Achaogen, Inc.
Form 10-K
April 01, 2019

UNITED STATES

SECURITIES AND EXCHANGE COMMISSION

WASHINGTON, D.C. 20549

FORM 10-K

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

OR

TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(D) OF THE SECURITIES EXCHANGE ACT OF 1934
FOR THE TRANSITION PERIOD FROM ___ TO ___.

Commission file number 001-36323

ACHAOGEN, INC.

(Exact name of registrant as specified in its charter)

Delaware	68-0533693
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)

1 Tower Place, Suite 400

South San Francisco, CA 94080

(Address of principal executive offices including zip code)

650-800-3636

(Registrant’s telephone number, including area code)

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

Title of each class	Name of each exchange on which registered
Common Stock, $0.001 par value	The NASDAQ Global Market

Securities registered pursuant to Section 12(g) of the Act: None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act.

Yes No

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act.

Yes No

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days.

Yes No

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted and posted pursuant to Rule 405 of Regulation S-T (§ 232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files).

Yes No

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K (§229.405 of this chapter) is not contained herein, and will not be contained, to the best of registrant’s knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K.

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

Large accelerated filer	Accelerated filer
Non-accelerated filer	Smaller reporting company
	Emerging growth company

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act.

Indicate by check mark whether the registrant is a shell company (as defined in 12b-2 of the Act).

Yes No

The aggregate market value of the common stock held by non-affiliates computed by reference to the last reported sale price on June 30, 2018 was approximately $370.8 million. As of March 25, 2019, there were 63,879,995 shares of the registrant's common stock outstanding.

DOCUMENTS INCORPORATED BY REFERENCE:

Certain information required by Part III of the Annual Report on Form 10-K is incorporated by reference to the registrant's definitive proxy statement for the registrant's 2019 annual meeting of stockholders, which will be filed with the Securities and Exchange Commission not later than 120 days after the close of the registrant's fiscal year ended December 31, 2018.

ACHAOGEN, INC.

ANNUAL REPORT ON FORM 10-K

TABLE OF CONTENTS

		Page
Part I.		
Item 1.	Business	3
Item 1A.	Risk Factors	29
Item 1B.	Unresolved Staff Comments	70
Item 2.	Properties	70
Item 3.	Legal Proceedings	71
Item 4.	Mine Safety Disclosures	71
Part II.		
Item 5.	Market for Registrant's Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities	72
Item 6.	Selected Financial Data	72
Item 7.	Management's Discussion and Analysis of Financial Condition and Results of Operations	73
Item 7A.	Quantitative and Qualitative Disclosures About Market Risk	90
Item 8.	Financial Statements and Supplementary Data	91
Item 9.	Changes in and Disagreements with Accountants on Accounting and Financial Disclosure	128
Item 9A.	Controls and Procedures	129
Item 9B.	Other Information	131
Part III.		
Item 10.	Directors, Executive Officers and Corporate Governance	132
Item 11.	Executive Compensation	132
Item 12.	Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters	132
Item 13.	Certain Relationships and Related Transactions, and Director Independence	132
Item 14.	Principal Accounting Fees and Services	132
Part IV.		
Item 15.	Exhibits, Financial Statement Schedules	133
Item 16.	Form 10-K Summary	137
	Signatures	138

Part I

Forward-Looking Statements

This Annual Report on Form 10-K, including “Business” in Part I, Item I and “Management's Discussion and Analysis of Financial Condition and Results of Operations” in Part II, Item 7, contains “forward-looking statements” within the meaning of Section 21E of the Securities Exchange Act of 1934, as amended (the “Exchange Act”). All statements other than statements of historical facts contained in this Annual Report on Form 10-K are statements that could be deemed forward-looking statements reflecting the current beliefs and expectations of management with respect to future events or to our future financial performance and involve known and unknown risks, uncertainties and other factors that may cause our actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by these forward-looking statements. These statements are often identified by the use of words such as “may,” “will,” “expect,” “believe,” “anticipate,” “intend,” “could,” “should,” “estimate,” or “continue expressions or variations. The risks and uncertainties referred to above include, without limitation, risks related to our research, development and commercialization efforts, need for future capital, uncertainty of clinical trial results or regulatory approvals or clearances, manufacturing of ZEMDRI at scales and costs appropriate for commercialization, enforcement of our patent and proprietary rights, potential competition and other risks that are described herein and that are otherwise described from time to time in our Securities and Exchange Commission (“SEC”) reports including, but not limited to, the factors described in Item 1A, “Risk Factors,” of this Annual Report. Given these risks and uncertainties, you should not place undue reliance on these forward-looking statements. Except as required by law, we assume no obligation to update or revise these forward-looking statements for any reason, even if new information becomes available in the future.

Item 1. Business.

Overview

We are a biopharmaceutical company passionately committed to developing and commercializing innovative antibacterial agents for multi-drug resistant (MDR) gram-negative infections. On June 25, 2018, the U.S. Food and Drug Administration (FDA) approved our first commercial product ZEMDRI® (plazomicin) for adults with complicated urinary tract infections (cUTI), including pyelonephritis, caused by certain Enterobacteriaceae in adult patients with limited or no alternative treatment options. ZEMDRI is an intravenous (IV) infusion, administered once daily over a 30-minute IV. The approval of ZEMDRI was supported by data from the EPIC (Evaluating Plazomicin in cUTI) clinical trial, which evaluated the safety and efficacy of plazomicin in patients with serious infections caused by gram-negative pathogens. ZEMDRI became commercially available in July 2018. In December 2018, we also filed a Formal Dispute Resolution Request with the FDA regarding a bloodstream infection (BSI) indication for plazomicin, for which the FDA issued a Complete Response Letter (CRL) in June 2018. We have global commercialization rights to ZEMDRI, which has patent protection in the United States estimated until 2031 or 2032. On October 17, 2018, we announced the submission of a Marketing Authorization Application (MAA) to the European Medicines Agency (EMA) for plazomicin. ZEMDRI was funded in part by a $124.4 million contract with the Biomedical Advanced Research and Development Authority (BARDA).

We are also currently developing C-Scape, which is in early-stage clinical development, as a product candidate, an orally administered antibiotic to address a serious unmet need for an effective oral treatment for patients with cUTI, including pyelonephritis, caused by extended spectrum beta-lactamases (ESBL)-producing Enterobacteriaceae. Our C-Scape program is also supported by BARDA.

ZEMDRI (plazomicin)

ZEMDRI is an aminoglycoside with once-daily dosing that has activity against certain Enterobacteriaceae, including carbapenem-resistant Enterobacteriaceae (CRE) and ESBL-producing Enterobacteriaceae. ZEMDRI was designed by our scientists to overcome the most common aminoglycoside resistance mechanisms, the aminoglycoside modifying enzymes (AMEs). We developed ZEMDRI by chemically modifying an existing aminoglycoside, sisomicin, a natural product isolated from bacteria, to shield the regions of the molecule that are targeted by the enzymes responsible for aminoglycoside resistance. As a result of these modifications, ZEMDRI has the potential to remain active against MDR organisms where most other major drug classes, including commercially available aminoglycosides, such as gentamicin and amikacin, have limited activity. Based on this profile, we

developed ZEMDRI as an IV therapy for the treatment of serious bacterial infections due to MDR Enterobacteriaceae.

We consider the following to be key attributes that support the clinical utility and ultimate commercial value of ZEMDRI:

- Met the objective of non-inferiority compared to meropenem in the Phase 3 EPIC trial in patients with cUTI and pyelonephritis for the FDA-specified primary efficacy endpoint, and achieved superiority for the EMA-specified primary efficacy endpoint. ZEMDRI was well tolerated with no new safety concerns identified in the EPIC trial.
- Convenient administration as once daily, 30-minute IV therapy.
- Potential to reduce the healthcare costs associated with the treatment of serious infections.
- Potential to improve dosing strategy compared to existing aminoglycosides and alternative therapeutic options, and individualized patient dosing using an in vitro assay.
- Potential to be used in combination with other antibiotics for the treatment of serious infections due to CRE.
- Potent in vitro activity against MDR Enterobacteriaceae, including ESBL-producers and CRE.

Based on these key attributes above, we believe that ZEMDRI has the potential to become a new standard of care for the treatment of multi-drug resistant recurrent cUTI infections and as an important part of the treatment algorithm for serious infections due to CRE.

