of the product;
- sales of the product may decrease significantly;

- we could be sued and held liable for harm caused to patients; and
- our brand and reputation may suffer.

Any of the above events could prevent us from achieving or maintaining market acceptance of the affected product candidate and could substantially increase the costs of commercializing our product candidates.

If any of our product candidates are approved for marketing and we are found to have improperly promoted off-label uses, or if physicians misuse our products or use our products off-label, we may become subject to prohibitions on the sale or marketing of our products, product liability claims and significant fines, penalties and sanctions, and our brand and reputation could be harmed.

The FDA and other regulatory agencies strictly regulate the marketing and promotional claims that are made about drug products. In particular, a product may not be promoted for uses or indications that are not approved by the FDA or such other regulatory agencies as reflected in the product's approved labeling. If we are found to have promoted off-label uses of any of our product candidates, we may receive warning or untitled letters and become subject to significant liability, which would materially harm our business. Both federal and state governments have levied large civil and criminal fines against companies for alleged improper promotion and have enjoined several companies from engaging in off-label promotion. If we become the target of such an investigation or prosecution based on our marketing and promotional practices, we could face similar sanctions, which would materially harm our business. In addition, management's attention could be diverted from our business operations, significant legal expenses could be incurred and our brand and reputation could be damaged. The FDA has also requested that companies enter into consent decrees or permanent injunctions under which specified promotional conduct is changed or curtailed. If we are deemed by the FDA to have engaged in the promotion of our products for off-label use, we could be subject to FDA regulatory or enforcement actions, including the issuance of an untitled letter, a warning letter, injunction, seizure, civil fine or criminal penalties. It is also possible that other federal, state or foreign enforcement authorities might take action if they determine our business activities constitute promotion of an off-label use, which could result in significant penalties, including criminal, civil or administrative penalties, damages, fines, disgorgement, exclusion from participation in government healthcare programs and the curtailment or restructuring of our operations.

We cannot, however, prevent a physician from using our product candidates in ways that fall outside the scope of the approved indications, as he or she may deem appropriate in his or her medical judgment. Physicians may also misuse our product candidates or use improper techniques, which may lead to adverse results, side effects or injury and, potentially, subsequent product liability claims. Furthermore, the use of our product candidates for indications other than those cleared by the FDA and/or other regulatory agencies may not effectively treat such conditions, which could harm our brand and reputation among both physicians and patients.

We may also be subject to healthcare laws, regulation and enforcement and our failure to comply with those laws could adversely affect our business, operations and financial condition.

Certain federal and state healthcare laws and regulations pertaining to fraud and abuse and patients' rights are and will be applicable to our business. We are subject to regulation by both the federal government and the states in which we conduct our business. The laws and regulations that may affect our ability to operate include:

- the federal healthcare program anti-kickback statute, which prohibits, among other things, any person or entity from knowingly and willfully offering, soliciting, receiving or providing any remuneration (including any kickback, bribe or rebate), directly or indirectly, overtly or covertly, in cash or in kind, to induce either the referral of an individual or in return for the purchase, lease, or order of any good, facility item or service, for which payment may be made, in whole or in part, under federal healthcare programs such as the Medicare and Medicaid programs;
- federal civil and criminal false claims laws and civil monetary penalty laws, including, for example, the United States False Claims Act, which impose criminal and civil penalties, including civil whistleblower or qui tam actions, against individuals or entities for, among other things, knowingly presenting, or causing to be presented, to the federal government, including the Medicare and Medicaid programs, claims for payment that are false or fraudulent or making a false statement to avoid, decrease or conceal an obligation to pay money to the federal government;

- the federal Health Insurance Portability and Accountability Act of 1996, as amended by the Health Information Technology for Economic and Clinical Health Act, or HIPAA, which prohibits knowingly and willfully executing, or attempting to execute, a scheme to defraud any healthcare benefit program or obtain, by means of false or fraudulent pretenses, representations or promises, any of the money or property owned by, or under the custody or control of, any healthcare benefit program, regardless of the payor (i.e., public or private), knowingly and willfully embezzling or stealing from a health care benefit program, willfully obstructing a criminal investigation of a health care offense and knowingly and willfully falsifying, concealing or covering up by any trick or device a material fact or making any materially false statements in connection with the delivery of, or payment for, healthcare benefits, items or services relating to healthcare matters;

- HIPAA and related implementing regulations, which impose obligations on covered entities, including healthcare providers, health plans, and healthcare clearinghouses, as well as their respective business associates that create, receive, maintain or transmit individually identifiable health information for or on behalf of a covered entity, with respect to safeguarding the privacy, security and transmission of individually identifiable health information;

- the federal physician sunshine requirements under the Patient Protection and Affordable Care Act, or ACA, which require manufacturers of drugs, devices, biologics and medical supplies to report annually to the Centers for Medicare & Medicaid Services information related to payments and other transfers of value provided to physicians and teaching hospitals, and ownership and investment interests held by physicians and their immediate family members, with such information published on a searchable website on an annual basis; 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 laws that require pharmaceutical companies to comply with the pharmaceutical industry's voluntary compliance guidelines and the applicable compliance guidance promulgated by the federal government, or otherwise restrict payments that may be provided to healthcare providers and other potential referral sources; state laws that require drug manufacturers to report information related to payments and other transfers of value to healthcare providers or marketing expenditures; 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 may not have the same effect, thus complicating compliance efforts.

Because of the breadth of these laws and the narrowness of the statutory exceptions and safe harbors available, it is possible that some of our business activities could be subject to challenge under one or more of such laws. In addition, recent health care reform legislation has strengthened these laws. For example, the recently enacted ACA, among other things, amended the intent requirement of the federal anti-kickback statute and certain criminal healthcare fraud statutes. A person or entity no longer needs to have actual knowledge of the statute or specific intent to violate it. In addition, the ACA provides that the government may assert that a claim including items or services resulting from a violation of the federal anti-kickback statute constitutes a false or fraudulent claim for purposes of the federal civil False Claims Act.

Achieving and sustaining compliance with these laws may prove costly. In addition, 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 our operations are found to be in violation of any of the laws described above or any other governmental laws or regulations that apply to us, we may be subject to penalties, including administrative, civil and criminal penalties, damages, fines, disgorgement, the exclusion from participation in federal and state healthcare programs, individual imprisonment or the curtailment or restructuring of our operations, any of which could materially and adversely affect our ability to operate our business and our financial results.

Our employees, independent contractors, principal investigators, consultants, vendors and CROs may engage in misconduct or other improper activities, including noncompliance with regulatory standards and requirements.

We are exposed to the risk that our employees, independent contractors, principal investigators, consultants, vendors and CROs may engage in fraudulent or other illegal activity. Misconduct by these persons could include intentional, reckless or negligent conduct or unauthorized activity that violates: laws or regulations, including those laws requiring the reporting of true, complete and accurate information to the FDA or foreign regulatory authorities; manufacturing standards; federal, state and foreign healthcare fraud and abuse laws and data privacy; or laws that require the true, complete and accurate reporting of financial information or data. In particular, sales, marketing and other business arrangements in the healthcare industry are subject to extensive laws intended to prevent fraud, kickbacks, self-dealing and other abusive practices. These laws may restrict or prohibit a wide range of business activities, including research, manufacturing, distribution, pricing, discounting, marketing and promotion, sales commission, customer incentive programs and other business arrangements. Activities subject to these laws also involve the improper use of information obtained in the course of clinical trials, or illegal misappropriation of drug product, which could result in regulatory sanctions or other actions or lawsuits stemming from a failure to comply with such laws or regulations, and serious harm to our reputation. In addition, federal procurement laws impose substantial penalties for misconduct in connection with government contracts and require certain contractors to maintain a code of business ethics and conduct. If any such actions are instituted against us, we may have to terminate employees or others involved and the impact of such termination can result in our experiencing delays and additional costs associated with replacing the services being provided. If we are not successful in defending ourselves or asserting our rights, those actions could have a significant impact on our business, including the imposition of civil, criminal and administrative penalties, damages, monetary fines, possible exclusion from participation in Medicare, Medicaid and other federal healthcare programs, FDA debarment, contractual damages, reputational harm, diminished profits and future earnings, and curtailment of our operations, any of which could adversely affect our ability to operate our business and our operating results.

Even if our current product candidates or any future product candidates obtain regulatory approval, they may fail to achieve the broad degree of health care payers, physician and patient adoption and use necessary for commercial success.

The commercial success of any of our current or future product candidates, if approved, will depend significantly on the broad adoption and use of the resulting product by health care payers, physicians and patients for approved indications, and may not be commercially successful. The degree and rate of physician and patient adoption of our current or future product candidates, if approved, will depend on a number of factors, including:

- the clinical indications for which the product is approved and patient demand for approved products that treat those indications;
- the effectiveness of our product as compared to other available therapies;
- the availability of coverage and adequate reimbursement from managed care plans and other healthcare payors for any of our product candidates that may be approved;
- the cost of treatment with our product candidates in relation to alternative treatments and willingness to pay for the product, if approved, on the part of patients;
- acceptance by physicians, major operators of clinics and patients of the product as a safe and effective treatment;
- physician and patient willingness to adopt a new therapy over other available therapies to treat approved indications;
- overcoming any biases physicians or patients may have toward particular therapies for the treatment of approved indications;
- proper training and administration of our product candidates by physicians and medical staff;

- patient satisfaction with the results and administration of our product candidates and overall treatment experience;
- the willingness of patients to pay for certain of our product candidates relative to other discretionary items, especially during economically challenging times;
- the revenue and profitability that our product candidate may offer a physician as compared to alternative therapies;
- the prevalence and severity of side effects;
- limitations or warnings contained in the FDA-approved labeling for our product candidates;
- any FDA requirement to undertake a REMS;
- the effectiveness of our sales, marketing and distribution efforts;
- adverse publicity about our product candidates or favorable publicity about competitive products; and
- potential product liability claims.

If any of our current or future product candidates are approved for use but fail to achieve the broad degree of physician and patient adoption necessary for commercial success, our operating results and financial condition will be adversely affected, which may delay, prevent or limit our ability to generate revenue and continue our operations.

If we are unable to achieve and maintain coverage and adequate levels of reimbursement for any of our product candidates for which we receive regulatory approval, or any future products we may seek to commercialize, their commercial success may be severely hindered.

As to any of our product candidates that become available by prescription only, our success will depend on the availability of coverage and adequate reimbursement for our product from third-party payors. Patients who are prescribed medicine for the treatment of their conditions generally rely on third-party payors to reimburse all or part of the costs associated with their prescription drugs. The availability of coverage and adequate reimbursement from governmental healthcare programs, such as Medicare and Medicaid, and private third-party payors is critical to new product acceptance. Coverage decisions may depend upon clinical and economic standards that disfavor new drug products when more established or lower cost therapeutic alternatives are already available or subsequently become available. If any of our product candidates fail to demonstrate attractive efficacy profiles, they may not qualify for coverage and reimbursement. Even if we obtain coverage for a given product, the resulting reimbursement payment rates might not be adequate or may require co-payments that patients find unacceptably high. Patients are unlikely to use our prescription-only products unless coverage is provided and reimbursement is adequate to cover a significant portion of the cost of our products.

In addition, the market for certain of our product candidates will depend significantly on access to third-party payors' drug formularies, or lists of medications for which third-party payors provide coverage and reimbursement. The industry competition to be included in such formularies often leads to downward pricing pressures on pharmaceutical companies. Also, third-party payors may refuse to include a particular branded drug in their formularies or otherwise restrict patient access to a branded drug when a less costly generic equivalent or another alternative is available.

Moreover, third-party payors, whether foreign or domestic, or governmental or commercial, are developing increasingly sophisticated methods of controlling healthcare costs. In addition, in the United States, although private third-party payors tend to follow Medicare, no uniform policy of coverage and reimbursement for drug products exists among third-party payors. Therefore, coverage and reimbursement for drug products can differ significantly from payor to payor. As a result, the coverage determination process is often a time-consuming and costly process that will require us to provide scientific and clinical support for the use of our product candidates to each payor separately, with no assurance that coverage and adequate reimbursement will be obtained.

Further, we believe that future coverage and reimbursement will likely be subject to increased restrictions in both the United States and in international markets. Third-party coverage and reimbursement for any of our product candidates for which we may receive regulatory approval may not be available or adequate in either the United States or international markets, which could harm our business, financial condition, operating results and prospects.

We cannot assure you that the market and consumers will accept our products or product candidates. If they do not, we will be unable to generate significant revenues from our products or product candidates and our business, financial condition and results of operations will be materially adversely affected.

The commercial success of our TerraCoV2 vaccine product candidate, our MU1140 homologs antibiotic product candidates, and any of our other product candidates and technologies, will depend in part on market acceptance by consumers. Biopharmaceutical companies have received substantial support from the scientific community, regulatory agencies and many governmental officials in the United States and internationally. Future scientific developments, media coverage and political events may diminish such support. Public attitudes may be influenced by claims that health products are unsafe for consumption or pose unknown risks to the environment or to traditional social or economic practices. Securing governmental approvals for, and consumer confidence in, such products poses numerous challenges, particularly outside the United States. The market success of product candidates developed by biopharmaceutical companies could be delayed or impaired in certain geographical areas as a result. Products based on our product candidates may compete with a number of traditional dental therapies and drugs manufactured and marketed by major pharmaceutical companies and biotechnology companies. Market acceptance of products based on our product candidates will depend on a number of factors including potential advantage over alternative treatment methods. We can offer you no assurance that dentists, physicians, patients or the medical and dental communities in general will accept and utilize products developed from our product candidates. If they do not, we may be unable to generate significant revenues from our product candidates and our business, financial condition and results of operations will be materially adversely affected.

If our products do not receive favorable third-party reimbursement, or if new restrictive legislation is adopted, market acceptance of our products may be limited and we may not generate significant revenues.

Our ability to commercialize our products will depend in part on the extent to which appropriate reimbursement levels for the cost of our proposed formulations and products and related treatments are obtained by governmental authorities, private health insurers and other organizations, such as Health Maintenance Organizations, or HMOs. Reimbursement from third parties depends greatly on our ability to present data which demonstrate positive outcomes and reduced utilization of other products or services as well as cost data which show that treatment costs using the new product are equal to or less than what is currently covered for other products. If our products do not receive favorable third-party reimbursement and patients are unwilling or unable to pay for our products out-of-pocket, it could limit our revenues and harm our business.

The continuing efforts of government and insurance companies, health maintenance organizations and other payers of healthcare costs to contain or reduce costs of health care may affect our future revenues and profitability, and the future revenues and profitability of our potential customers, suppliers and collaborative partners and the availability of capital. For example, in certain foreign markets, pricing or profitability of prescription pharmaceuticals is subject to government control. In the United States, recent federal and state government initiatives have been directed at lowering the total cost of health care. In March 2010, President Obama signed into law the Patient Protection and Affordable Care Act, a sweeping law intended to broaden access to health insurance, reduce or constrain the growth of healthcare spending, enhance remedies against fraud and abuse, add new transparency requirements for healthcare and health insurance industries, impose new taxes and fees on the health industry and impose additional health policy reforms. Federal and state legislatures will likely continue to focus on health care reform, controlling the cost of prescription pharmaceuticals and on the reform of the Medicare and Medicaid systems. While we cannot predict whether any such legislative or regulatory proposals will be adopted, the announcement or adoption of such proposals could materially harm our business, financial condition and results of operations.

If we are successful in producing a vaccine against SARS-CoV-2, we may need to devote significant resources to its scale-up and development, including for use by the U.S. government or other foreign authorities. Moreover, government involvement may limit the commercial success of our vaccine product candidate.

Because the COVID-19 outbreak has been classified as a pandemic by public health authorities, it is possible that one or more government entities may take actions that directly or indirectly have the effect of abrogating some of our rights or opportunities with respect to the research, development and commercialization of our TerraCoV2 vaccine product candidate. We have not manufactured a pandemic vaccine to date, but if we were to do so, the economic value of such a vaccine to us could be limited by such government action or inaction. Various government entities, including the U.S. government, are offering, but may not continue to offer, incentives, grants and contracts to encourage additional investment by commercial organizations into preventative and therapeutic agents against SARS-CoV-2 and/or COVID-19, which may have the effect of increasing the number of competitors and/or providing advantages to known competitors. Accordingly, there can be no assurance that we will be able to successfully establish a competitive market share for our TerraCoV2 vaccine product candidate.

In the event that any of the preclinical research or, if an IND is accepted by the FDA, the Phase 1 clinical trials for our SARS-CoV-2 vaccine product candidate are perceived to be successful, we may need to work toward the large scale technical development, manufacturing scale-up and larger scale deployment of this potential vaccine through a variety of U.S. government-sponsored mechanisms, such as an Expanded Access Program or an Emergency Use Authorization program. In this case we may need to divert significant resources to this program, which would require diversion of resources from our other existing product candidate programs. In addition, since the path to licensure of any vaccine against SARS-CoV-2 is unclear, we may have a widely-used vaccine in circulation in the United States or another country prior to our receipt of marketing approval. Unexpected safety issues in these circumstances could lead to significant reputational damage for us and our technology platform going forward and other issues, including delays in our other programs, the need for re-design of our clinical trials and the need for significant additional financial resources.

Our product candidates, if approved, will face significant competition and our failure to compete effectively may prevent us from achieving significant market penetration.

The pharmaceutical industry is characterized by rapidly advancing technologies, intense competition and a strong emphasis on developing proprietary therapeutics. Numerous companies are engaged in the development, patenting, manufacturing and marketing of healthcare products competitive with those that we are developing. We face competition from a number of sources, such as pharmaceutical companies, including generic drug companies, biotechnology companies and academic and research institutions, many of which have greater financial resources, marketing capabilities, sales forces, manufacturing capabilities, research and development capabilities, clinical trial expertise, intellectual property portfolios, experience in obtaining patents and regulatory approvals for product candidates and other resources than us. Some of the companies that offer competing products also have a broad range of other product offerings, large direct sales forces and long-term customer relationships with our target physicians, which could inhibit our market penetration efforts. In addition, certain of our product candidates, if approved, may compete with other products, for a share of some patients' discretionary budgets and for physicians' attention within their clinical practices.

We anticipate that, if we obtain regulatory approval of our product candidates, we will face significant competition from other approved therapies and may need to compete with unregulated, unapproved and off-label treatments. Certain of our product candidates, if approved, will present novel therapeutic approaches for the approved indications and will have to compete with existing therapies, some of which are widely known and accepted by physicians and patients. To compete successfully in this market, we will have to demonstrate that the relative cost, safety and efficacy of our approved products, if any, provide an attractive alternative to existing and other new therapies. Such competition could lead to reduced market share for our product candidates and contribute to downward pressure on the pricing of our product candidates, which could harm our business, financial condition, operating results and prospects.

Due to less stringent regulatory requirements in certain foreign countries, there are many more products and procedures available for use in those international markets than are approved for use in the United States. In certain international markets, there are also fewer limitations on the claims that our competitors can make about the effectiveness of their products and the manner in which they can market them. As a result, we expect to face more competition in these markets than in the United States.

Because our vaccine product development efforts depend on new and rapidly evolving technologies, we cannot be certain that our efforts will be successful.

Currently, neither the FDA nor any other major public health regulatory agency has approved or authorized a vaccine specifically for the prevention of SARS-CoV-2 or COVID-19. However, a number of vaccine manufacturers, academic institutions and other organizations currently have programs to develop such a vaccine. While we are not aware of all of our competitors' efforts, we believe that Moderna, Sanofi, Janssen, Inovio, Novavax, AIM ImmunoTech Inc. and several others are in the early stages of developing vaccine candidates. These companies have greater experience and expertise in securing government contracts and grants to support their research and development efforts, conducting testing and clinical trials, obtaining regulatory approvals to market products, manufacturing such products on a broad scale and marketing approved products. These companies may also partner or collaborate with large and established companies, such as Merck & Co., Inc., GlaxoSmithKline plc, CSL Ltd, Pfizer Inc. and AstraZeneca, among others, or they may partner or collaborate with or obtain funding from governments, academic institutions or other nongovernmental organizations. In order to effectively compete, we will have to make substantial investments in development, testing, manufacturing and sales and marketing or partner with one or more established companies.

Moreover, our new vaccine development efforts depend on new, rapidly evolving technologies. Our development efforts and, if those are successful, commercialization of our TerraCoV2 vaccine product candidate could fail for a variety of reasons, and include the possibility that:

- Our SARS-CoV-2 vaccine product candidate or technologies, any or all of the products based on such technologies or any manufacturing process will be ineffective or unsafe, or otherwise fail to receive necessary regulatory approvals or achieve commercial viability;
- third-party manufacturer facilities will be unable or unwilling to scale-up manufacturing capabilities for our products in a cost-effective manner;
- the products, if safe and effective, may be difficult to manufacture on a large-scale or uneconomical to market;
- third-party manufacturing facilities will fail to continue to pass regulatory inspections;
- proprietary rights of third-parties will prevent us or our collaborators from exploiting technologies, and manufacturing or marketing products; and
- third-party competitors will gain greater market share due to superior products or marketing capabilities.

Our SARS-CoV-2 vaccine product candidate may face competition from biosimilars approved through an abbreviated regulatory pathway.

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

We believe that, to the extent we are able to reach the BLA stage, our TerraCoV2 vaccine product candidate should qualify for the twelve-year period of exclusivity. However, risks exist that we may not so qualify, that this exclusivity could be shortened due to Congressional action or otherwise, or that the FDA will not consider our vaccine product candidate to be a reference product for competing products, potentially creating the opportunity for generic competition sooner than anticipated. Other aspects of the BPCIA, some of which may impact the BPCIA exclusivity provisions, have also been the subject of recent litigation. Moreover, the extent to which a biosimilar, once approved, will be substituted for a reference product in a way that is similar to traditional generic substitution for non-biological products is not yet clear, and will depend on a number of marketplace and regulatory factors that are still developing.

We may face product liability exposure, and if successful claims are brought against us, we may incur substantial liability if our insurance coverage for those claims is inadequate.

We face an inherent risk of product liability as a result of the clinical testing of our product candidates and will face an even greater risk if we commercialize any products. This risk exists even if a product is approved for commercial sale by the FDA and manufactured in facilities regulated by the FDA or an applicable foreign regulatory authority. Our products and product candidates are designed to affect bodily functions and processes. Any side effects, manufacturing defects, misuse or abuse associated with our product candidates could result in injury and possibly death to a patient. An inability to obtain sufficient insurance coverage on commercially reasonable terms or otherwise to protect against potential product liability claims could inhibit our business.

In addition, a liability claim may be brought against us even if our product candidates merely appear to have caused an injury. Product liability claims may be brought against us by consumers, healthcare providers, pharmaceutical companies or others selling or otherwise coming into contact with our product candidates, among others. If we cannot successfully defend ourselves against product liability claims we will incur substantial liabilities and reputational harm. In addition, regardless of merit or eventual outcome, product liability claims may result in:

- withdrawal of clinical trial participants;
- termination of clinical trial sites or entire trial programs;
- the inability to commercialize our product candidates;
- decreased demand for our product candidates;
- impairment of our brand and/or reputation;
- product recall or withdrawal from the market or labeling, marketing or promotional restrictions;
- substantial costs of any related litigation or similar disputes;
- distraction of management's attention and other resources from our primary business;
- substantial monetary awards to patients or other claimants against us that may not be covered by insurance; or
- loss of revenue.

Although we maintain product liability insurance coverage for clinical trials, our insurance coverage may not be sufficient to cover all of our product liability-related expenses or losses and may not cover us for any expenses or losses we 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, in sufficient amounts or upon adequate terms to protect us against losses due to product liability, particularly if any of our product candidates receive regulatory approval. Further, 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 decrease our cash and harm our business, financial condition, operating results and prospects.

We may choose not to continue developing or commercializing any of our product candidates at any time during development or after approval, which would reduce or eliminate our potential return on investment for those product candidates.

At any time, we may decide to discontinue the development or commercialization of any of our products or product candidates for a variety of reasons, including inadequate financial resources the appearance of new technologies that render our product obsolete, competition from a competing product or changes in or failure to comply with applicable regulatory requirements. If we terminate a program in which we have invested significant resources, we will not receive any return on our investment and we will have missed the opportunity to allocate those resources to potentially more productive uses.

Failure to obtain marketing approval in international jurisdictions would prevent our product candidates from being marketed abroad.

In order to market and sell our products in the European Union and many other jurisdictions, we or our third-party collaborators must obtain separate marketing approvals and comply with numerous and varying regulatory requirements. The approval procedure varies among countries and can involve additional testing. The time required to obtain approval may differ substantially from that required to obtain FDA approval. The regulatory approval process outside the United States generally includes all of the risks associated with obtaining FDA approval. In addition, in many countries outside the United States, it is required that the product be approved for reimbursement before the product can be approved for sale in that country. We or these third parties may not obtain approvals from regulatory authorities outside the United States on a timely basis, if at all. Approval by the FDA does not ensure approval by regulatory authorities in other countries or jurisdictions, and approval by one regulatory authority outside the United States does not ensure approval by regulatory authorities in other countries or jurisdictions or by the FDA. We may not be able to file for marketing approvals and may not receive necessary approvals to commercialize our products in any market.

We will need to further increase the size and complexity of our organization in the future, and we may experience difficulties in executing our growth strategy and managing our growth.

Our current management, personnel, systems and facilities are not adequate to support our future growth plans. We will need to further expand our scientific, sales and marketing, operational, financial and other resources to support our planned research, development, clinical trial work, and commercialization activities.

To manage our operations, growth and various projects effectively, we must:

- continue to improve our operational, financial, management and regulatory compliance controls and reporting systems and procedures;
- attract and retain sufficient numbers of talented employees;
- develop a marketing, sales, and distribution capability;
- manage our commercialization activities for our product candidates effectively;
- establish and maintain relationships with development and commercialization partners;
- manage our preclinical and clinical trials effectively;
- manage our third-party supply and manufacturing operations effectively and in a cost-effective manner, while increasing production capabilities for our current product candidates to commercial levels; and
- manage our development efforts effectively while carrying out our contractual obligations to partners and other third parties.

In addition, we have utilized and continue to utilize the services of part-time outside consultants to perform a number of tasks for us, including tasks related to preclinical and clinical testing. Our growth strategy may also entail expanding our use of consultants to implement these and other tasks going forward. We rely on consultants for certain functions of our business and will need to effectively manage these consultants to ensure that they successfully carry out their contractual obligations and meet expected deadlines. There can be no assurance that we will be able to manage our existing consultants or find other competent outside consultants, as needed, on economically reasonable terms, or at all. If we are not able to manage our growth effectively and expand our organization by hiring new employees and expanding our use of consultants, we might be unable to implement successfully the tasks necessary to execute effectively on our planned research, development and commercialization activities and, accordingly, might fail to achieve our research, development and commercialization goals.