The need for new antibiotics to treat ESBL-producing Enterobacteriaceae is high, as these bacteria have become widespread globally in both healthcare-associated and community-onset infections and the use of carbapenems to treat infections caused by these organisms is felt to be contributing to the rise in CRE. In 2013, the CDC indicated that ESBL-producing Enterobacteriaceae pose a serious concern to public health threat requiring “prompt and sustained action.” These bacteria are commonly MDR, exhibiting resistance not only to extended spectrum cephalosporins but also to fluoroquinolones, and currently-marketed aminoglycosides. In many cases, the remaining treatment option is a carbapenem and use of carbapenems to treat these infections is thought to be contributing to increased carbapenem resistance. We estimate that there are over one million cases of recurrent and/or multi-drug resistant hospital treated complicated urinary tract infections in the United States today.

The need for new antibiotics to treat CRE is particularly acute, as CRE are one of the top global threats in infectious disease. In 2013, the CDC labeled CRE as “nightmare bacteria” and indicated that CRE pose a public health threat requiring “urgent and aggressive action.” These bacteria are commonly MDR, exhibiting resistance not only to carbapenems, but also to most antibiotics commonly used to treat gram-negative infections, including cephalosporins, b-lactam/b-lactamase inhibitor combinations, fluoroquinolones, and currently-marketed aminoglycosides. We estimate that there were approximately 180,000 cases of CRE infections in the United States and the EU5 in 2016, of which 70,000 to 80,000 were in the United States. We believe that CRE incidence will continue to increase in the future.

Commercial Strategy for ZEMDRI

Given the lack of effective therapeutic options and the increasing rates of gram-negative infections such as CRE and those caused by ESBL-producing bacteria, we believe the commercial opportunity for ZEMDRI is significant. Our strategy is intended to support ZEMDRI’s differentiated profile from both approved and development-stage antibacterials. We expect ZEMDRI to be used in the recurrent and/or multi-drug resistant cUTI population, with a duration of treatment of four to seven days per the label. We estimate over one million patients suffer from these types of cUTI infections each year. Our commercialization of ZEMDRI is focused on this combined population and we are seeing the majority of our initial use in outpatient sites of care. Physicians are looking for additional treatment options for these patients as many have failed oral and/or IV antibiotics, with infections often recurring after treatment with IV carbapenems. We are using a small sales organization to promote ZEMDRI which is focused in key geographic outpatient opportunities and high-volume hospitals. In key markets

4

outside of the United States, including Europe, Asia, and Latin America, we currently believe we can expand the value of ZEMDRI through collaborating with one or more global or regional commercialization partners who have local market expertise.

Given ZEMDRI's product profile, it can be used across multiple treatment settings, which is important when treating cUTI patients. Although some patients need to remain in the hospital for the treatment of comorbidities, other patients are hospitalized solely because they are receiving multiple antibiotic infusions per day. ZEMDRI allows physicians and patients to start cUTI treatment in the hospital and then transition to an outpatient or homecare setting, which benefits both hospitals and patients from a cost-saving and quality of care perspective. In addition, some patients treated with ZEMDRI are avoiding hospitalization altogether.

In August 2018, we received the New Technology Add-on Payment (NTAP) designation from CMS. This designation provides up to 50% of our drug cost (approximately $2,700) in additional reimbursement to certain eligible hospitals for Medicare patients who receive ZEMDRI in the inpatient setting. In the outpatient setting, we are focused on educating office and reimbursement managers on billing and coding and building reimbursement confidence.

Phase 3 EPIC Trial of Plazomicin for the Treatment of cUTI (Supported FDA Approval)

In the EPIC trial, plazomicin successfully met or exceeded the objective of non-inferiority compared to meropenem for the FDA-specified primary efficacy endpoints, and achieved superiority for the primary efficacy endpoints specified by the EMA. Results for the FDA pre-specified composite endpoint of clinical cure and microbiological eradication in the microbiological modified intent-to-treat (mMITT) population at Day 5 achieved statistical non-inferiority, and Test-of-Cure (Day ~17) achieved statistical superiority. Results for EMA-specified endpoints of microbiological eradication at the test-of-cure visit achieved statistical superiority in both the mMITT and microbiologically evaluable (ME) populations.

Plazomicin was well tolerated with no new safety concerns identified in the EPIC trial. Treatment emergent adverse events (TEAEs) related to renal function were reported in 3.6% and 1.3% of patients in the plazomicin and meropenem groups, respectively. TEAEs related to cochlear or vestibular function were reported in a single patient in each of the plazomicin and meropenem treatment groups. Both events were considered mild and resolved completely.

Phase 3 CARE Trial of Plazomicin (Did Not Support FDA Approval)

The second study, our Phase 3 CARE (Combating Antibiotic Resistant Enterobacteriaceae) clinical trial, was a resistant pathogen trial designed to evaluate the efficacy and safety of plazomicin in patients with serious bacterial infections due to CRE. We closed enrollment in the CARE study in August 2016 with 69 patients, comprised of 39 patients enrolled in Cohort 1, comparing plazomicin to colistin-based therapy in patients with bloodstream infections or pneumonia due to CRE, and 30 patients in Cohort 2, a single arm cohort of plazomicin treatment in patients with serious infections due to CRE. In Cohort 1 of the CARE trial, a lower rate of mortality or serious disease-related complications was observed for plazomicin compared with colistin therapy.

The safety profile of plazomicin was favorable to that of colistin in critically ill patients in the CARE trial. Study drug-related TEAEs related to renal function were reported in 16.7% and 38.1% of patients in the plazomicin and colistin groups, respectively. No TEAEs related to cochlear or vestibular function were reported in either group. However, due to the clinical status of patients enrolled in the trial who were frequently ventilated and unconscious, planned assessments of hearing and tinnitus were not possible for many of the patients.

The FDA issued a CRL for the bloodstream infection (BSI) indication, supported by the CARE trial, in June 2018. In December 2018, we filed a Formal Dispute Resolution Request (FDRR) with the FDA regarding the BSI indication

for plazomicin. We believe that the data submitted in the NDA for plazomicin provides substantial evidence of efficacy in treating BSI and that plazomicin should be approved for the proposed BSI indication. The FDA denied our first-round FDRR and we are evaluating our current options, including requesting a further meeting with the reviewing division or further pursuing our appeal.

C-Scape Development Program

We are developing C-Scape, an orally administered antibiotic to address a serious unmet need for an effective oral treatment for patients with cUTI, including pyelonephritis, caused by ESBL-producing Enterobacteriaceae. C-Scape is a b-lactam/b-lactamase inhibitor combination comprised of ceftibuten, an approved third generation cephalosporin, and clavulanate, an approved b-lactamase inhibitor. The FDA awarded Qualified Infectious Disease Product (QIDP) status to C-Scape for the treatment of cUTI in 2017. QIDP status provides incentives for the development of new antibiotics, including priority review and an extension by an additional five years of any existing non-patent market exclusivity the product may be awarded upon approval. Our C-Scape program is funded in part by a contract with BARDA for up to $18.0 million, of which $12.0 million is committed.

We believe that C-Scape has the potential to rapidly address a serious unmet need for an effective oral treatment for patients with cUTI, including pyelonephritis, caused by ESBL-producing Enterobacteriaceae. Both ceftibuten and clavulanate have been previously approved by the FDA, therefore we expect C-Scape to qualify for the 505(b)(2) NDA regulatory pathway for the combination product, which would permit the application to rely in part on the FDA's findings of safety and effectiveness for each compound alone, and FDA's guidance for Antibacterial Therapies for Patients with Unmet Medical Need for the Treatment of Serious Bacterial Diseases.

On January 2, 2018, we announced positive Phase 1 top-line results for C-Scape. The Phase 1 top-line results demonstrated that, in healthy subjects, C-Scape was well tolerated across all doses studied, with no drug-drug interactions observed between the previously approved compounds when dosed in combination. We completed additional in vitro and in vivo experiments with an alternative formulation of the product candidate and, based on these results, believe this alternative formulation of the product candidate improves the likelihood of success for C-Scape for a subsequent Phase 1 clinical pharmacology study.

Strategic Review

On November 5, 2018, we announced the beginning of a review of strategic alternatives to maximize stockholder value, including but not limited to the potential sale or merger of us or our assets. The strategic review process continues alongside our continued focus on the commercialization of ZEMDRI and other corporate initiatives. We may be unable to identify strategic alternatives to maximize stockholder value, and even if executed, such strategic alternatives may not enhance stockholder value or our financial position.