We may be adversely affected by natural disasters, pandemics and other catastrophic events, and by man-made problems such as terrorism, that could disrupt our business operations and our business continuity and disaster recovery plans may not adequately protect us from a serious disaster.

Our corporate headquarters are located in Tampa, Florida, a hurricane zone. If a disaster, power outage or other event occurred that prevented us from using all or a significant portion of our headquarters, that damaged critical infrastructure, such as enterprise financial systems, manufacturing resource planning or enterprise quality systems, or that otherwise disrupted operations, it may be difficult or, in certain cases, impossible for us to continue our business for a substantial period of time. Our contract manufacturers' and suppliers' facilities are located in multiple locations, where other natural disasters or similar events, such as blizzards, tornadoes, fires, explosions or large-scale accidents or power outages, and other public health emergencies could severely disrupt our operations and have a material adverse effect on our business, financial condition, operating results and prospects. For example, the recent COVID-19 pandemic may cause significant disruption to our business operations, the operations of our third-party contractors and suppliers and the operations of our clinical trials, including as a result of significant restrictions or bans on travel into and within the geographic areas in which our manufacturers product our product candidates or where we conduct our clinical trials. A public health emergency could also affect the operations of the FDA and other regulatory or public health authorities, resulting in delays to meetings related to planned or completed clinical trials and ultimately of reviews and approvals of our product candidates. Such disruption could impede, delay, limit or prevent our employees and third-party contractors from beginning or continuing research and development or clinical trial-related activities, which may impede, delay, limit or prevent initiation or completion of our ongoing clinical trials and preclinical research and ultimately lead to the delay or denial of regulatory approval of our product candidates, which could seriously harm our operations and financial condition.

In addition, acts of terrorism and other geo-political unrest could cause disruptions in our business or the businesses of our partners, manufacturers or the economy as a whole. All of the aforementioned risks may be further increased if we do not implement a disaster recovery plan or our partners' or manufacturers' disaster recovery plans prove to be inadequate. To the extent that any of the above should result in delays in the regulatory approval, manufacture, distribution or commercialization of our product candidates, our business, financial condition, operating results and prospects would suffer.

Our business and operations would suffer in the event of cybersecurity/information systems risk.

Despite the implementation of security measures, our internal computer systems, and those of our manufacturers and other third parties on which we rely, are vulnerable to damage from computer viruses, malware, ransomware, unauthorized access, natural disasters, fire, explosions or large-scale accidents, power outages or surges, terrorism, successful breaches, employee malfeasance, or human or technological error, war and telecommunication and electrical failures. In addition, our systems safeguard important confidential personal data regarding our subjects. If a disruption event were to occur and cause interruptions in our operations, it could result in a material disruption of our drug development programs. For example, the loss of clinical trial data from completed, ongoing or planned clinical trials could result in delays in our regulatory approval efforts and significantly increase our costs to recover or reproduce the data. To the extent that any disruption or security breach results in a loss of or damage to our data or applications, or inappropriate disclosure of confidential or proprietary information, we could incur liability and the further development of our product candidates could be delayed.

We may incur costs of addressing a cybersecurity incident.

Cybersecurity incidents have increased in number and severity recently and it is expected that these trends will continue. Should we be affected by such an incident, we may incur substantial costs and suffer other negative consequences, which may include:

- investigation costs and costs to engage specialized consultants;
- remediation costs, such as liability for stolen assets or information, repairs of system damage, and incentives to customers or business partners in an effort to maintain relationships after an attack; and
- litigation and legal risks, including regulatory actions by state and federal regulators.

Our business and operations would suffer in the event of failures in our internal computer systems or those of our collaborators.

Despite the implementation of security measures, our internal computer systems and those of our current and any future partners, contractors and consultants are vulnerable to damage from computer viruses, unauthorized access, natural disasters, terrorism, war and telecommunication and electrical failures. While we have not experienced any such material system failure, accident or security breach to date, if such an event were to occur and cause interruptions in our operations, it could result in a material disruption of our development programs and our business operations. For example, the loss of manufacturing records or clinical trial data from completed or future clinical trials could result in delays in our regulatory approval efforts and significantly increase our costs to recover or reproduce the data. To the extent that any disruption or security breach were to result in a loss of, or damage to, our data or applications, or inappropriate disclosure of confidential or proprietary information, we could incur liability and the further development of our product candidates could be delayed.

Changes in patent law or patent jurisprudence could diminish the value of patents in general, thereby impairing our ability to protect our product candidates.

The United States has recently enacted and is currently implementing wide-ranging patent reform legislation. Further, recent United States Supreme Court rulings have either narrowed the scope of patent protection available in certain circumstances or weakened the rights of patent owners in certain situations. Moreover, patent law and protection in foreign countries, particularly developing countries, may be insufficient or otherwise unclear in its efficacy to protect our intellectual property. In addition to increasing uncertainty with regard to our ability to obtain patents in the future, this combination of events has created uncertainty with respect to the scope and value of patents, once obtained.

For our U.S. patent applications containing a priority claim after March 16, 2013, there is a greater level of uncertainty in the patent law. In September 2011, the Leahy-Smith America Invents Act, also known as the America Invents Act, or AIA, was signed into law. The AIA includes a number of significant changes to U.S. patent law, including provisions that affect the way patent applications will be prosecuted and may also affect patent litigation. The USPTO is currently developing regulations and procedures to govern administration of the AIA, and many of the substantive changes to patent law associated with the AIA. It is not clear what other, if any, impact(s) the AIA will have on the operation of our business. Moreover, the AIA and its implementation could increase the uncertainties and costs surrounding the prosecution of our patent applications and the enforcement or defense of our issued patents, all of which could have an adverse effect on our business. One important change introduced by the AIA is that, as of March 16, 2013, the United States transitioned to a “first-to-file” system for deciding which party should be granted a patent when two or more patent applications are filed by different parties claiming the same invention. A third party who files a patent application with the USPTO after such date but prior to us may therefore be awarded a patent covering an invention of ours even if we were the first to invent. This “first-inventor-to-file” system will require us both to remain cognizant, going forward, of the timing between invention and filing of a patent application.

Among some of the other changes introduced by the AIA are those that (i) limit where a patentee may file a patent infringement suit and (ii) provide opportunities for third parties to challenge any issued patent in the USPTO. Such changes apply to all of our U.S. patents, even those issued prior to March 16, 2013. Because of a lower evidentiary standard in USPTO proceedings, as compared to the evidentiary standard applied in U.S. federal courts, necessary to invalidate a patent claim, a third party could potentially present evidence in a USPTO proceeding sufficient for the USPTO to find a claim invalid, notwithstanding that the same evidence would be insufficient to invalidate a claim first presented in a district court action. Accordingly, a third party may attempt opportunistically to use USPTO procedures to invalidate our patent claims.

Depending on decisions by the United States Congress, the U.S. federal courts, the USPTO or similar authorities in foreign jurisdictions, the laws and regulations governing patents could change in unpredictable ways that may weaken our and our licensors' abilities to obtain new patents or to enforce existing patents we and our licensors or partners may obtain in the future.

If we are unable to protect our trademarks or other intellectual property from infringement, our business prospects may be harmed.

We have applied for trademark protection for trademarks in the United States, the European Union and China. Although we take steps to monitor the possible infringement or misuse of our trademarks, it is possible that third parties may infringe, dilute or otherwise violate our trademark rights. Any unauthorized use of our trademarks or other intellectual property rights could harm our reputation or commercial interests. Moreover, our license with the NIH and NIAID, the NIAID does not commit to defend any declaratory judgment action alleging the invalidity of any of the licensed patent rights covered by the license, nor does the NIAID commit to commence legal actions against third parties alleged to infringe upon those licensed patent rights. Our enforcement against third-party infringers or violators may be unduly expensive and time-consuming, and any remedy obtained may constitute insufficient redress relative to the damages we may suffer.

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

Filing, prosecuting and defending patents on our product candidates in all countries throughout the world would be prohibitively expensive. The requirements for patentability may differ in certain countries, particularly developing countries. In addition, the laws of some foreign countries do not protect intellectual property rights to the same extent as laws in the United States. Consequently, we may not be able to prevent third parties from practicing our inventions in all countries outside the United States. Competitors may use our technologies in jurisdictions where we have not obtained patent protection to develop their own products and, further, may export otherwise infringing products to territories where we have patent protection insufficient to guard against such infringement. These products may compete with our products, and our patents or other intellectual property rights may not be effective or sufficient to prevent them from competing.

The legal systems of certain countries, particularly certain developing countries, do not favor the enforcement of patents and other intellectual property protection, particularly those relating to pharmaceuticals. In such instances, we may be unable to enjoin or otherwise prevent infringement of our patents or marketing of competing products in violation of our proprietary rights, generally. Proceedings to enforce our patent rights in foreign jurisdictions could (i) result in substantial costs and divert our efforts and attention from other aspects of our business, (ii) put our patents at risk of being invalidated or interpreted narrowly and our patent applications at risk of not issuing and (iii) provoke third parties to assert claims against us. We may not prevail in any lawsuits that we initiate and the damages or other remedies awarded, if any, may not be commercially meaningful. In addition, certain countries in Europe and certain developing countries have compulsory licensing laws under which a patent owner may be compelled to grant licenses to third parties. In those countries, we may be unable to seek adequate remedies to address infringement and/or material diminishment of the value of our patents, which could limit our potential revenue opportunities in such jurisdictions. Accordingly, our efforts to establish or enforce our intellectual property rights around the world may be inadequate to obtain a significant commercial advantage from our intellectual property. Finally, our ability to protect and enforce our intellectual property rights may be adversely affected by unforeseen changes in foreign intellectual property laws.

If we fail to comply with our obligations under our intellectual property license agreements, we could lose our license rights that are important to our business and development of our product candidates.

In addition to our intellectual property and biological materials license with the NIH, we are a party to two ECC agreements that impose various royalty and other obligations on us. If we fail to comply with these obligations, our collaboration partners may have the right to terminate the license, in which event we may not be able to develop or market the affected product candidate. Both the NIH license and the ECC agreements may be terminated in the event of a breach. The loss of such rights could materially adversely affect our business, financial condition, operating results and prospects.

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 could have a material adverse effect on our business.

Our commercial success depends upon our ability to develop, manufacture, market, and sell our product candidates and use our proprietary technologies without infringing the proprietary rights of third parties. We cannot guarantee that marketing and selling such candidates and using such technologies will not infringe existing or future patents. Numerous U.S. and foreign issued patents and pending patent applications owned by third parties exist in the fields relating to our product candidates. As the biotechnology and pharmaceutical industries expand and more patents issue, the risk increases that others may assert that our product candidates, technologies or methods of delivery or use infringe their patent rights. Moreover, it is not always clear to industry participants, including us, which patents cover various drugs, biologics, drug delivery systems or their methods of use, and which of these patents may be valid and enforceable. Thus, due to the large number of patents issued and patent applications filed in our fields, third parties may allege they have patent rights encompassing our product candidates, technologies or methods.

In addition, our product candidates or proprietary technologies may infringe patents owned and/or filed by third parties, or third parties may allege such infringement. Because (i) some patent applications in the United States may be maintained in secrecy until the patents are issued, (ii) patent applications in the United States and many foreign jurisdictions are typically not published until 18 months after filing and (iii) publications in the scientific literature often lag behind actual discoveries, we cannot be certain that others have not filed patent applications for technology covered by our own and in-licensed issued patents or our pending applications. Our competitors may have filed, and may in the future file, patent applications covering our product candidates or technology similar to ours. Any such patent application may have priority over our own and in-licensed patent applications or patents, which could further require us to obtain rights to issued patents covering such technologies. If another party has filed a U.S. patent application on inventions similar to those owned or in-licensed to us, we or, in the case of in-licensed technology, the licensor may have to participate, in the United States, in an interference proceeding to determine priority of invention.

We may be exposed to, or threatened with, future litigation by third parties having patent or other intellectual property rights alleging that our product candidates or proprietary technologies infringe such third parties' intellectual property rights, including litigation resulting from filing under Paragraph IV of the Hatch-Waxman Act. Such lawsuits can be costly and could adversely affect our operating results and divert the attention of managerial and technical personnel, even if we do not infringe such patents or the patents asserted against us are later invalidated. A court may, however, decide that we are infringing the third party's patents and order us to cease the activities covered by the patents. In addition, there is a risk that a court will order us to pay to such third-party damages for having violated the other party's patents.

As a result of patent infringement claims, or to avoid potential claims, we may choose or be required to seek licenses from third parties. These licenses may not be available on commercially 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 nonexclusive, which could result in our competitors gaining access to the same intellectual property, or such rights might be restrictive and limit our present and future activities. Ultimately, we or a licensee could be prevented from commercializing a product, or 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.

In addition to possible infringement claims against us, we may become a party to other patent litigation and other proceedings, including interference, derivation, re-examination or other post-grant proceedings declared or granted by the USPTO, and similar proceedings in foreign countries, regarding intellectual property rights with respect to our current or future products.

There is a substantial amount of litigation involving patent and other intellectual property rights in the biotechnology and pharmaceutical industries, generally. To date, no litigation asserting infringement claims has ever been brought against us. If a third-party claims that we infringe its intellectual property rights, we may face a number of issues, including:

- infringement and other intellectual property claims which, regardless of merit, may be expensive and time-consuming to litigate and may divert our management's attention from our core business;
- substantial damages for infringement, which we may have to pay if a court decides that the product or technology at issue infringes or violates the third party's rights, and if the court finds that the infringement was willful, we could be ordered to pay treble damages and the patent owner's attorneys' fees;
- a court prohibiting us from selling or licensing the product or using the technology unless the third party licenses its intellectual property rights to us, which it is not required to do;
- if a license is available from a third party, we may have to pay substantial royalties or upfront fees or grant cross-licenses to intellectual property rights for our products or technologies; and
- redesigning our products or processes so they do not infringe, which may not be possible or may require substantial monetary expenditures and time.

Some of our competitors may be able to sustain the costs of complex patent litigation more effectively than we can because they have substantially greater resources. In addition, any uncertainties resulting from the initiation and continuation of any litigation could harm our ability to raise additional funds or otherwise adversely affect our business, financial condition, operating results and prospects.

Because we rely on certain third-party licensors and partners, and will continue to do so in the future, if one of our licensors or partners is sued for infringing a third party's intellectual property rights, our business, financial condition, operating results and prospects could suffer in the same manner as if we were sued directly. In addition to facing litigation risks, we have agreed to indemnify certain third-party licensors and partners against claims of infringement caused by our proprietary technologies, and we have entered or may enter into cost-sharing agreements with some our licensors and partners that could require us to pay some of the costs of patent litigation brought against those third parties whether or not the alleged infringement is caused by our proprietary technologies. In certain instances, these cost-sharing agreements could also require us to assume greater responsibility for infringement damages than our technology alone would otherwise suggest.

We may become involved in lawsuits to protect or enforce our patents or other intellectual property or the patents of our licensors, which could be expensive and time-consuming.

Competitors may infringe our intellectual property, including our patent applications or the patents of our licensors. As a result, we may be required to file infringement claims to stop third-party infringement or unauthorized use. Such proceedings and/or litigation can be expensive – particularly for a company of our size – and time-consuming. In addition, in an infringement proceeding, a court may decide that a patent of ours is not valid or is unenforceable, or may refuse to enjoin the other party from using the technology at issue on the grounds that our patent claims do not cover its technology or that the factors necessary to grant an injunction are not satisfied. An adverse determination in such case could put one or more of our patents at risk of being invalidated, interpreted narrowly or amended such that they fail to cover or otherwise protect our product candidates. Moreover, such adverse determinations could subject our patent applications to the risk that they will not issue, or issue with limited and potentially inadequate scope to cover our product candidates.

Interference, derivation or other proceedings brought at the USPTO may be necessary to determine the priority or patentability of inventions with respect to our patent applications or those of our licensors or potential partners. Litigation or USPTO proceedings brought by us may fail or may be invoked against us by third parties. Even if we are successful, domestic or foreign litigation, or USPTO or foreign patent office proceedings may result in substantial costs and distraction to our management. We may not be able, alone or with our licensors or potential partners, to prevent misappropriation of our proprietary rights, particularly in countries where the laws may not protect such rights as fully as in the United States.

Furthermore, because of the substantial amount of discovery required in connection with intellectual property litigation or other proceedings, there is a risk that we may, intentionally or incidentally, disclose some of our confidential results of hearings, motions or other interim proceedings or developments or public access to related documents. If investors perceive these results to be negative, the market price for our common stock could be significantly harmed.

If we fail to maintain an effective system of internal controls, we may not be able to accurately report our financial results or prevent fraud which could subject us to regulatory sanctions, harm our business and operating results and cause the trading price of our stock to decline.

Effective internal controls required under Section 404 of the Sarbanes-Oxley Act of 2002, or Sarbanes-Oxley Act, are necessary for us to provide reliable financial reports and effectively prevent fraud. If we cannot provide reliable financial reports or prevent fraud, our business, reputation and operating results could be harmed. We have discovered, and may in the future discover, areas of our internal controls that need improvement. We cannot be certain that the measures we have taken or intend to take will ensure that we maintain adequate controls over our financial processes and reporting in the future. Any failure to implement required new or improved controls or difficulties encountered in their implementation could subject us to regulatory sanctions, harm our business and operating results or cause us to fail to meet our reporting obligations. Inferior internal controls could also harm our reputation and cause investors to lose confidence in our reported financial information, which could have a negative impact on the trading price of our stock.

The recently passed U.S. federal income tax reform could adversely affect us.

On December 22, 2017, U.S. federal tax legislation, commonly referred to as the Tax Cuts and Jobs Act (TCJA), was signed into law, significantly reforming the U.S. Internal Revenue Code. The TCJA, among other things, includes changes to U.S. federal tax rates, limitation of the deduction for net operating losses to 80% of current year taxable income and elimination of net operating loss carrybacks. We have evaluated the effect of the TCJA on our net operating losses for the quarter and the year ending December 31, 2019. The estimated impact of the TCJA is based on our management's current knowledge and assumptions and recognized impacts could be materially different from current estimates based on our actual results and our further analysis of the new law. The impact of the TCJA on holders of common shares is uncertain and could be adverse. This Annual Report on Form 10-K does not discuss any such tax legislation or the manner in which it might affect holders of our common stock. Investors should consult with their own tax advisors with respect to such legislation and the potential tax consequences of investing in our common stock.

Our ability to use our net operating loss carryforwards and certain other tax attributes may be limited, each of which could harm our business.

As of December 31, 2019, we had U.S. federal and state net operating loss carryforwards of approximately $117,963,000. We also accumulated U.S. federal and state research tax credits of $2,805,000 as of December 31, 2019. Under Sections 382 and 383 of the Internal Revenue Code (the "Code"), if a corporation undergoes an "ownership change," the corporation's ability to use its pre-ownership change net operating loss carryforwards and other pre-ownership change tax attributes, such as research tax credits, to offset its post-ownership change income and taxes may be limited.). In general, an ownership change will occur when the percentage of the Corporation's ownership (by value) of one or more "5-percent shareholders" (as defined in the Code) has increased by more than 50 percent over the lowest percentage owned by such shareholders at any time during the prior three years (calculated on a rolling basis). Similar rules may apply under state tax laws. An entity that experiences an ownership change generally will be subject to an annual limitation on its pre-ownership change tax loss and credit carryforwards equal to the equity value of the corporation immediately before the ownership change, multiplied by the long-term, tax-exempt rate posted monthly by the IRS (subject to certain adjustments). The annual limitation would be increased each year to the extent that there is an unused limitation in a prior year. In the event that it is determined that we have in the past experienced an ownership change as a result of transactions in our stock, or if we experience one or more ownership changes as a result of future transactions in our stock, then we may be limited in our ability to use our net operating loss carryforwards and other tax assets to reduce taxes owed on the net taxable income that we earn. Any limitations on the ability to use our net operating loss carryforwards and other tax assets could harm our business.

Additionally, the Tax Act, which was enacted on December 22, 2017, significantly reforms the Code, including changes to the rules governing net operating loss carryforwards. For net operating loss carryforwards arising in tax years beginning after December 31, 2017, the Tax Act limits a taxpayer's ability to utilize such carryforwards to 80% of taxable income. In addition, net operating loss carryforwards arising in tax years ending after December 31, 2017 can be carried forward indefinitely, but carryback is generally prohibited. Net operating loss carryforwards generated by us before January 1, 2018 will not be subject to the taxable income limitation and will continue to have a twenty-year carryforward period. However, the changes in the carryforward and carryback periods as well as the new limitation on use of net operating losses may significantly impact our ability to use net operating loss carryforwards generated after December 31, 2017, as well as the timing of any such use, and could harm our business.

The United Kingdom's vote in favor of withdrawing from the European Union may have a negative effect on our ability to obtain marketing approval in foreign jurisdictions and could prevent our product candidates from being marketed abroad.

In order to market and sell our products in the European Union (the "EU") and many other foreign jurisdictions, we or our potential third-party collaborators must obtain separate marketing approvals and comply with numerous and varying regulatory requirements. The approval procedure varies among countries and can involve additional testing. The time required to obtain approval may differ substantially from that required to obtain FDA approval. The regulatory approval process outside of the United States generally includes all of the risks associated with obtaining FDA approval. In addition, in many countries outside of the United States, it is required that the product be approved for reimbursement before the product can be approved for sale in that country. We or our potential third-party collaborators may not obtain approvals from regulatory authorities outside of the United States on a timely basis, if at all. Approval by the FDA does not ensure approval by regulatory authorities in other countries or jurisdictions, and approval by one regulatory authority outside of the United States does not ensure approval by regulatory authorities in other countries or jurisdictions or by the FDA. However, a failure or delay in obtaining regulatory approval in one country may have a negative effect on the regulatory process in other countries. We may not be able to file for marketing approvals and may not receive necessary approvals to commercialize our products in any market.

On January 31, 2020 the UK formally withdrew from the EU. Since a significant proportion of the regulatory framework in the UK is derived from EU directives and regulations, the withdrawal could materially impact the regulatory regime with respect to the approval of our product candidate in the UK or the EU. Any delay in obtaining, or an inability to obtain, any marketing approvals, as a result of Brexit or otherwise, would prevent us from commercializing our product candidate in the UK and/or the EU and restrict our ability to generate revenue and achieve and sustain profitability. If any of these outcomes occur, we may be forced to restrict or delay efforts to seek regulatory approval in the UK and/or EU for our product candidate, which could significantly and materially harm our business.

Risks Related to Coronavirus Disease 2019 (COVID-19)

Our business is subject to risks arising from public health crises, epidemic or pandemic diseases, such as the recent global outbreak of the coronavirus disease 2019 (COVID-19).

Our business operations expose us to risks associated with public health crises, epidemics and pandemics. An epidemic or pandemic disease outbreak, including the recent COVID-19 outbreak, could cause significant disruption to our business operations or the operations of our third-party manufacturers and CROs upon whom we rely, as well as to our clinical trials, including as a result of significant restrictions or bans on travel into and within the countries in which our manufacturers produce our product candidates or where we conduct our clinical trials. Such disruption could impede, delay, limit or prevent our employees and CROs from continuing research and development activities, the production, delivery or release of our product candidates to our clinical trial sites, as well as clinical trial investigators, patients or other critical staff from traveling to or otherwise continuing to participate in our clinical trials, and delay data collection and analysis and other related activities, any of which could impede, delay, limit or prevent completion of our ongoing clinical trials and preclinical studies or commencement of new clinical trials, and ultimately lead to the delay or denial of regulatory approval of our product candidates, which would seriously harm our operations and financial condition and increase our costs and expenses.

The COVID-19 outbreak could also potentially affect the business of the FDA, EMA or other health authorities, which could result in delays in meetings related to planned or completed clinical trials and ultimately of reviews and approvals of our product candidates. The COVID-19 outbreak and mitigation measures also have had and may continue to have an adverse impact on global economic conditions which could have an adverse effect on our business and financial condition, including impairing our ability to raise capital when needed. The extent to which the COVID-19 outbreak impacts our results will depend on future developments that are highly uncertain and cannot be predicted, including new information that may emerge concerning the severity of the virus and the actions to contain its impact. The severity of the coronavirus disease could also make access to our existing supply chain difficult or impossible and could materially impact our business. Any one or a combination of the aforementioned events could have an adverse effect on our business.

Our ability to conduct clinical trials may be impeded, delayed, limited or prevented entirely due to the spread of COVID-19, the imposition of government restrictions and the concurrent disruptions to ordinary business activities globally.

As the U.S. and foreign governments and nongovernmental organizations continue to respond to the COVID-19 public health crisis, our ability to conduct clinical trials may impeded, delayed, limited or prevented entirely by a number of factors, including, but not limited to, the following:

- delays or difficulties in enrolling patients in our clinical trials;
- delays or difficulties in clinical site initiation, including difficulties in recruiting clinical site investigators and clinical site staff;
- diversion of healthcare resources away from the conduct of clinical trials, including the diversion of hospitals serving as our clinical trial sites and hospital staff supporting the conduct of our clinical trials;
- interruption of key clinical trial activities, such as clinical trial site monitoring, due to limitations on travel imposed or recommended by federal or state governments, employers and others;
- limitations in employee resources that would otherwise be focused on the conduct of our clinical trials, including because of sickness of employees or their families or the desire of employees to avoid contact with large groups of people;
- delays in receiving approval from local regulatory authorities to initiate our planned clinical trials;
- delays in clinical sites receiving the supplies and materials needed to conduct our clinical trials;

  interruption in global shipping that may affect the transport of clinical trial materials;
- changes in local regulations as part of a response to the COVID-19 coronavirus outbreak which may require us to change the ways in which our clinical trials are conducted, which may result in unexpected costs, or to discontinue the clinical trials altogether;
- delays in necessary interactions with local regulators, ethics committees and other important agencies and contractors due to limitations in employee resources or forced furlough of government employees; and
- refusal of the FDA to accept data from clinical trials in affected geographies outside the United States.

The global outbreak of the COVID-19 coronavirus continues to rapidly evolve. The extent to which the COVID-19 coronavirus may impact our business and clinical trials will depend on future developments, which are highly uncertain and cannot be predicted with confidence, such as the ultimate geographic spread and density of the disease, the duration of the outbreak, travel restrictions and social distancing in the United States and other countries, business closures or business disruptions and the effectiveness of actions taken in the United States and other countries to contain and treat the disease.