Silicon Valley Bank Loan and Security Agreement

In December 2018, our secured lender Silicon Valley Bank (SVB) collateralized $25.0 million of the $50.0 million we previously borrowed under our loan and security agreement with SVB. Collateralization of this $25.0 million means that these funds are restricted and no longer available for our use until our cash on deposit at SVB exceeds the "Minimum Account Threshold" for thirty consecutive days, which is the greater of (a) $48.0 million and (b) the "Monthly Cash Burn," which is defined as the difference of (1)(i) net loss plus (ii) unfinanced capital expenditures minus (2)(i) depreciation and amortization expenses, (ii) non-cash stock compensation expense and (iii) other non-cash expenses as approved by SVB.

Antibacterials Background

Antibacterials, which, for small molecules, we refer to interchangeably as antibiotics, are drugs used to treat infections that are caused by bacteria. The introduction of antibiotics is recognized as one of the most transformative events in medicine. Prior to the introduction of the first antibiotics in the 1930s and 1940s, bacterial infections were often fatal, and invasive surgery was accompanied by a high risk of infectious complications. Today, antibacterials are used routinely to treat and prevent infection.

There are two main varieties of bacteria, based on a common laboratory staining test known as the “Gram stain.” Gram-positive bacteria are surrounded by a single lipid membrane and a thick cell wall. Common gram-positive pathogens include Staphylococcus aureus (including methicillin-resistant strains), Streptococcus species, and Clostridium difficile. In contrast, gram-negative bacteria are encircled by two lipid membranes, an inner membrane and an outer membrane, with a thinner cell wall in between. Gram-negative bacteria include Pseudomonas aeruginosa, Acinetobacter baumannii, and the Enterobacteriaceae, a family of related organisms that includes Escherichia coli, Klebsiella pneumoniae, Enterobacter, Salmonella, and Shigella species. Drugs that act in the cytoplasm of gram-negative bacteria must cross both the inner and outer membranes, whereas drugs that just act on gram-positive bacteria only have to cross one membrane. Each membrane in gram-negative bacteria excludes

different types of chemical entities, requiring antibiotics that act in the gram-negative cytoplasm to be specifically designed to permeate both membranes.

Antibiotics are classified according to several criteria:

- Spectrum: Antibiotics that are effective against a wide variety of bacteria, including both gram-negative and gram-positive organisms, are considered to be broad-spectrum, while those that act upon only a limited number of species are considered to be narrow-spectrum. Narrow-spectrum antibiotics are most often selected if a specific pathogen is suspected or confirmed.
- Cidality: Antibiotic action generally falls into two categories: bacteriostatic and bactericidal. Bacteriostatic antibiotics halt the growth of bacteria, relying on the immune system to clear the infection. Bactericidal antibiotics kill the bacterial pathogen directly and are preferred in life-threatening infections and when the patient's immune system is not functioning optimally.
- In vitro microbiological activity: This is the ability of the antibiotic to kill or inhibit growth of bacteria in vitro. In vitro experiments and assays do not take into account the complex interactions that occur in animals or humans, but are relatively easy to perform in the laboratory and usually constitute the extent of routine microbiological testing in hospital laboratories. Potency, which relates drug concentrations to activity, is commonly expressed as the minimum inhibitory concentration ("MIC") in μg/mL, which is the lowest concentration at which the drug inhibits growth of the bacteria. Antibiotics with lower MICs are considered to be more potent.
- Susceptibility/non-susceptibility: The relationship between microbiological activity and the clinical utility of an antibiotic to treat a given infection can be described in terms of susceptibility or non-susceptibility. A susceptible MIC value indicates a high probability that an antibiotic can be used to treat a particular infection. A non-susceptible MIC value from in vitro testing suggests the antibiotic is unlikely to be effective against the causative pathogen and thus should only be used under supervision of an infectious disease specialist. An intermediate MIC value suggests there is a slight chance the antibiotic will be effective against the causative pathogen. The MIC values defining susceptibility are established by FDA on approval of new antibiotics and medical standards organizations including the Clinical Laboratory and Standards Institute ("CLSI"), and the European Committee on Antimicrobial Susceptibility Testing ("EUCAST").
- Antimicrobial resistance: Resistance generally indicates the inability of an antibiotic to effectively treat an infection at usually administered doses. Some bacteria are naturally resistant to certain types of antibiotics. Resistance can also occur due to genetic mutations or acquisition of exogenous genetic material (e.g., plasmids). Mechanisms responsible for resistance to different antibiotics commonly travel together on mobile elements like plasmids which can transfer and spread between different bacteria, leading to multi-drug resistance.

New Antibiotics Are Needed for Resistant Gram-negative Infections

Antibiotic-resistant infections not only cause significant morbidity and mortality, but also place a substantial cost burden on the healthcare system. In most cases, antibiotic-resistant infections require prolonged and/or costlier treatments, extend hospital stays, and necessitate additional doctor visits and healthcare expenditures compared with infections that are easily treatable with antibiotics. The CDC estimates that the excess annual cost resulting from these infections in the United States is as high as $20 billion. According to an estimate from a 2012 study of over 5,500 U.S. patients, the average incremental per-patient hospital cost for antibiotic-resistant healthcare-associated infections, as compared to antibiotic-susceptible infections, was over $15,000.

According to government agencies and physician groups such as the CDC and the Infectious Disease Society of America, one of the greatest needs is for new antibiotics to treat infections caused by drug-resistant gram-negative pathogens, including ESBL-producing Enterobacteriaceae, CRE, Pseudomonas aeruginosa, and Acinetobacter baumannii. These pathogens are associated with significant morbidity and mortality, as growing antibiotic resistance has left limited effective treatment options.

7

Governments, in collaboration with the private sector, have begun to respond to this significant and growing unmet medical need by creating governmental and non-governmental entities tasked with addressing the problem and progressing legislation for reimbursement and regulatory reform, and economic incentives. In the United States, the federal government has developed a National Action Plan for Combating Antibiotic Resistant Bacteria, which outlines Federal activities over the five-year period from 2015 to 2020 designed (i) to enhance domestic and international capacity to prevent and contain outbreaks of antibiotic-resistant infections; (ii) to maintain the efficacy of current and new antibiotics; and (iii) to develop and deploy next-generation diagnostics, antibiotics, vaccines, and other therapeutics. The National Action Plan proposes to accelerate research and development for new antibiotics through a multifaceted approach that includes intensified support for antibiotic product development from the NIH, BARDA, and the DOD's Defense Threat Reduction Agency ("DTRA"). Accordingly, the 2019 U.S. federal budget request includes $1.27 billion for BARDA of which $192 million is to combat antimicrobial resistant bacteria (CARB), and $510 million is for Project BioShield (PBS) to support late stage development and procurement of medical countermeasures for national security threats. The federal government has also established the Presidential Advisory Council on Combating Antibiotic Resistant Bacteria, a federal advisory committee, which is designed to provide advice, information, and recommendations to the Secretary of Health and Human Services on programs and policies related to combating antibiotic-resistant bacteria.

On the legislative front, in July 2012, the Federal Drug and Administration Safety and Innovation Act ("FDASIA") was passed, which included the Generating Antibiotics Incentives Now Act (the "GAIN Act"). The GAIN Act provides incentives for the development of new QIDP, including potential for priority review and the potential for adding five years to the otherwise applicable regulatory exclusivity period. In December 2016, the 21st Century Cures Act (the "Cures Act") was passed by Congress and signed into law. This piece of legislation is intended to modernize the regulation of drugs and spur innovation in biomedical research.

Government Contracts and Non-Profit Grants

Biomedical Advanced Research and Development Authority ("BARDA")

Our program to develop ZEMDRI for the treatment of serious bacterial infections due to MDR Enterobacteriaceae, including CRE, as well as for disease caused by certain bacterial biothreat pathogens, was partially funded under a contract with BARDA ("BARDA-plazo Contract"), an agency of the U.S. Department of Health and Human Services. This contract was awarded in August 2010 and consists of a base amount as well as four options, all of which were exercised. The base amount and the four-exercised options totaled $124.4 million of funding, all of which has been recorded as revenues as of December 31, 2018.

Overall, the BARDA-plazo Contract called for the development, manufacturing, nonclinical and clinical evaluation of, and regulatory filings for, ZEMDRI as a countermeasure for diseases caused by antibiotic-resistant pathogens. These pathogens include bacteria associated with serious hospital-acquired infections, such as CRE, as well as biothreats, such as F. tularensis, which causes tularemia, and Y. pestis, which causes plague. As the prime contractor, we were responsible for all technical and regulatory activities under the research plan proposed by us and accepted by BARDA.

Our program to develop C-Scape, a product candidate to treat serious bacterial infections due to ESBL producing Enterobacteriaceae, is also partially funded under a contract with BARDA. In September 2017, we were awarded the C-Scape Contract ("BARDA C-Scape Contract") which includes a base period with obligated funding of $12.0 million and subsequent option periods that, if exercised, would bring the total value of the award to $18.0 million. Through December 31, 2018, we have recorded $5.2 million to revenue, with $6.8 million remaining available from the funding currently committed under the C-Scape Contract.

Payments under the BARDA-plazo and BARDA C-Scape Contracts, collectively ("the BARDA contracts,") have been made in installments as activities are conducted in accordance with the research plan. Payments to us are based on direct costs incurred and allowances for overhead, plus a fee, where applicable. From time to time, we may propose a change to the research plan to BARDA, and BARDA may or may not choose to accept the change to the research plan, along with any associated additional costs, subject to the availability of funding, as well as other factors. We are also obligated under the contract to satisfy various federal reporting requirements, including technical reporting with respect to our ZEMDRI and C-Scape development activities, reporting with respect to

intellectual property and financial reporting. In addition, technical documents and regulatory filings may be reviewed by BARDA prior to their finalization and/or submission.

Under standard government contracting terms, the government receives only limited rights for government use of certain of our pre-existing data and certain data produced with non-federal funding, to the extent such data are required for delivery to BARDA under the project. The U.S. government receives unlimited rights to use and disclose new data first produced under the project with BARDA funding. The U.S. government is entitled to a nonexclusive, worldwide, royalty-free license to practice or have practiced any patent on an invention that is conceived or first reduced to practice under the project, and may obtain additional rights if we do not elect to retain ownership of a subject invention or if we do not satisfy certain disclosure and patent prosecution obligations with respect to a subject invention. The government's rights do not include the composition of matter patents related to ZEMDRI or C-Scape, as these were developed and prosecuted prior to our entry into the BARDA contracts and without government funding. The BARDA contracts do not entitle the government to any sales royalties or other post-commercialization financial rights.

BARDA is entitled to terminate contracts for convenience at any time provided reasonable closeout costs are paid and is not obligated to provide funding beyond currently obligated amounts allotted from Congressionally appropriated funds.

Combating Antibiotic Resistant Bacteria Biopharmaceutical Accelerator ("CARB-X")

On April 26, 2018, we entered into a subaward agreement with CARB-X to support the development of a next-generation broad-spectrum aminoglycoside antibiotic capable of overcoming clinically-relevant resistance mechanisms and potentially treating highly-resistant gram-negative pathogens such as the Enterobacteriaceae family, Acinetobacter baumannii, and Pseudomonas aeruginosa. The initial subaward is up to $2.4 million, with the possibility of up to $9.6 million based on the discretion of CARB-X and the achievement of certain project milestones.

Payments under the CARB-X agreement are made in installments as activities are conducted in accordance with the research plan. Payments to us are based on direct costs incurred and allowances for overhead, plus a fee, where applicable. Through December 31, 2018, we have recorded $1.3 million to revenue, with $1.1 million remaining available from the funding currently committed under the CARB-X agreement.

Bill & Melinda Gates Foundation (the "Gates Foundation")

We entered into a research agreement with the Gates Foundation on May 4, 2017 to discover drug candidates against gram-negative bacterial pathogens intended to prevent neonatal sepsis in developing countries. Pursuant to the Grant Agreement, the Gates Foundation awarded us up to approximately $10.5 million in grant funding ("Grant Funds") over a three-year research term, of which approximately $3.2 million was received in May 2017 (the "Advanced Funds"). As of December 31, 2018, the entire Advanced Funds has been recorded as revenue. Payments under the Grant Agreement with the Gates Foundation are based on milestone, target or reporting deliverables. Payments are based on direct program costs incurred or committed plus an indirect overhead fee. If the Gates Foundation terminates the agreement based on the term in the Grant Agreement, we are obligated to return any unused or committed Grant Funds.

Concurrently with the Grant Agreement, we entered into a Common Stock Purchase Agreement (the "Gates Purchase Agreement") with the Gates Foundation, pursuant to which we sold 407,331 shares of our contingently redeemable common stock (the "Shares") on May 5, 2017 to the Gates Foundation in a private placement at a purchase price per share equal to $24.55, for gross proceeds of $10.0 million (the "Gates Investment").

In connection with the Grant Agreement and the Gates Investment, on May 4, 2017, we entered into a strategic relationship with the Gates Foundation (the “Letter Agreement”), pursuant to which we agreed to use the proceeds from the Gates Investment and Grant Funds only to, among other things, conduct mutually agreed upon work, including the discovery of monoclonal antibody candidates targeting Acinetobacter baumannii with the goal of discovering drug candidates that can be administered to neonates at birth to protect against early and late onset neonatal sepsis in developing countries. We are responsible for all technical and research development activities under a scope of work proposed by us and accepted by the Gates Foundation. In addition, we agreed to publish or make the product and information from the program available and accessible at an affordable price to people in need

within certain developing countries, and at the request of the Gates Foundation we will grant the Gates Foundation a non-exclusive license to commercialize selected drug candidates in certain developing countries, which may only be exercised in the event of certain defaults described in a letter agreement between the Gates Foundation and us (the "Global Access Commitments"). The Global Access Commitments will continue in effect until the earlier of 25 years from the closing of the Gates Investment or 7 years following the termination of all funding provided by the Gates Foundation, provided that the Global Access Commitments will continue for any products or services developed with funding provided by the Gates Foundation which continue to be developed or available in certain developing countries.

On December 27, 2018, we entered into a License Confirmation Agreement and a Redemption Agreement with the Gates Foundation (together, the "2018 Gates Agreements") in connection with the amendment of certain provisions of the Grant Agreement and the Letter Agreement. The 2018 Gates Agreements were entered into following the de-prioritization of antibody work by the Company, which was the focus of the Company's collaboration with the Gates Foundation. Among other things, the 2018 Gates Agreements (a) terminated the Company's obligations to conduct mutually agreed upon work, including work related to the Company's platform technology to develop and launch a product intended to prevent neonatal sepsis, (b) terminated the obligations of the Company to discover drug candidates intended to prevent neonatal sepsis and the obligation of the Gates Foundation to fund approximately $7.1 million in grants not yet received by the Company and (c) granted the Gates Foundation a non-exclusive license to intellectual property developed by the Company pursuant to the Grant Agreement and Letter Agreement in specified developing countries.

The Redemption Agreement also provided for the redemption by the Company of the 407,331 shares of the Company's common stock (the "Gates Shares") purchased by the Gates Foundation pursuant to a Common Stock Purchase Agreement between the Company and the Gates Foundation dated as of May 4, 2017 (the "Purchase Agreement") for an aggregate redemption price of $5.7 million. The Company paid for the redemption of the Gates Shares with the unused portion of the restricted cash received by the Company pursuant to the original purchase of the Gates Shares under the Purchase Agreement.

For more information regarding the government contracts referred to above see "Risk Factors--Risks Related to Our U.S. Government Contracts and to Certain Grant Agreements" and "Risk Factors--Risks Related to Intellectual Property." Provisions in our U.S. government contracts, including our contract with BARDA, and certain grant agreements, including our collaboration with the Gates Foundation, may affect our intellectual property rights. As is customary under many government-funded research grants and contracts with foundations, including our collaboration with the Gates Foundation, we may not have sole rights to certain intellectual property and, in specific situations, could share or lose the rights we do have.

Commercial Agreements

License Agreement with Ionis Pharmaceuticals, Inc. (formerly Isis Pharmaceuticals, Inc.)