Our business involves international components, and we are exposed to various global and local risks related to the coronavirus disease 2019 (COVID-19) that could have a material adverse effect on our financial condition and results of operations.

Our business involves international components, including, for example, our worldwide ECC Agreement with Precigen and Precigen Actobiotics NV, pursuant to which we hold certain exclusive rights to our AG013 product candidate. Consequently, we may be exposed to, or our third-party contractors, suppliers or manufacturers may be exposed to, certain global events beyond our control, including war, public health crises, epidemics, pandemics, trade disputes, geopolitical conflicts and other international events, including, for example, the global impact of COVID-19 and the various responses taken by foreign authorities, such as government-imposed quarantines and other public health safety measures.

The extent to which the coronavirus impacts our results will depend on future developments, which are highly uncertain and cannot be predicted, including new information which may emerge concerning the severity of the coronavirus and the actions to contain the coronavirus or treat its impact, among others. Moreover, the coronavirus outbreak has begun to have indeterminable adverse effects on general commercial activity and the world economy, and our business and results of operations could be adversely affected to the extent that this coronavirus or any other epidemic harms the global economy generally. The international components of our business may be directly subject to, and the domestic components may be indirectly impacted by, a variety of risks, including:

- foreign currency exchange rate fluctuations;
- greater difficulty in staffing and managing foreign operations;
- greater risk of uncollectible accounts;
- longer collection cycles;
- logistical and communications challenges;
- potential adverse changes in laws and regulatory practices, including export license requirements, trade barriers, tariffs and tax laws;
- changes in labor conditions;
- burdens and costs of compliance with a variety of foreign laws;
- political and economic instability;
- increases in duties and taxation;
- foreign tax laws and potential increased costs associated with overlapping tax structures;
- greater difficulty in protecting intellectual property;
- the risk of third party disputes over ownership of intellectual property and infringement of third party intellectual property by our products; and
- general economic and political conditions in these foreign markets.

International markets are also affected by economic pressure to contain reimbursement levels and healthcare costs. Profitability from international operations may be limited by risks and uncertainties related to regional economic conditions, regulatory and reimbursement approvals, competing products, infrastructure development, intellectual property rights protection and our ability to implement our overall business strategy. We expect these risks will increase as we pursue our strategy to expand operations into new geographic markets. We may not succeed in developing and implementing effective policies and strategies in each location where we conduct business. Any failure to do so may harm our business, results of operations and financial condition.

Macroeconomic pressures in the markets in which we operate, including, but not limited to, the effectives of the coronavirus disease 2019 (COVID-19) may alter the ways in which we conduct our business operations and manage our financial capacities.

To varying degrees, the ways in which we conduct our business operations and manage our financial capacities are influenced by macroeconomic conditions that affect companies directly involved in or providing services related to the drug and biological product development. For example, real GDP growth, business and investor confidence, the COVID-19 pandemic, inflation, employment levels, oil prices, interest rates, tax rates, availability of consumer and business financing, housing market conditions, foreign currency exchange rate fluctuations, costs for items such as fuel and food and other macroeconomic trends can adversely affect not only our decisions and ability to engage in research and development and clinical trials, but also those of our management, employees, third-party contractors, manufacturers and suppliers, competitors, shareholders and regulatory authorities. In addition, geopolitical issues around the world and how our markets are positioned can also impact the macroeconomic conditions and could have a material adverse impact on our financial results.

Economic uncertainty may adversely affect our access to capital, cost of capital and ability to execute our business plan as scheduled.

Generally, worldwide economic conditions remain uncertain. Access to capital markets is critical to our ability to operate. Traditionally, biotechnology companies have funded their research and development expenditures through raising capital in the equity markets. Declines and uncertainties in these markets in the past have severely restricted raising new capital and have affected companies' ability to continue to expand or fund existing research and development efforts. We require significant capital for research and development for our vaccine candidates and clinical trials. The general economic and capital market conditions, both in the U.S. and worldwide, have been volatile in the past and at times have adversely affected our access to capital and increased the cost of capital. There is no certainty that the capital and credit markets will be available to raise additional capital on favorable terms. If economic conditions become worse, our future cost of equity or debt capital and access to the capital markets could be adversely affected. In addition, if we are unable to access the capital markets on favorable terms, our ability to execute our business plan as scheduled would be compromised. Moreover, we rely and intend to rely on third-parties, including clinical research organizations, contract manufacturing organizations and other important vendors and consultants. Global economic conditions may result in a disruption or delay in the performance of our third-party contractors and suppliers. If such third-parties are unable to adequately satisfy their contractual commitments to us in a timely manner, our business could be adversely affected.

Inadequate funding for the FDA, the SEC and other government agencies in light of the coronavirus pandemic could hinder their ability to hire and retain key leadership and other personnel, prevent new products and services from being developed or commercialized in a timely manner or otherwise prevent those agencies from performing normal business functions on which the operation of our business may rely, 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 the SEC and other government agencies on which our operations may rely, including those 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, the U.S. government has shut down several times and certain regulatory agencies, such as the FDA and the SEC, have had to furlough critical FDA, SEC and other government employees and stop critical activities. Moreover, at this time, we cannot predict the extent to which the COVID-19 pandemic outbreak will impact the resources of such government agencies, including, in particular, the public health resources available to the FDA. 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. Further, in our operations as a public company, future government shutdowns could impact our ability to access the public markets and obtain necessary capital in order to properly capitalize and continue our operations.

Risks Related to Our Common Stock

We had previously received a non-compliance letter from the NYSE American and we cannot assure you that our shares will continue to be listed on the NYSE American.

The listing of our common stock on the NYSE American is contingent on our compliance with the NYSE American's continued listing standards. On May 10, 2015, we were notified by the NYSE American (formerly known as NYSE MKT) that we were no longer in compliance with the NYSE American continued listing standards because our last reported stockholders' equity was below continued listing standards. Specifically, we are not in compliance with Section 1003(a)(iii) (requiring stockholders' equity of $6.0 million or more if it has reported losses from continuing operations and/or net losses in its five most recent fiscal years). As of December 31, 2015, we had stockholders' equity of $4.7 million. We were required to submit a plan to the NYSE American by June 10, 2016 advising of actions we have taken or will take to regain compliance with the continued listing standards by November 10, 2017.

We submitted a plan by the June 10, 2016 deadline and were notified that NYSE Regulation has accepted the Company's plan to regain compliance with the NYSE American exchange's continued listing standards set forth in Sections 1003(a)(ii) and 1003(a)(iii) of the NYSE American Company Guide (the "Company Guide") by November 10, 2017, subject to periodic review by the NYSE American for compliance with the initiatives set forth in the plan. On November 9, 2017, the Company filed a Form 8-K report with the Securities and Exchange Commission announcing that its Stockholders' Equity was approximately $6,929,555 on a pro-forma basis. With this information provided, the NYSE American determined the Company had resolved the continued listing deficiency with respect to Section 1003(a)(i), Section 1003(a)(ii) and Section 1003(a)(iii) of the Guide. In a letter dated November 10, 2017, the NYSE American notified the Company that it had successfully regained compliance with the NYSE American continued listing standards.

Going forward, the Company will be subject to the NYSE American's normal continued listing monitoring. In addition, in the event that the Company is again determined to be noncompliant with any of the NYSE American's continued listing standards within twelve (12) months of the notice, the NYSE American will consider the relationship between the Company's previous noncompliance and such new event of noncompliance and take appropriate action which may include implementing truncated compliance procedures or immediately initiating delisting proceedings.

A delisting of our common stock from the NYSE American could negatively affect the price and liquidity of our common stock and could impair our ability to raise capital in the future.

Our Series C preferred stock has a preference senior to all other classes of stock in distribution and liquidation and our Series A and Series B preferred stock, if not converted into common stock, will also have a distribution and liquidation preference senior to our common stock in liquidation either of which could negatively affect the value of our common stock and impair our ability to raise additional capital.

On November 8, 2017 we issued to Precigen Corporation ("Precigen") approximately $3.4 million of equity in the form of 100 shares of Series C, Non-Voting, Non-Convertible Preferred Stock (the "Series C Preferred Stock"). The shares of Series C are entitled to (payment-in-kind ("PIK") dividends thereon at the annual rate of twelve percent (12%) (the "Initial Rate") of its Stated Value, payable by issuing additional shares of Series C Preferred Stock within thirty days after the end of each calendar year pro-rata for partial years. The Initial Rate is subject to increase to twenty percent (20%) automatically after May 10, 2019. In January of 2020, we paid a dividend on our Series C Preferred Stock to Precigen of 19.542 shares of additional Series C Preferred Stock with a stated value of approximately $661,000. Upon Liquidation of the Company, whether voluntary or involuntary, each holder of shares of Series C Preferred Stock is entitled to receive, in preference to the holders of Common Stock, Series A Preferred Stock, Series B Preferred Stock and to all other equity securities issued by the Company from time to time (the "Junior Securities"), an amount of cash equal to the product of the number of shares of Series C Non-Convertible Preferred Stock then held by such holder, multiplied by the Stated Value per share of Series C Non-Convertible Preferred Stock plus any accrued but unpaid dividends (the "Series C Liquidation Amount") and no distributions or payments shall be made in respect of any Junior Securities unless all Series C Liquidation Amounts, if any, are first paid in full. The "Stated Value" shall mean $33,847.9874 per share. In January of 2018 we paid a dividend on our Series C Preferred Stock to Precigen of 1.733 shares for the portion of the 2017 fiscal year that the Series C Preferred was outstanding and in January of 2019, we paid a dividend on our Series C Preferred Stock to Precigen of 12.208 shares. On January 27, 2020 we paid a dividend on our Series C Preferred Stock to Precigen of 19.542 shares of additional Series C Preferred Stock. As a result of the recent sale by Precigen of its equity interest in Oragenics to TS Biotechnology LLC, future dividend payments would be paid to TS Biotechnology.

On November 8, 2017, we issued $3.3 million of Series B Non-Voting, Convertible Preferred Stock (the "Series B Preferred Stock") pursuant to which upon Liquidation each holder of shares of Series B Preferred Stock shall be entitled to receive, after payment to the Series C Preferred Stock, but on par with Series A Convertible Preferred Stock and in preference to the holders of Common Stock, an amount of cash equal to the greater of (i) the product of the number of shares of Series B Preferred Stock then held by such holder, multiplied by the Series B Original Issue Price; and (ii) the amount that would be payable to such holder in the Liquidation in respect of Common Stock issuable upon conversion of such shares of Series B Preferred Stock if all outstanding shares of Series B Preferred Stock were converted into Common Stock immediately prior to the Liquidation.

In May and July of 2017, we issued an aggregate of $3.0 million of Series A Non-Voting, Convertible Preferred Stock (the "Series A Preferred Stock") pursuant to which upon Liquidation each holder of shares of Series A Preferred Stock shall be entitled to receive, after payment to the Series C Preferred Stock, but on par with Series B Convertible Preferred Stock and in preference to the holders of Common Stock, an amount of cash equal to the greater of (i) the product of the number of shares of Series A Preferred Stock then held by such holder, multiplied by the Series B Original Issue Price; and (ii) the amount that would be payable to such holder in the Liquidation in respect of Common Stock issuable upon conversion of such shares of Series A Preferred Stock if all outstanding shares of Series A Preferred Stock were converted into Common Stock immediately prior to the Liquidation.

As such, our Series C preferred stock is senior to all other classes of stock in distribution and liquidation and our Series A and Series B preferred stock, if not converted into common stock, will also be senior to our common stock in distribution and liquidation if such shares are not converted into common stock, which could negatively affect the value of our common stock and impair our ability to raise additional capital.

The conversion of our Series A Preferred Stock, and Series B Preferred Stock and the exercise of currently outstanding warrants could result in significant dilution to the holders of our common stock.

The holders of our Series A Preferred Stock and Series B Preferred Stock may convert their shares of preferred stock into shares of common stock. As of December 31, 2019, we had outstanding: (i) 9,417,000 shares of Series A Preferred Stock outstanding, which are convertible into 941,701 shares of common stock and (ii) 6,600,000 shares of Series B Preferred Stock, which are convertible into 1,320,002 shares of common stock. In addition to our outstanding shares of preferred stock, as of December 31, 2019, there were currently outstanding warrants to purchase 26,538,593 shares of our common stock. The conversion of our Series A Preferred Stock and Series B Preferred Stock, as well as the exercise of our outstanding warrants could result in significant dilution to existing common shareholders, adversely affect the market price of our common stock and impair our ability to raise capital through the sale of additional equity securities.

The Holder of Our Series C Preferred Stock continues to receive dividends in additional shares of Series C Preferred Stock.

Each issued and outstanding share of Series C Preferred Stock entitled the holder of record to receive dividends at the annual rate of twelve percent (12%) (the "Initial Rate") of its Stated Value of $33,847 per share, payable by issuing additional shares of Series C Preferred Stock within thirty days after the end of each calendar year. Such Initial Rate was automatically increased to a rate of twenty percent (20%), effective May 10, 2019, for periods after such date. On January 25, 2018 we paid a dividend on our Series C Preferred Stock to Precigen of 1.733 shares of additional Series C Preferred Stock, on January 31, 2019 we paid a dividend on our Series C Preferred Stock to Precigen of 12.208 shares of additional Series C Preferred Stock and on January 27, 2020 we paid an additional annual dividend on our Series C Preferred Stock to the holder of 19.542 shares of additional Series C Preferred Stock. The accruing dividend is payable in additional shares of Series C Preferred Stock that we continue to be obligated to pay annually.