On January 25, 2006, we entered into a license agreement with Ionis Pharmaceuticals, Inc. ("Ionis"), pursuant to which Ionis granted us an exclusive license under certain patents relating to aminoglycoside antibacterial compounds and related know-how to develop and commercialize certain novel aminoglycoside antibacterial compounds. We are required to use commercially reasonable efforts to develop and commercialize certain compounds under the agreement. In consideration for the rights granted to us by Ionis under the license agreement, we issued $1.5 million of our Series A convertible preferred stock to Ionis in 2006. In addition, we are required to make payments to Ionis upon the achievement of specified development and regulatory milestones totaling up to $19.5 million for the first aminoglycoside product developed under certain terms of the agreement. We paid $4.0 million to Ionis in the fourth quarter of 2014 following dosing the first patient in our Phase 3 CARE trial of ZEMDRI, $7.5 million in the third

quarter of 2018 upon FDA approval of ZEMDRI, and could owe up to $9.75 million for a second aminoglycoside product, if any, developed under this agreement. The agreement requires us to pay Ionis a low double-digit share of non-royalty sublicensing revenues that we receive from certain sublicensees for the grant of sublicenses under our agreement with Ionis, provided that the maximum amount we are required to pay Ionis with respect to the sum of all development and regulatory milestones and non-royalty sublicensing revenue payment obligations for ZEMDRI, but only to the extent it qualifies as the first aminoglycoside product under the agreement, is $19.5 million. Likewise, our cumulative development and regulatory milestone payment and non-royalty sublicensing revenues payment obligations for a possible second aminoglycoside product under the

agreement with Ionis will not exceed $9.75 million. To date, we have made development milestone payments of $14.5 million to Ionis with respect to ZEMDRI, $14.0 million of which was paid in cash and $0.5 million of which was paid in the form of our Series B convertible preferred stock. We are also required to pay additional milestone payments of up to $20.0 million in the aggregate upon the first achievement of specified threshold levels of annual net sales of certain aminoglycoside products in a calendar year. The license agreement also provides that the Company shall pay royalties equal to a low single-digit percentage of annual worldwide net sales of all licensed products, including, if applicable, ZEMDRI.

Our license agreement with Ionis will continue for as long as we are obligated to pay royalties to them, which will be on a product-by-product basis until the later of (a) ten years from the date of first commercial sale of an aminoglycoside product covered by the agreement in the United States, Japan or Europe; and (b) the abandonment, revocation, invalidation or expiration of the last valid claim of a patent covered under the agreement which covers such product, not to exceed twenty years after the first commercial sale in the United States, Japan or Europe. Either party may terminate the agreement for the uncured material breach of the other party, and Ionis may terminate the agreement if we fail to make timely payments, subject to a specified cure period. We may also terminate the agreement or the license with respect to a particular product without cause upon 60 days' notice.

Thermo Fisher Collaborative Development and Commercialization Agreement

In April 2016, we entered into a collaborative development and commercialization agreement (the "Assay Agreement") with Microgenics Corporation ("Thermo Fisher"), a wholly owned subsidiary of Thermo Fisher Scientific Inc. Under the Assay Agreement, Thermo Fisher is commercializing an in vitro assay to measure levels of plazomicin in serum and plasma to guide and monitor dosing regimens so that exposures fall within the desired range. In November 2018, Thermo Fisher received FDA clearance for its do novo submission of the Thermo Scientific QMS Plazomicin Immunoassay. The assay developed under the Assay Agreement provides TDM to certain patients receiving plazomicin. Thermo Fisher is responsible for the research, development, manufacture and sale of the assay. Depending on the commercialization strategy for the assay, we are required to pay Thermo Fisher up to an aggregate amount of approximately $7.0 million in milestone payments for the achievement of certain development, manufacturing and regulatory milestones. To date, we have incurred $4.3 million in such milestone payments, recorded as research and development expense. Intellectual property rights relating solely to the assay developed under the Assay Agreement are owned by Thermo Fisher and intellectual property rights relating solely to plazomicin are owned by us. In addition, each party retains ownership of certain background intellectual property and improvements thereto.

Under the Assay Agreement, Thermo Fisher also has the worldwide exclusive rights to manufacture this assay during the period in which we continue to develop and commercialize plazomicin (unless the Assay Agreement is earlier terminated). Thermo Fisher also has the exclusive right to commercialize this assay under the Thermo Scientific name in each country in the territory in which we are commercializing plazomicin, for as long as we are commercializing plazomicin in such country. We are required to prioritize the promotion of the assay developed under the Assay Agreement relative to the promotion of any other assay capable of measuring plazomicin in certain countries, including the United States, Japan and Europe, so long as Thermo Fisher is capable of providing sufficient supply of the assay. The Assay Agreement further requires us to make certain annual payments to Thermo Fisher if commercialization targets are not met during certain periods following commercialization. If Thermo Fisher abandons its commercialization of the assay, Thermo Fisher is required to negotiate an agreement for the continued supply of the assay to us or our distributor.

The term of the Assay Agreement continues until we cease development and commercialization of plazomicin. Either we or Thermo Fisher may terminate the Assay Agreement for the other party's uncured material breach or bankruptcy (or similar event), and we may terminate without cause upon sixty days' written notice to Thermo Fisher. If we

terminate the Assay Agreement without cause or Thermo Fisher terminates the Assay Agreement for cause prior to the payment of all milestone payments, we must pay to Thermo Fisher a sum equal to the amount that would have been due if the next applicable milestone had been achieved, provided that no payment will be due if we terminate the agreement at will in connection with the failure to obtain or maintain regulatory approval for ZEMDRI. If, within two years following the termination of the Assay Agreement by us at will or by Thermo Fisher for cause, we decide to develop and commercialize ZEMDRI, subject to certain conditions and limitations, we and Thermo Fisher are required to use good faith efforts to negotiate an agreement for the continued development, manufacture, supply and sale of the assay by Thermo Fisher on commercially reasonable terms, but

we would have no duty to enter into any new agreement with Thermo Fisher and we would not be prohibited from negotiating or entering into an agreement with a third party for the development, manufacture, supply or sale of any assay.

Competition

The pharmaceutical industry is very competitive and subject to rapid and significant innovation. Our potential competitors include major multinational pharmaceutical companies, established biotechnology companies, specialty pharmaceutical and generic drug companies, universities, and other research institutions. Many of our competitors have greater financial resources, as well as larger research and development staff and more experienced marketing and manufacturing organizations. As a result, these companies may obtain regulatory approval more rapidly than we are able to and may be more effective in selling and marketing their products. Smaller or early-stage companies may also prove to be significant competitors, particularly through collaborative arrangements with large, established companies. Our competitors may succeed in developing, acquiring or licensing technologies and drug products that are superior to, or more effectively marketed than, ZEMDRI or any other drug candidate that we are currently developing or that we may develop, which could render our products obsolete and noncompetitive.

The competition in the antibiotics market is intense. Our clinical development program supports ZEMDRI's differentiated profile from both approved and development-stage antibacterials by focusing on the treatment of serious bacterial infections due to MDR Enterobacteriaceae in patients with limited or no alternative treatment options, including patients with cUTI or AP. ZEMDRI will face competition from commercially available antibiotics such as Avycaz™ (ceftazidime-avibactam), which is marketed in the United States by Allergan plc and marketed by Pfizer outside the United States, Vabomere™ (meropenem/vaborbactam), which is marketed by Melinta Therapeutics, Zerbaxa™ (ceftolozane/tazobactam) which is marketed by Merck, meropenem marketed by Pfizer as Merrem®, ertapenem which is marketed by Merck at Envanz™, Xerava™ (eravacycline), which is marketed by Tetraphase Pharmaceuticals, Inc., other aminoglycosides that are generically available (such as gentamicin, amikacin, tobramycin), and polymixins that are generically available (colistin and polymixin B).

There are also a number of products in late-stage clinical development by third parties to treat MDR gram-negative infections. Merck & Co., Inc. is developing imipenem/relebactam for certain life-threatening infections caused by MDR strains, including infections due to metallo-beta-lactamase producing gram-negative pathogens. Nabriva Therapeutics plc is developing Contepo™ (intravenous fosfomycin) for cUTI. Shionogi is developing cefiderocol for carbapenem-resistant gram-negative pathogens. Allergan plc and Pfizer Inc. are developing aztreonam/avibactam for infections caused by MDR strains. Iterum is developing sulopenem for uUTI and cUTI and Spero Therapeutics is developing tebipenem for cUTI. We may also eventually face competition from products in earlier development stage. If our competitors obtain marketing approval from the FDA or comparable foreign regulatory authorities for their product candidates more rapidly than us, it could result in our competitors establishing a strong market position before we are able to enter the market.

We believe that ZEMDRI would compete effectively against both marketed and known pipeline competitors based on the following:

- Potent in vitro and in vivo activity in nonclinical studies against MDR Enterobacteriaceae, including CRE;
- Activity in the presence of a range of resistance mechanisms, including most aminoglycoside modifying enzymes, fluoroquinolone target site mutations, extended-spectrum -lactamases, and carbapenemases;
- Demonstration of similar efficacy to levofloxacin and acceptable safety in a Phase 2 clinical trial in patients with cUTI infections caused primarily by non-resistant Enterobacteriaceae;
- Demonstration of non-inferiority to meropenem at day 5 and statistically favorable outcomes compared to meropenem at day 17 in patients with cUTI/AP infections due to Enterobacteriaceae, including fluoroquinolone

resistant and ESBL-producing isolates;

- Improved efficacy, overall mortality and safety of ZEMDRI versus colistin in patients with serious bacterial infections due to CRE, based on results observed in the CARE study;

12

- Potential to individualize patient dosing using an in vitro drug-monitoring assay to optimize efficacy and safety of ZEMDRI therapy in BSI or pneumonia;
- Potential for more convenient administration as a once-daily, 30-minute IV therapy compared to other IV antibiotics administered multiple times per day with infusion times up to two hours; and
- Potential to reduce the healthcare costs associated with the treatment of such infections.

If we are unable to demonstrate these or other advantages of ZEMDRI over competing drugs and drug candidates or have sufficient funds or infrastructure to effectively invest in commercialization, we may not be able to successfully commercialize ZEMDRI and our results of operations may suffer. Established pharmaceutical companies may also invest heavily to accelerate discovery and development of novel compounds or to in-license novel compounds that could make ZEMDRI or any other product candidates that we develop obsolete. As a result of all of these factors, our competitors may succeed in obtaining patent protection and/or regulatory approval or discovering, developing and commercializing antibiotics before we do.

Intellectual Property

The proprietary nature of, and protection for, our product candidates and our discovery programs, processes and know-how are important to our business. We have sought patent protection in the United States and certain other jurisdictions for plazomicin, C-Scape, and certain other inventions to which we have rights, where available and when appropriate. Our policy is to pursue, maintain and defend patent rights, whether developed internally or licensed from third parties, and to protect the technology, inventions and improvements that are commercially important to the development of our business. We also rely on trade secrets relating to our proprietary technology platform that may be important to the development of our business.

Our commercial success will depend in part on obtaining and maintaining patent protection and trade secret protection for our current and future product candidates and the methods used to develop and manufacture them, as well as successfully defending these patents against third-party challenges. Patents, issued or applied for, can cover inventions ranging from research compounds and techniques to processes related to specific products to the products themselves. Our issued patents extend for varying periods according to the date of patent application filing or grant and the legal term of patents in the various countries where patent protection is obtained. The actual protection afforded by a patent, which can vary from country to country, depends upon the type of patent, the scope of its coverage as determined by the patent office or courts in the country, and the availability of legal remedies in the country. We have applications or patents on platform technologies and methods of using our products (in either case, that may relate to classes of products or methods), that may confer additional patent protection but are not necessarily a protection against competition.

Our ability to stop third parties from making, using, selling, offering to sell, or importing our products depends in part on the extent to which we have rights under valid and enforceable patents or trade secrets that cover our activities. We cannot be sure that patents will be granted with respect to any of our pending patent applications or with respect to any patent applications filed by us in the future, nor can we be sure that any of our existing patents or any patents that may be granted to us in the future will be commercially useful in protecting our product candidates, discovery programs and processes. For this and more comprehensive risks related to our intellectual property, see “Risk Factors—Risks Related to Intellectual Property.”

We consider that in the aggregate our patent applications, patents and licenses under patents owned by third parties are of material importance to our operations. For our lead product candidate, plazomicin, we have identified in the following paragraph the patents that are owned or controlled by us having claims directed to product-specific compositions of matter. This paragraph does not identify all patents or applications that may relate to plazomicin but are not material. We also have pending patent applications or applications we continue to file that may give rise to new patents relating to plazomicin. We do not consider any of our additional patents or patent applications are

material at this time and it is unclear what, if any, patent protection we will have for the ultimate products we choose to move forward through development.

Plazomicin (ZEMDRI)

The patent portfolio for plazomicin is based upon an Achaogen-owned patent family that includes patents and patent applications directed to plazomicin and structural analogs thereof, pharmaceutical compositions containing plazomicin or analogs thereof, and methods of using plazomicin or analogs thereof in the treatment of bacterial infections. As of January 31, 2019, this patent family included four U.S. patents (U.S. Patent No. 8,383,596, issued February 26, 2013; U.S. Patent No. 8,822,424, issued September 2, 2014; U.S. Patent No 9,266,919, issued February 23, 2016; and, U.S. Patent No. 9,688,711, issued June 27, 2017 which we refer to herein as the ‘596, ‘424, ‘919 and ‘711 patents, respectively), and corresponding foreign patents and patent applications. As of January 31, 2019, we had corresponding granted patent or patents in Australia, Brazil, Canada, China, Eurasia (with country-specific validations), Europe (with country-specific validations), Hong Kong (via Europe), India, Israel, Japan, Korea, Mexico and Taiwan. In addition, as of January 31, 2019, we had corresponding patent applications pending in Brazil, Europe, and the US. We expect any U.S. and foreign patents in this patent family to expire in November 2028, excluding any available extensions or adjustments. Note, the U.S. Patent and Trademark Office (“USPTO”) has determined that the ‘596 patent is entitled to 923 days of patent term adjustment.

ZEMDRI (plazomicin) achieved U.S. regulatory approval in June 2018, therefore the term of a US patent could be extended up to the lesser of (i) up to five additional years or (ii) no more than fourteen years from plazomicin’s approval date, under the provisions of the Drug Price Competition and Patent Term Restoration Act of 1984, also referred to as the Hatch-Waxman Act. Applications for Patent Term Extension have been filed with the USPTO for the ‘596 and ‘424 patents. Plazomicin could also qualify for pediatric exclusivity, which can be obtained during the approval process or after approval, and effectively delays the approval of a generic application until six months after the expiration of any patent or other exclusivity that would otherwise delay approval, thus providing an additional six months without generic competition. In order to qualify for pediatric exclusivity, the FDA must make a written request for pediatric studies, the application holder must agree to the request and complete the studies within the required timeframe, and the studies must be accepted by the FDA based on a determination that the studies fairly respond to the request.

Patent term extension and supplementary protection certificates also may be available in certain foreign countries upon regulatory approval. Additional intellectual property, including patent protection, may protect plazomicin in areas including but not limited to method of use, manufacturing, and platform technologies.

Additional Patent Positions

Our C-Scape program was created at Achaogen and we are pursuing intellectual property relating to this program. C-Scape was granted QIDP designation by the FDA which provides incentives for the development of new antibiotics, including priority review and extension by an additional five years of any non-patent market exclusivity the product may be awarded upon approval. Currently, C-Scape is not covered by any issued patents but we are pursuing patent positions in connection with various aspects of our program.

Trade Secrets

In addition to patents, we rely on trade secrets and know-how to develop and maintain our competitive position. We seek to protect our proprietary data and processes, in part, by confidentiality agreements and invention assignment agreements with our employees, consultants, scientific advisors, contractors, and partners. These agreements are designed to protect our proprietary information. We also seek to preserve the integrity and confidentiality of our data, trade secrets and know-how by maintaining physical security of our premises and physical and electronic security of our information technology systems. Trade secrets and know-how can be difficult to protect. Consequently, we anticipate that trade secrets and know-how will, over time, be disseminated within the industry through independent development, the publication of journal articles, and the movement of personnel skilled in the art from academic to industry scientific positions.

Government Regulation and Product Approval

Government authorities in the United States, at the federal, state and local level, and in other countries extensively regulate, among other things, the research, development, testing, manufacture, including any manufacturing changes, packaging, storage, recordkeeping, labeling, advertising, promotion, distribution, marketing, import and export of pharmaceutical products such as those we are developing. The processes for obtaining regulatory approvals in the United States and in foreign countries, along with subsequent compliance with

appropriate federal, state, local and foreign statutes and regulations, require the expenditure of substantial time and financial resources.

U.S. Government Regulation

In the United States, the FDA regulates drugs under the Federal Food, Drug, and Cosmetic Act ("FDCA"), and its implementing regulations. The process of obtaining regulatory approvals and the subsequent compliance with appropriate federal, state, local and foreign statutes and regulations requires the expenditure of substantial time and financial resources. Failure to comply with the applicable U.S. requirements at any time during the product development process, approval process or after approval, may subject an applicant to a variety of administrative or judicial sanctions, such as the FDA's refusal to approve pending NDAs, withdrawal of an approval, imposition of a clinical hold, issuance of warning letters, product recalls, product seizures, total or partial suspension of production or distribution, injunctions, fines, refusals of government contracts, restitution, disgorgement or civil or criminal penalties.