Our stockholders may not realize a benefit from our acquisition of Noachis Terra commensurate with the ownership dilution they will experience in connection with the acquisition.

In May 2020, in connection with our acquisition of Noachis Terra, the former sole shareholder received the following: (i) cash consideration of approximately $1,925,000; (ii) 9,200,000 restricted shares of the Company's common stock; and (iii) warrants to purchase 9,200,000 shares of the Company's common stock, which warrants and may not be exercised until the Company has obtained shareholder approval with respect to the exercisability of the warrants pursuant to the NYSE requirements. In addition to the above consideration, the former sole shareholder also received the right to receive contingent consideration based upon the exercise of certain of the Company's outstanding warrants. Accordingly, immediately following the acquisition and exclusive of the warrants received as consideration, the former sole shareholder held approximately 16.63% of the total issued and outstanding shares of the Company's common stock.

This issuance had the effect of diluting the holdings of the existing holders of our common stock, and the former sole shareholder of Noachis Terra now may have the ability to influence us and exert significant control through this ownership position. That shareholder may significantly influence the elections of directors, issuance of equity, including to our employees under equity incentive plans, amendments of our organizational documents, or approval of any merger, sale of assets or other major corporate transaction. That shareholder's interests may not always align with our corporate interests or the interests of other stockholders, and it may exercise its voting and other rights in a manner with which our other stockholders may not agree or that may not be in the best interests of the other holders of our common stock. Consequently, our existing common stockholders may have significantly less influence over the management and policies of the Company after the acquisition than the may have had prior to the acquisition. If we are unable to realize the full strategic and financial benefits currently anticipated from the acquisition, our common stockholders will have experienced substantial dilution of their ownership interests without receiving any commensurate benefit, or only receiving part of the commensurate benefit to the extent we are able to realize only part of the strategic and financial benefits currently anticipated from the acquisition.

The issuance of additional equity securities by us in the future would result in dilution to our existing common shareholders.

Our board of directors has authority, without action or vote of our shareholders, to issue all or a part of our authorized but unissued shares, except where shareholder approval is required by law. Any issuance of additional equity securities by us in the future could result in dilution to our existing common shareholders. Such issuances could be made at a price that reflects a discount or a premium to the then-current trading price of our common stock. In addition, our business strategy may include expansion through internal growth by acquiring complementary businesses, acquiring or licensing additional products or brands, or establishing strategic relationships with targeted customers and suppliers. In order to do so, or to finance the cost of our other activities, we may issue additional equity securities that could result in further dilution to our existing common shareholders. These issuances would dilute the percentage ownership interest of our existing common shareholders, which would have the effect of reducing their influence on matters on which our shareholders vote, and might dilute the book value of our common stock. For example, we issued a total of 4,436,000 shares of common stock, 9,364,000 shares of Series D Preferred Stock convertible into 9,364,000 shares of common stock, and total warrants to purchase 13,800,000 shares of common stock in our recent underwritten public offering that closed on July 17, 2018. As of December 31, 2018, 9,364,000 shares of Series D Preferred Stock had been converted into shares of common stock and 9,505,500 warrants had been exercised. We also issued 16,666,668 shares of common stock, short-term warrants to purchase up to 9,583,334 shares of common stock, and long-term warrants to purchase up to 9,583,334 shares of common stock, as part of our March 25, 2019 underwritten public offering. As a result, our outstanding shares of common stock have increased significantly from 4,928,335 shares as of December 31, 2017 to 46,124,803 shares as of December 31, 2019, and inclusive of the shares of our common stock issued in connection with our acquisition of Noachis Terra, 55,324,803 outstanding shares of our common stock.

In connection with the Oral Mucositis ECC we entered into on June 9, 2015 and which was amended in November of 2017, we will be required, at our option, to pay up to $37.5 million cash to Precigen or issue up to $37.5 million of additional shares of our common stock to Precigen upon meeting certain milestone events. Additionally, in connection with our acquisition of Noachis Terra, we issued to the former sole shareholder of Noachis Terra, among other consideration, warrants to purchase 9,200,000 shares of our common stock. The exercisability of the warrants is subject to shareholder approval, in accord with NYSE rules, and may not be exercised until the earlier of (i) notification of BARDA's willingness to fund development of our SARS-CoV-2 vaccine product candidate, (ii) Phase 1 clinical results for our SARS-CoV-2 vaccine product candidate demonstrating activity (as defined in the Stock Purchase Agreement) or (iii) one year from the date of issuance. If exercisable, these newly-issued warrants, upon exercise, would result in dilution to our existing common shareholders.

Certain provisions of our articles of incorporation, bylaws, executive employment agreements and stock option plan may prevent a change of control of our company that a shareholder may consider favorable.

Provisions of our articles of incorporation, bylaws, executive employment agreements and stock option plan may discourage, delay or prevent a change of control of our company that a shareholder may consider favorable. These provisions include:

- authorization of the issuance of "blank check" preferred stock that could be issued by our Board of Directors without shareholder approval and that may be substantially dilutive or contain preferences or rights objectionable to an acquirer;
- the ability of our Board of Directors to amend the bylaws without shareholder approval;
- vacancies on our Board may only be filled by the remaining directors and not our shareholders;
- requirements that only our Board, our President or holders of more than 10% of our shares can call a special meeting of shareholders;
- obligations to make certain payments under executive employment agreements in the event of a change of control and termination of employment; and
- immediate vesting of all outstanding stock options.

As a result, these provisions could discourage bids for our common stock at a premium and limit the price that investors are willing to pay in the future for shares of our common stock. However, in our articles of incorporation we expressly elected not to be governed by Sections 607.0901 and 607.0902 of the Florida Business Corporation Act, which are statutory anti-takeover provisions relating to affiliated transactions and control share acquisitions, respectively. As such, we do not have the protection of these statutes in connection with any unwanted takeover attempts which could have the effect of encouraging an attempted change of control without first negotiating with our Board of Directors.

Our stock price has historically been volatile and the trading volume of our stock has been low.

The trading price of our common stock has historically been, and may in the future be, subject to wide fluctuations in response to a number of factors, many of which are beyond our control. These factors include:

- announcements of the results of our pending clinical trials;
- our level of, and expected future use of, working capital;

- quarter-to-quarter variations in our operating results;
- our perceived funding needs;
- the results of testing, technological innovations, or new commercial products by us or our competitors;
- governmental regulations, rules, and orders;
- general conditions in the health care, biotechnology or biopharmaceutical industries;
- changes in market or trading conditions in light of economic uncertainty due to the COVID-19 pandemic;
- comments, research reports and/or earnings estimates by securities analysts;
- developments concerning patents or other intellectual property rights;
- litigation or public concern about the safety of our products;
- announcements by us or our competitors of significant acquisitions, strategic partnerships, joint ventures or capital commitments;
- additions or departures of directors, officers and key personnel;
- release of transfer restrictions on our outstanding shares of common stock or sales of additional shares of common stock;
- potential litigation initiated against us; and
- the additional sale of common stock by us in capital raising transactions.

Historically, the daily trading volume of our common stock has been relatively low and on some days our stock does not trade at all. An order for the purchase or sale of a large number of our shares could significantly affect the price at which the order is executed. We cannot guarantee that an active public market for our common stock will be sustained or that the average trading volume will increase. In addition, the stock market in general has experienced significant price and volume fluctuations. Volatility in the market price for particular companies has often been unrelated or disproportionate to the operating performance of those companies. Broad market factors may seriously harm the market price of our common stock, regardless of our operating performance. In addition, securities class action litigation has often been initiated following periods of volatility in the market price of a company's securities. A securities class action suit against us could result in substantial costs, potential liabilities, and the diversion of management's attention and resources. To the extent our stock price fluctuates or remains low, it could impair our ability to raise capital through the offering of additional equity securities.

Following our acquisition of Noachis Terra, the market price of our common stock may decline or otherwise be subject to volatility.

The market price of our common stock may decline as a result of the acquisitions for a variety of reasons, including, but not limited to, the following:

- investors reacting negatively to Noachis Terra's business prospects or our ability to support Noachis Terra's business plans going forward;
- the effect of the acquisition on our business and prospects may not be consistent with the expectations of financial or industry analysts; or
- the perception that we may not achieve the perceived benefits of the acquisition as rapidly or to the extent anticipated by financial or industry analysts.

We may be subject to securities litigation, which is expensive and could divert management attention.

The market price of our common stock has been in the past and may continue to be volatile. In the past, other publicly-traded companies that have experienced volatility in the market price of their stock have been subject to securities class action litigation. We may be the target of securities law-related litigation in the future, and such litigation against us could result in substantial costs and divert management's attention from other business concerns, which could seriously harm our business.

Future sales of our common stock may depress our stock price.

The market price of our common stock could decline as a result of sales of substantial amounts of our common stock in the public market, or the perception that these sales could occur. In addition, these factors could make it more difficult for us to raise funds through future offerings of common stock. We have recently issued a significant number of shares of common stock and the number of outstanding shares has increased from 4,928,335 shares as of December 31, 2017 to 46,124,803 shares as of December 31, 2019, and inclusive of the shares of our common stock issued in connection with our acquisition of Noachis Terra, 55,324,803 outstanding shares of our common stock. In addition, there were 16,017,000 shares of our Preferred stock outstanding which are convertible into 2,261,703 shares of our common stock and, as of December 31, 2019, warrants to purchase an additional 26,538,593 shares of our common stock issuable upon exercise of warrants to investors, exclusive of the warrants to purchase 9,200,000 shares of our common stock issued in connection with our acquisition of Noachis Terra, the exercisability of which is contingent upon, among other things, shareholder approval. There were also 2,486,365 shares issuable upon exercise of options outstanding and an additional 5,522,885 shares available for option grants under our 2012 Equity Incentive Plan.

The issuance of shares of our common stock under our 2012 Equity Incentive Plan is covered by Form S-8 registration statements we filed with the Securities and Exchange Commission, or SEC, and upon exercise of the options, such shares may be resold into the market. We have also issued shares of common stock and warrants in connection with previous private placements. Such shares are available for resale as well as certain of the shares of common stock issuable upon exercise of the warrants. We have also issued shares of our common stock in the private placement and financing transaction, which are deemed to be "restricted securities," as that term is defined in Rule 144 promulgated under the Securities Act of 1933, as amended, or Securities Act, and such shares may be resold pursuant to the provisions of Rule 144. For example, on June 30, 2016 we issued 904,568 restricted shares of our common stock to three accredited investors (Precigen, the KFLP and our Chairman Dr. Telling) in a private placement. In addition, in our 2017 private placements, we issued Series A and Series B convertible preferred stock that are convertible into shares of our common stock. Moreover, in connection with our May 2020 acquisition, we issued to the former shareholder of Noachis Terra, among other consideration, 9,200,000 restricted shares of our common stock and warrants to purchase 9,200,000 shares of our common stock, both of which are subject to enumerated restrictions upon exercise and sale but which benefit from our obligation to file with the Securities and Exchange Commission a registration statement covering such shares and warrants. The resale of shares acquired from us in the aforementioned transactions could cause our stock price to decline significantly.

In addition, from time to time, certain of our shareholders may be eligible to sell all or some of their restricted shares of common stock by means of ordinary brokerage transactions in the open market pursuant to Rule 144, subject to certain limitations. In general, pursuant to Rule 144, after satisfying a six-month holding period: (i) affiliated shareholders, or shareholders whose shares are aggregated, may, under certain circumstances, sell within any three-month period a number of securities which does not exceed the greater of 1% of the then-outstanding shares of common stock or the average weekly trading volume of the class during the four calendar weeks prior to such sale and (ii) non-affiliated shareholders may sell without such limitations, in each case provided we are current in our public reporting obligations. Rule 144 also permits the sale of securities by non-affiliates that have satisfied a one-year holding period without any limitation or restriction.

We are unable to estimate the number of shares that may be sold because this will depend on the market price for our common stock, the personal or business circumstances of sellers and other factors.

The requirements of being a public company may strain our resources, divert management's attention and affect our ability to attract and retain qualified members for our Board of Directors.

As a public company, we are already subject to the reporting requirements of the Securities Exchange Act of 1934, as amended, or the Exchange Act, and the Sarbanes-Oxley Act. The requirements of these rules and regulations may increase our legal, accounting and financial compliance costs; may make some activities more difficult, time-consuming and costly; and may also place undue strain on our personnel, systems and resources. Our management and other personnel need to devote a substantial amount of time to comply with these requirements. Moreover, these rules and regulations increase our legal and financial compliance costs and make some activities more time-consuming and costlier. These rules and regulations could also make it more difficult for us to attract and retain qualified persons to serve on our Board of Directors and Board committees or as executive officers.