The process required by the FDA before a drug may be marketed in the United States generally involves the following:

- completion of preclinical laboratory tests, animal studies and formulation studies in compliance with the FDA's good laboratory practice regulations;
- submission to the FDA of an IND which must become effective before human clinical trials may begin;
- approval by an independent institutional review board ("IRB"), at each clinical site before each trial may be initiated;
- performance of adequate and well-controlled human clinical trials in accordance with good clinical practice ("GCP"), requirements to establish the safety and efficacy of the proposed drug product for each indication;
- submission to the FDA of an NDA;
- satisfactory completion of an FDA advisory committee review, if applicable;
- satisfactory completion of an FDA inspection of the manufacturing facility or facilities at which the product is produced to assess compliance with current good manufacturing practice ("cGMP") requirements and to assure that the facilities, methods and controls are adequate to preserve the drug's identity, strength, quality and purity;
- satisfactory completion of preapproval audits of selected clinical sites, clinical trial vendors and sponsor facilities to ensure that the clinical trials upon which the approval will be based have been conducted in accordance with GCP and consistent with regulations for the protection of human subject rights described in 21 C.F.R. 50; and
- FDA review and approval of the NDA.

Preclinical Studies

Preclinical studies include laboratory evaluation of product chemistry, toxicity and formulation, as well as animal studies to assess potential safety and efficacy. An IND sponsor must submit the results of the preclinical tests, together with manufacturing information, analytical data and any available clinical data or literature, among other things, to the FDA as part of an IND. Some preclinical testing may continue even after the IND is submitted. An IND automatically becomes effective 30 days after receipt by the FDA, unless before that time the FDA raises concerns or questions related to one or more proposed clinical trials and places the clinical trial on a clinical hold. In such a case, the IND sponsor and the FDA must resolve any outstanding concerns before the clinical trial can begin. As a result, submission of an IND may not result in the FDA allowing clinical trials to commence. In 2008, we submitted our first IND to the FDA for ZEMDRI.

Clinical Trials

Clinical trials involve the administration of the investigational new drug to human subjects under the supervision of qualified investigators in accordance with GCP requirements, which include the requirement that all research subjects provide their informed consent in writing for their participation in any clinical trial. Clinical trials are conducted under protocols detailing, among other things, the objectives of the trial, the parameters to be used in monitoring safety, and the effectiveness criteria to be evaluated. A protocol for each clinical trial and any subsequent protocol amendments must be submitted to the FDA as part of the IND. In addition, an IRB at each institution participating in the clinical trial must review and approve the plan for any clinical trial before it commences at that institution. Information about certain clinical trials must be submitted within specific timeframes to NIH, for public dissemination on their www.clinicaltrials.gov website.

Human clinical trials are typically conducted in three sequential phases, which may overlap or be combined. Favorable results in a trial do not necessarily predict the results of subsequent trials:

- Phase 1: The drug is initially introduced into healthy human subjects or patients with the target disease or condition and tested for safety, dosage tolerance, absorption, metabolism, distribution, excretion and, if possible, to gain an early indication of its effectiveness.
- Phase 2: The drug is administered to a limited patient population to identify possible adverse effects and safety risks, to preliminarily evaluate the efficacy of the product for specific targeted diseases and to determine dosage tolerance and optimal dosage.
- Phase 3: The drug is administered to an expanded patient population, generally at geographically dispersed clinical trial sites, in well-controlled clinical trials to generate enough data to statistically evaluate the efficacy and safety of the product for approval, to establish the overall risk-benefit profile of the product, and to provide adequate information for the labeling of the product.

Progress reports detailing the results of the clinical trials must be submitted at least annually to the FDA and more frequently if serious adverse events occur. Phase 1, Phase 2 and Phase 3 clinical trials may not be completed successfully within any specified period, or at all. Furthermore, the FDA or the sponsor may suspend or terminate a clinical trial at any time on various grounds, including a finding that the research subjects are being exposed to an unacceptable health risk. Similarly, an IRB can suspend or terminate approval of a clinical trial at its institution if the clinical trial is not being conducted in accordance with the IRB's requirements or if the drug has been associated with unexpected serious harm to patients.

Marketing Approval

Assuming successful completion of the required clinical testing, the results of the preclinical and clinical studies, together with detailed information relating to the product's chemistry, manufacture, controls and proposed labeling, among other things, are submitted to the FDA as part of an NDA requesting approval to market the product for one or more indications. In most cases, the submission of an NDA is subject to a substantial application user fee. Under PDUFA guidelines that are currently in effect, the FDA has a goal of ten months from the date of "filing" of a standard NDA for a new molecular entity to review and act on the submission. This review typically takes twelve months from the date the NDA is submitted to FDA because the FDA has approximately two months to make a "filing" decision.

In addition, under the Pediatric Research Equity Act of 2003, as amended and reauthorized, certain NDAs or supplements to an NDA must contain data that are adequate 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 product is safe and effective. The FDA may, on its own initiative or at the request of the applicant, grant deferrals for submission of some or all pediatric data until after approval of the product for use in adults, or full or partial waivers from the pediatric data requirements.

The FDA also may require submission of a risk evaluation and mitigation strategy ("REMS") plan to ensure that the benefits of the drug outweigh its risks. The REMS plan could include medication guides, physician communication plans, assessment plans, and/or elements to assure safe use, such as restricted distribution methods, patient registries, or other risk minimization tools.

The FDA conducts a preliminary review of all NDAs within the first 60 days after submission, before accepting them for filing, to determine whether they are sufficiently complete to permit substantive review. The FDA may request additional information rather than accept an NDA for filing. In this event, the application must be resubmitted with the additional information. The resubmitted application is also subject to review before the FDA accepts it for filing. Once the submission is accepted for filing, the FDA begins an in-depth substantive review. The FDA reviews an NDA to determine, among other things, whether the drug is safe and effective and whether the facility in which it is manufactured, processed, packaged or held meets standards designed to assure the product's continued safety, quality and purity.

The FDA may refer an application for a novel drug to an advisory committee. An advisory committee is a panel of independent experts, including clinicians and other scientific experts, that reviews, evaluates and provides a recommendation as to whether the application should be approved and under what conditions. The FDA is not bound by the recommendations of an advisory committee, but it considers such recommendations carefully when making decisions.

Before approving an NDA, the FDA typically will inspect the facility or facilities where the product is manufactured. The FDA will not approve an application unless it determines that the manufacturing processes and facilities are in compliance with cGMP requirements and adequate to assure consistent production of the product within required specifications. Additionally, before approving an NDA, the FDA may inspect one or more clinical trial sites to assure compliance with GCP requirements.

The FDA generally accepts data from foreign clinical trials in support of an NDA if the trials were conducted under an IND. If a foreign clinical trial is not conducted under an IND, the FDA nevertheless may accept the data in support of an NDA if the study was conducted in accordance with GCP requirements and the FDA is able to validate the data through an on-site inspection, if deemed necessary. Although the FDA generally requests that marketing applications be supported by some data from domestic clinical studies, the FDA may accept foreign data as the sole basis for marketing approval if (1) the foreign data are applicable to the U.S. population and U.S. medical practice, (2) the studies were performed by clinical investigators with recognized competence, and (3) the data may be considered valid without the need for an on-site inspection or, if the FDA considers the inspection to be necessary, the FDA is able to validate the data through an on-site inspection or other appropriate means.

The testing and approval process for an NDA requires substantial time, effort and financial resources, and each may take several years to complete. Data obtained from preclinical and clinical testing are not always conclusive and may be susceptible to varying interpretations, which could delay, limit or prevent regulatory approval. The FDA may not grant approval on a timely basis, or at all.

After evaluating the NDA and all related information, including the advisory committee recommendation, if any, and inspection reports regarding the manufacturing facilities and clinical trial sites, the FDA may issue an approval letter, or, in some cases, a complete response letter. A complete response letter generally contains a statement of specific conditions that must be met in order to secure final approval of the NDA and may require additional clinical or preclinical testing in order for FDA to reconsider the application. Even with submission of this additional information, the FDA ultimately may decide that the application does not satisfy the regulatory criteria for approval. If and when those conditions have been met to the FDA's satisfaction, the FDA will typically issue an approval letter. An approval letter authorizes commercial marketing of the drug with specific prescribing information for specific indications.

Even if the FDA approves a product, it may limit the approved indications for use of the product, require that contraindications, warnings or precautions be included in the product labeling, require that post-approval studies, including Phase 4 clinical trials, be conducted to further assess a drug's safety after approval, require testing and surveillance programs to monitor the product after commercialization, or impose other conditions, including

distribution and use restrictions or other risk management mechanisms under a REMS, which can materially affect the potential market and profitability of the product. The FDA may prevent or limit further marketing of a product based on the results of post-marketing studies or surveillance programs. After approval, some types of changes to the approved product, such as adding new indications, manufacturing changes, and additional labeling claims, are subject to further testing requirements and FDA review and approval.