As a public company we are also required to assess our internal control over financial reporting under Section 404 of the Sarbanes-Oxley Act and file periodic reports with the SEC. If we are unable to comply with these requirements in a timely manner, or if material weaknesses or significant deficiencies persist, the market price of our stock could decline and we could be subject to sanctions or regulatory investigations, which could harm our business. We must perform an assessment of our internal control over financial reporting to allow management to report on the effectiveness of our internal control over financial reporting, as required by Section 404 of the Sarbanes-Oxley Act. Our compliance with Section 404 of the Sarbanes-Oxley Act requires that we incur substantial accounting expense and expend significant management efforts. If we are unable to comply with the requirements of Section 404 of the Sarbanes-Oxley Act or the SEC reporting requirements in a timely manner, or if we note or identify deficiencies in our internal control over financial reporting that are deemed to be material weaknesses, the market price of our stock could decline and we could be subject to sanctions or investigations by the SEC or other regulatory authorities, which would require additional financial and management resources. As a smaller reporting company, we do not have to have our independent registered public accounting firm report on the effectiveness of our internal control over financial reporting. If in the future we no longer meet the requirements of a smaller reporting company, our independent registered public accounting firm will have to report on our internal controls over financial reporting. There can be no assurance that our independent registered public accounting firm will not identify material weaknesses which could have an adverse effect on our stock price.

We cannot assure you that we will continue to be listed on the NYSE American.

Our common stock commenced trading on the NYSE American (formerly the NYSE MKT) on April 10, 2013, and we are subject to certain NYSE American continued listing requirements and standards. We may also incur costs that we have not previously incurred for expenses for compliance with the rules and requirements of the NYSE American. We cannot provide any assurance that we will be able to continue to satisfy the requirements of the NYSE American's continued listing standards. A delisting of our common stock could negatively affect the price and liquidity of our common stock and could impair our ability to raise capital in the future.

We will continue to incur significant costs as a result of and devote substantial management time to operating as a public company listed on the NYSE American.

As a public company listed on the NYSE American, we incurred and will continue to incur significant legal, accounting and other expenses that we did not incur before when trading on the OTCQB Marketplace. For example, we are subject to the rules and regulations required by the NYSE American, including changes in corporate governance practices and minimum listing requirements. These requirements have increased our legal and financial compliance costs and have and will continue to render some activities more time-consuming and costlier. In addition, our management and other personnel have diverted and will continue to divert attention from operational and other business matters to devote substantial time to these listing requirements and failure to meet these requirements could lead to an adverse effect on the listing of our common stock on the NYSE American.

If securities or industry analysts publish research or publish inaccurate or unfavorable research about our business, our stock price and trading volume could decline.

The trading market for our common stock depends in part upon the research and reports that securities or industry analysts publish about us or our business from time to time. If one or more of the analysts who seek to cover us downgrades our stock or publishes inaccurate or unfavorable research about our business, our stock price would likely decline. If one or more of these analysts ceases coverage, once commenced, or fails to publish reports on us regularly, demand for our stock could decrease, which could cause our stock price and trading volume to decline.

We may issue debt or debt securities convertible into equity securities, any of which may be senior to our common stock as to distributions and in liquidation, which could negatively affect the value of our common stock.

In the future, we may attempt to increase our capital resources by entering into debt or debt-like financing that is unsecured or secured by up to all of our assets, or by issuing additional debt or equity securities, which could include issuances of secured or unsecured commercial paper, medium-term notes, senior notes, subordinated notes, guarantees, preferred stock, hybrid securities, or securities convertible into or exchangeable for equity securities. In the event of our liquidation, our lenders and holders of our debt and securities would receive distributions of our available assets before distributions to the holders of our common stock. Because our decision to incur debt and issue securities in future offerings may be influenced by market conditions and other factors beyond our control, we cannot predict or estimate the amount, timing or nature of our future offerings or debt financings. Further, market conditions could require us to accept less favorable terms for the issuance of our securities in the future.

We are a "smaller reporting company" and, as a result of the reduced disclosure and governance requirements applicable to smaller reporting companies, our common stock may be less attractive to investors.

We are a "smaller reporting company," meaning that we are not an investment company, an asset-backed issuer, or a majority-owned subsidiary of a parent company that is not a "smaller reporting company," have a public float of less than $250 million and have annual revenues of less than $100 million during the most recently completed fiscal year. As a "smaller reporting company," we are subject to lesser disclosure obligations in our SEC filings compared to other issuers. Specifically, "smaller reporting companies" are able to provide simplified executive compensation disclosures in their filings, are exempt from the provisions of Section 404(b) of the Sarbanes-Oxley Act requiring that independent registered public accounting firms provide an attestation report on the effectiveness of internal control over financial reporting and have certain other decreased disclosure obligations in their SEC filings, including, among other things, only being required to provide two years of audited financial statements in annual reports. Decreased disclosures in our SEC filings due to our status a "smaller reporting company" may make it harder for investors to analyze our operating results and financial prospects.

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

We have never paid cash dividends on our capital stock. We currently intend to retain any future earnings to finance the operation and expansion of our business, and we do not expect to declare or pay any cash dividends in the foreseeable future. Consequently, stockholders must rely on sales of their common stock after price appreciation, which may never occur, as the only way to realize any future gains on their investment.

Item 9.01 Financial Statements and Exhibits.

(d) Exhibits.

Exhibit No.	Description
99.1	Investor Presentation

SIGNATURES

In accordance with the requirements of the Exchange Act, the registrant has caused this report to be signed on its behalf by the undersigned, thereunto duly authorized on this 8th day of May, 2020.

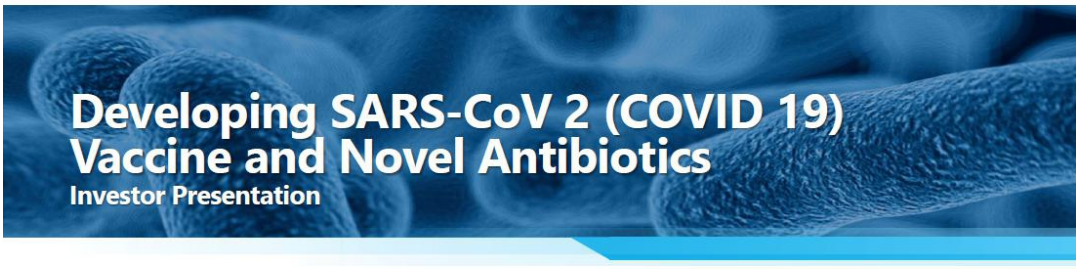
ORAGENICS, INC.
(Registrant)

BY: */s/ Michael Sullivan*
Michael Sullivan
Chief Financial Officer

Exhibit 99.1

Alan F. Joslyn, PhD
President & CEO
813 286 7900 ext 232
ajoslyn@oragenics.com

Oragenics, Inc.
4902 Eisenhower Blvd., Suite 125
Tampa, FL 33634
www.oragenics.com

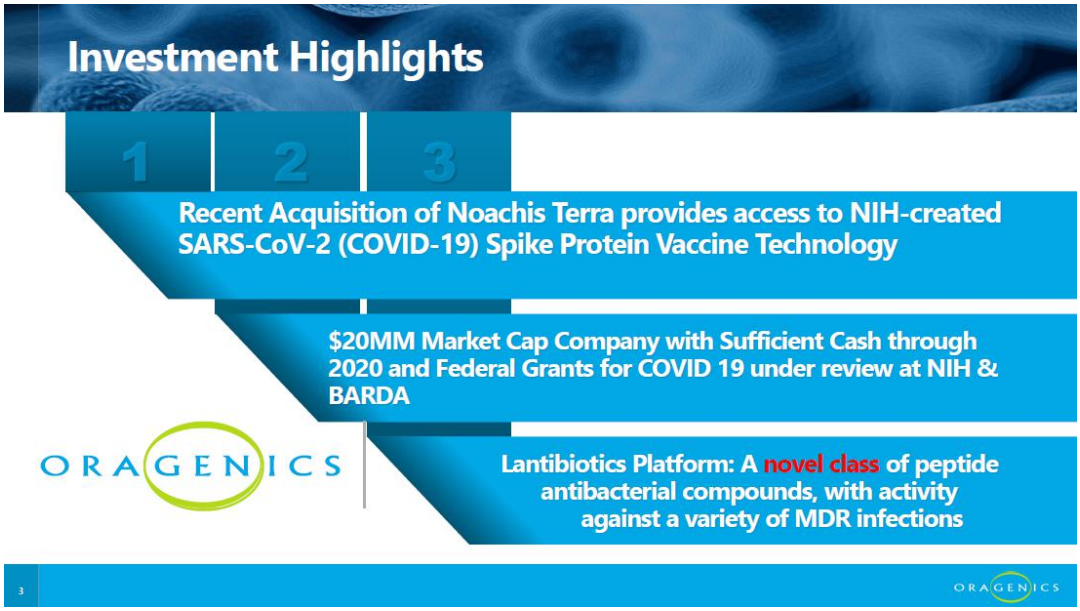


NYSE American: **OGEN**

May 7, 2020

Safe Harbor Statement

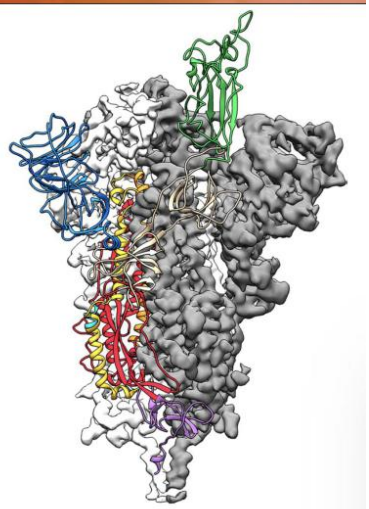
Certain statements made in this presentation include forward-looking actions that Oragenics, Inc. ("Oragenics," or the "Company") anticipates based on certain assumptions. These statements are indicated by words such as "expect", "anticipate", "should" and similar words indicating uncertainty in facts, figures and outcomes. Such statements are made pursuant to the Safe Harbor Provisions of the Private Securities Litigation Reform Act of 1995. While Oragenics believes that the expectations reflected in such forward-looking statements are reasonable, it can give no assurance that such statements will prove to be correct. The risks associated with the Company are detailed in the Company's various reports filed by the Company with the Securities and Exchange Commission.


Investment Highlights
1
2
3
Recent Acquisition of Noachis Terra provides access to NIH-created SARS-CoV-2 (COVID-19) Spike Protein Vaccine Technology
$20MM Market Cap Company with Sufficient Cash through 2020 and Federal Grants for COVID 19 under review at NIH & BARDA
ORAGENICS
Lantibiotics Platform: A novel class of peptide antibacterial compounds, with activity against a variety of MDR infections
3
ORAGENICS

Overview

Objective: To develop and commercialize a vaccine providing lifetime immunity from SARS-CoV-2 infection.

Benefits: Lifetime protection from SARS-CoV-2 virus, COVID-19 infection prevention, 1-2 doses, more rapid immune response, lower antigen concentration required, potential protection from other coronaviruses

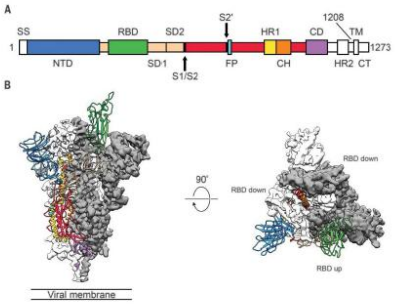


The molecular structure of the spike protein.
Jason McLellan/Univ. of Texas at Austin

Technology Overview - Antigen

Stabilized Prefusion Spike Protein Ectodomain Trimer

- Class I fusion protein
- Two amino acid substitutions stabilize prefusion conformation
- T4 fibritin trimerization domain
- Expressed in mammalian cell line



Daniel Wrapp et al. Science 2020; 367:1260-1263

NOACHIS TERRA

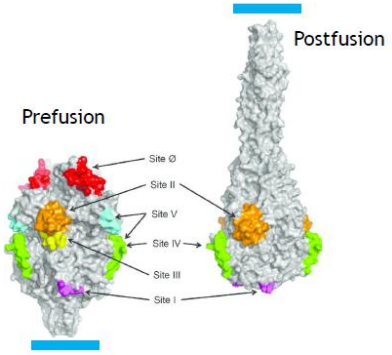
Technology Overview - RSV F Protein Example

Accessible antigenic sites depend on protein conformation:

- **Pre sites: Ø, V**
- **Post site[1]: I**
- **Pre/post sites: II, III, IV**

Absorption of human convalescent serum with postfusion F modestly reduces neutralizing antibodies

Absorption of human convalescent serum with prefusion F removes almost all neutralizing antibodies



Flynn et al, PLOS ONE|DOI:10.1371/journal.prone.0164789 Oct. 20, 2016

1. MAbs to site 1 preferentially bind postfusion conformation

NOACHIS TERRA

Adjuvants

CpG 1018 - in HEPLISAV-B

- 22-base synthetic oligonucleotide (ODN) containing immunostimulatory cytidine-phospho-guanosine (CpG) sequence motifs
- the principal actions of 1018 in humans include:
    - activating pDCs to secrete interferons (IFNs) and cytokines,
    - converting pDCs into highly efficient antigen-presenting cells that present processed HBsAg peptides to CD4+ T cells, and
    - promoting T cell differentiation to functional helper T (Th) cells through pDC derived IFNs and cytokines.
- FDA approved HEPLISAV-B in November 2017

GSK AS03 - in Influenza A (H5N1) Virus Monovalent Vaccine, Adjuvanted

- α-tocopherol, squalene and polysorbate 80 in an oil-in-water emulsion
- In clinical studies using the H5N1 influenza strain, an adjuvanted formulation has been shown to stimulate a higher immune response while using a smaller amount of antigen as compared to a formulation without adjuvant.
- FDA approved Influenza A (H5N1) Virus Monovalent Vaccine, Adjuvanted in 2013

Regulatory Strategy: Fast Track Approach

Proposed Clinical Trial Pathway and Timeline

Assumptions

- Run initial batch with research CHO cell line
- Initial Pilot Manufacturing Batch used for filing FDA IND
- FDA truncates 30-day IND review period

Technology Overview - Current Status

- NIH/NIAID License secured with acquisition of Noachis Terra
- NIH & BARDA grants submitted (other non-dilutive grants under development)
- Utilize NIAID Pre-Clinical services for pre-IND enabling Studies
- Contracts in place for:
  - cell bank manufacture (work initiated)
  - Vaccine manufacture
  - Clinical Research Organization
  - Regulatory Consultants
- Utilize BARDA services for fill/finish

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Novel Lantibiotic Platform for
Multidrug Resistant Bacterial Infections

CDC Antibiotic-Resistant Threats, 2017 (cases/yr, US)

Drug-resistant pathogen (blue = gram (+) grey= gram (-))	Infections/year
Clostridium difficile	**500,000**
Carbapenem-Resistant Enterobacteriaceae (CRE)	9,000
Neisseria gonorrhoeae	246,000
MDR Acinetobacter	7,300
Drug-Resistant Campylobacter	310,000
Extended Spectrum ß-lactamase Enterobacteriaceae	26,000
Vancomycin-Resistant Enterococcus (VRE)	**20,000**
MDR *Pseudomonas aeruginosa*	6,700
Drug-Resistant Non-Typhoid Salmonella	100,000
Drug-Resistant Typhoid Salmonella	3,800
Drug-Resistant Shigella	27,000
Methicillin-Resistant *Staphylococcus aureus* (MRSA)	**80,000**
Drug-Resistant *Streptococcus pneumoniae*	**1,200,000**

Center Disease Control; U.S. MDR pathogen update, 2017

C. difficile and *C. difficile* Infection (CDI): Epidemiology

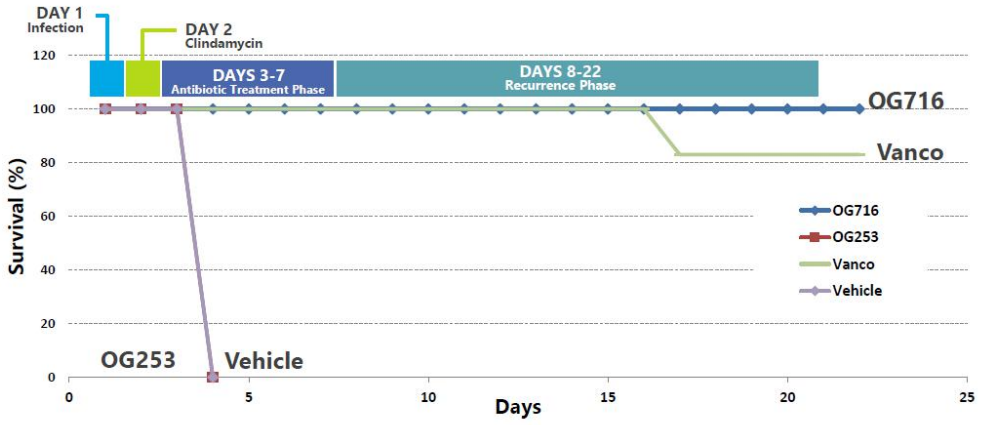
- *C. difficile* is an infection of the colon causing colitis by producing toxins that damage lining of the colon
- 500,000 infections annually resulting in 29,000 deaths
- 83,000 will experience at least one recurrence
- Deaths have increased 400% since 2000
- Healthcare-associated infections occur: 37% hospital onset, 36% nursing home onset, 27% community onset
- *C. difficile* associated diarrhea is associated with a 1-2 week hospital stay
- **Emerging problem**: 8% of CDI associated with onset of concomitant Vancomycin Resistant Enterococci (VRE) infection

Lantibiotics: Novel Platform of Antibiotics to Treat Serious Life-Threatening Infections

- Lantibiotics are novel class of peptide antibacterial compounds naturally produced by variety of Gram-positive bacterial strains to attack competing bacterial strains
- Platform: >700 lantibiotic structures created, potentially generating a pipeline of new compounds
- Prior development limited by manufacturing technical hurdles
- Platform provides potential for development in multidrug resistant infections:
  - Methicillin Resistant *Staphlococcus aureus* (MRSA)
  - Vancomycin Resistant Enterococci (VRE)
  - Virulent *Clostridium difficile*
  - Gram(-) infections

Mutacin 1140: a lantibiotic produced by *Streptococcus mutans*

Oral OG716 Superior at Preventing *C. difficile* Deaths in Hamster Model



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Lantibiotics: OG716 *C. difficile* Program Milestones

Tech Transfer of Manufacturing Process

Fermentation complete; purification underway

Manufacture of API

Ongoing at 1400L scale: transitioning to GMP manufacture; Enough material generated for rat tox study, lots for monkey tox study ongoing

Toxicology and Microbiology Underway

14-day rat tox study underway and monkey tox study under development

File IND

Timing of filing of the IND is subject to having adequate available capital to complete requisite studies

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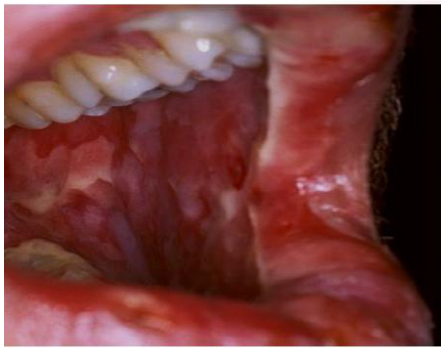
AG013: First-in-Class Therapy for
Prevention of Oral Mucositis

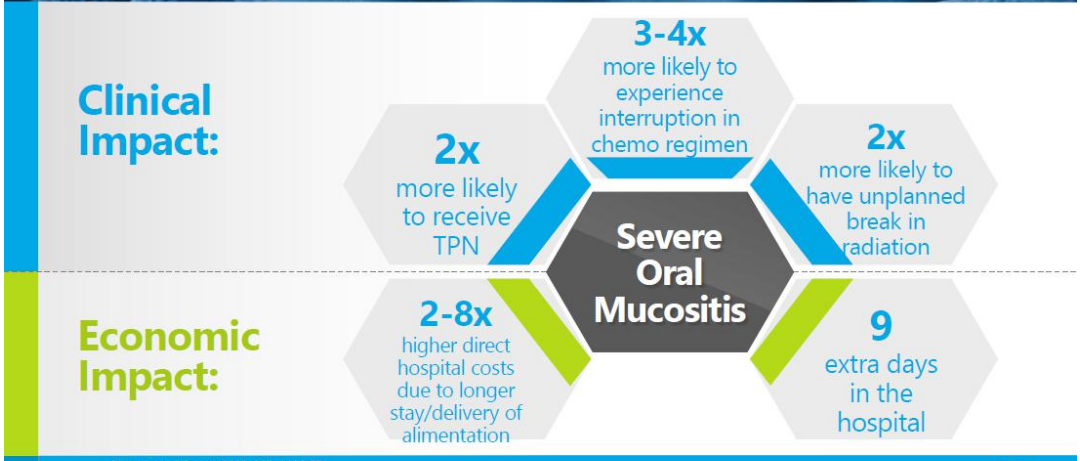
Oral Mucositis



- Most common and debilitating complication of cancer chemo and radiation therapy.
- Caused by breakdown of mucosal lining resulting in formation of oral ulcers.
- Inability to eat/drink (WHO grades 3 & 4) resulting in nutritional deficits and potential alterations of cancer treatment regimens.
- **Large Addressable Market**: > 770,000 U.S. newly diagnosed cancer patients receiving conventional chemotherapy and radiation are at increased risk of developing OM*

*Center Disease Control, 2017

Economic and Clinical Impact of Severe OM



Nonzee et al Cancer 2008; 113: 1446-52
Vera_Llonch et al Cancer 2006; 106: 329-36
Carlotto et al Pharmacoeconomics 2013; 2013: 753-66

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AG013: Target Product Profile

- Convenient, flavored oral rinsing solution composed of genetically modified *Lactococcus lactis* (non-pathologic food grade bacterium) engineered to deliver mucosal protectant human Trefoil Factor 1 (hTFF1) to mucosal tissues
  - Trefoil Factors (TFF's) are a class of peptides involved in protecting mucosal tissues against damage and in subsequent repair
- Cost effective (low COGs) delivery system provides daily continuous oropharyngeal coverage with *L. lactis* producing hTFF1 during entire cancer treatment regimen

Intellectual Property:

Intellectual property relating to AG013 extends into 2030s

Additional protections support underlying gene transfer technologies

AG013 in Action

1

AG013 delivers hTTF1 via genetically modified lactococcus

2

The bacteria is freeze-dried into vials

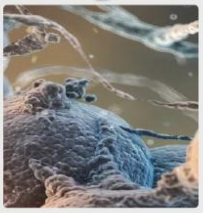
3

Patient mixes powder with a raspberry-flavored solution

4

Patient swishes for 30 seconds after every meal

5



This activity promotes a protein called trefoil factor, which regrows the oral lining

OM Products Under Development

Company	Oragenics	Galera	Soligenix	Innovation	Monopar
Product Name	AG013: dapatifagene navolactibac	GC 4419: avasopasem manganese	SGX942: dusquetide	Briliciden	Clonidine
Mechanism	Trefoil Factor 1	Superoxide dismutase mimetic	Innate Defense Regulator	Defensin mimetic	α 2 receptor agonist
Route of Administration	Oral rinse system	IV (1 hour infusion)	IV	Oral rinse	Buccal Tablet
Phase of Clinical Development	2/3	3	3	2	2
Market Cap(MM) (3.6.20)	31.9	338.4	61.6	34.9	97.7
Listing/ ticker	NYSE American: OGEN	NASDAQ: GRTX	NASDAQ: SNGX	OTC Markets: IPIX	NASDAQ: MNPR

AG013: Current Study Design Agreed with FDA

- Double-blind, placebo – controlled evaluation of daily AG013 ($2x10^{11}$ CFU) TID oral suspension for duration of cancer treatment regimen
- 160-180 evaluable patients with head and neck cancer receiving chemoradiation therapy over 7-9 weeks and standard of care for prevention of OM
- ~59 clinical centers in United States and Europe
- **Primary efficacy endpoint:** Duration (in days) of severe OM (WHO grades 3 (unable to eat) & 4 (unable to drink))
- **Sample size consideration:** 160 evaluable patients (80/group) provides 80% power to detect 5-day difference between groups with respect to severe OM
- **OM secondary endpoints:** number of OM free (WHO grades 1 & 2) days, time to onset, use of pain medication, alteration in cancer regimens; emergency room visits for SOM

AG013 Received **FDA Fast Track** Designation

AG013: Near Term News Flow

- On April 15, 2020 the company release news that the study did not demonstrate statistical significance between AG013 and Placebo for key efficacy endpoints. Analysis of various sub-groups are ongoing and the data will be released once those analyses are complete.


Corporate Status Update

Capitalization

	Common Stock Equivalents*
Common Stock Outstanding**	55,362,803
Series A and Series B Convertible Preferred (As Converted)	2,261,703
Series C Non-Convertible Perpetual Preferred*** (113.941 shares outstanding)	-
Warrants (WAEP $1.12)**	35,700,593
Reserved for issuance under stock incentive plan	8,009,250
Total	101,334,349

Cash	$18.3M*

* Information is as of December 31 1, 2019 unless otherwise indicated.

** Includes 9,200,000 shares of common stock and warrants issued in connection with the acquisition of Noachis Terra.

*** As of December 31, 2019, the Non-Voting, Non-Convertible Series C Preferred Shares have a stated value of $33,847 per share and have an accruing dividend of 20% per year. The Series C Preferred Shares resulted from the conversion of approximately $3.3 million in debt obligations previously owed to Precigen (fka: Intrexon).

The Series A, B, and C Preferred stock have no price based downround protection for the conversion price.

Experienced Management Team

Dr. Alan F. Joslyn
Director, President and Chief Executive Officer

- Assumed CEO position at Oragenics in June 2016
- Held CEO positions at several private biotechnology companies including Sentinella Pharmaceuticals, Edusa Pharmaceuticals and Mt. Cook Pharma
- Over 25 years of drug development experience at Glaxo, Johnson & Johnson and Penwest

Mike Sullivan
Chief Financial Officer

- Held senior-level financial positions for both publicly and privately held businesses
- Significant experience in product licensing and IP issues with strong background in both domestic and international retail operations

Dr. Martin Handfield
Senior Vice President, Discovery Research

- Molecular Microbiologist and former Tenured Associate Professor, College of Dentistry at The University of Florida
- Prolific researcher focusing on infectious diseases, host-pathogen interactions and non-invasive diagnostics

Experienced Management Team

David Zarley
Consultant

- More than 30 years in vaccine research and development in the private sector
- Vice-President of Program Management for Vaccine Research and Development at Pfizer
- Senior Director /Medicines Team Leader for Pfizer Primary Care Business Unit
- Senior Director for Wyeth Research Project Management Business Unit
- Senior Director for Technical Operations and Product Supply (TOPS) at Wyeth Vaccines
- Senior Research Biochemist / Project Leader for Viral Vaccine Research and Development at Lederle-Praxis Biologicals