Special FDA Expedited Review and Approval Programs

The FDA has various programs, including fast-track designation, accelerated approval, priority review, and breakthrough therapy designation that are intended to expedite or simplify the process for the development and FDA review of drugs that are intended for the treatment of serious or life-threatening diseases or conditions and demonstrate the potential to address unmet medical needs. The purpose of these programs is to provide important new drugs to patients earlier than under standard FDA review procedures.

To be eligible for a fast-track designation, the FDA must determine, based on the request of a sponsor, that a product is intended to treat a serious or life-threatening disease or condition and demonstrates the potential to address an unmet medical need, or if the drug qualifies as a QIDP under the GAIN Act. The FDA will determine that a product will fill an unmet medical need if it will provide a therapy where none exists or provide a therapy that may be potentially superior to existing therapy based on efficacy or safety factors. The FDA may review sections of the NDA for a fast-track product on a rolling basis before the complete application is submitted, if the sponsor provides a schedule for the submission of the sections of the NDA, the FDA agrees to accept sections of the NDA and determines that the schedule is acceptable, and the sponsor pays any required user fees upon submission of the first section of the NDA.

The FDA may give a priority review designation to drugs that offer major advances in treatment, or provide a treatment where no adequate therapy exists, or that the drug qualifies as a QIDP under the GAIN Act. A priority review means that the goal for the FDA to review an application is six months, rather than the standard review of ten months under current PDUFA guidelines. Under the new PDUFA agreement, these six and 10-month review periods are measured from the “filing” date rather than the receipt date for NDAs for new molecular entities, which typically adds approximately two months to the timeline for review and decision from the date of submission. Most products that are eligible for fast-track designation are also likely to be considered appropriate to receive a priority review.

In addition, products studied for their safety and effectiveness in treating serious or life-threatening illnesses and that provide meaningful therapeutic benefit over existing treatments may be eligible for accelerated approval and may be approved on the basis of adequate and well-controlled clinical trials establishing that the drug product has an effect on a surrogate endpoint that is reasonably likely to predict clinical benefit, or on a clinical endpoint that can be measured earlier than irreversible morbidity or mortality, that is reasonably likely to predict an effect on irreversible morbidity or mortality or other clinical benefit, taking into account the severity, rarity or prevalence of the condition and the availability or lack of alternative treatments. As a condition of approval, the FDA may require a sponsor of a drug receiving accelerated approval to perform post-marketing studies to verify and describe the predicted effect on irreversible morbidity or mortality or other clinical endpoint, and the drug may be subject to accelerated withdrawal procedures.

Moreover, under the provisions of the FDASIA, passed in July 2012, a sponsor can request breakthrough therapy designation (“BTD”) for a product candidate. BTD can be granted for a product candidate that is intended, alone or in combination with one or more other drugs, to treat a serious or life-threatening disease or condition, and preliminary clinical evidence indicates that the product candidate may demonstrate substantial improvement over existing therapies on one or more clinically significant endpoints, such as substantial treatment effects observed early in clinical development. Product candidates designated as breakthrough therapies are also eligible for the other expedited review and approval programs, including accelerated approval, priority review, and fast-track designation. The FDA must take certain actions, such as holding timely meetings and providing advice, intended to expedite the development and review of an application for approval of a breakthrough therapy.

Even if a product qualifies for one or more of these programs, the FDA may later decide that the product no longer meets the conditions for qualification or decide that the time period for FDA review or approval will not be shortened. Moreover, qualification for one or more of these programs does not ensure that approval will ultimately be granted.

We received fast-track designation from the FDA for plazomicin in August 2012. We received BTD from the FDA for plazomicin in May 2017.

Post-Approval Requirements

Drugs manufactured or distributed pursuant to FDA approvals are subject to pervasive and continuing regulation by the FDA, including, among other things, requirements relating to recordkeeping, periodic reporting, product sampling and distribution, advertising and promotion and reporting of adverse experiences with the product.

After approval, most changes to the approved product, such as adding new indications or other labeling claims, are subject to prior FDA review and approval. There also are continuing, annual user fee requirements for any marketed products.

The FDA may impose a number of post-approval requirements as a condition of approval of an NDA. For example, the FDA may require post-marketing testing, including Phase 4 clinical trials, and surveillance to further assess and monitor the product's safety and effectiveness after commercialization.

In addition, drug manufacturers and other entities involved in the manufacture and distribution of approved drugs are required to register their establishments with the FDA and state agencies, and are subject to periodic unannounced inspections by the FDA and these state agencies for compliance with cGMP requirements. Changes to the manufacturing process are strictly regulated and often require prior FDA approval before being implemented. FDA regulations also require investigation and correction of any deviations from cGMP requirements and impose reporting and documentation requirements upon the sponsor and any third-party manufacturers that the sponsor may decide to use. Accordingly, manufacturers must continue to expend time, money, and effort in the area of production and quality control to maintain cGMP compliance.

Once an approval is granted, the FDA may withdraw the approval if compliance with regulatory requirements and standards is not maintained or if problems occur after the product reaches the market.

Later discovery of previously unknown problems with a product, including adverse events of unanticipated severity or frequency, or with manufacturing processes, or failure to comply with regulatory requirements, may result in mandatory revisions to the approved labeling to add new safety information; imposition of post-market studies or clinical trials to assess new safety risks; or imposition of distribution or other restrictions under a REMS program. Other potential consequences include, among other things:

- restrictions on the marketing or manufacturing of the product, complete withdrawal of the product from the market or product recalls;
- fines, warning letters or holds on post-approval clinical trials;
- refusal of the FDA to approve pending NDAs or supplements to approved NDAs, or suspension or revocation of product license approvals;
- product seizure or detention, or refusal to permit the import or export of products; or
- injunctions or the imposition of civil or criminal penalties.

The FDA strictly regulates marketing, labeling, advertising and promotion of products that are placed on the market. Drugs may be promoted only for the approved indications and in accordance with the provisions of the approved label. The FDA and other agencies actively enforce the laws and regulations prohibiting the promotion of off-label uses, and a company that is found to have improperly promoted off-label uses may be subject to significant liability.

In addition, Title II of the Federal Drug Quality and Security Act of 2013, known as the Drug Supply Chain Security Act ("DSCSA"), have imposed new "track and trace" requirements on the distribution of prescription drug products by manufacturers, distributors, and other entities in the drug supply chain. These requirements are being phased in over a ten-year period. The DSCSA ultimately will require product identifiers (i.e., serialization) on prescription drug products in order to establish an electronic interoperable prescription product system to identify and trace certain prescription drugs distributed in the United States. The DSCSA replaced the prior drug "pedigree" requirements under the Prescription Drug Marketing Act ("PDMA") and pre-empts existing state drug pedigree laws and regulations. The DSCSA also establishes requirements for the licensing of wholesale distributors and third party logistic providers. These licensing requirements preempt states from imposing licensing requirements that are inconsistent with, less stringent than, directly related to, or otherwise encompassed by standards established by FDA pursuant to

the DSCSA. Until FDA promulgates regulations to address the DSCSA's new national licensing standard, current state licensing requirements typically remain in effect.

Finally, PDMA regulates the distribution of drug samples by drug manufacturers and, along with state laws, limits the distribution of prescription pharmaceutical product samples, and imposes certain recordkeeping, reporting and accountability requirements on distribution of drug samples.

505(b)(2) Regulatory Pathway

As an alternative path to FDA approval for modifications to formulations or new uses of products previously approved by the FDA, an applicant may submit an NDA under Section 505(b)(2) of the FDCA. Section 505(b)(2) was enacted as part of the Hatch-Waxman Amendments and 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 FDA's previous findings of safety and effectiveness is scientifically appropriate, it may eliminate the need, or reduce the requirements, to conduct certain preclinical or clinical studies of the new product. The FDA may also require companies to perform additional studies or measurements, including clinical trials, to support the change from the approved branded reference drug(s). The FDA may then approve the new product candidate for all, or some, of the label indications for which the branded reference drug has been approved, as well as for any new indication sought by the 505(b)(2) applicant. We plan to pursue a 505(b)(2) regulatory pathway for C-Scape.

Exclusivity and Approval of Competing Products

Orange Book Listing

In seeking approval for a drug through an NDA, including a 505(b)(2) NDA, applicants are required to list with the FDA certain patents whose claims cover the applicant's product. Upon approval of an NDA, each of the patents listed in the application for the drug is then published in the Orange Book. Any applicant who files a 505(b)(2) NDA referencing a drug listed in the Orange Book must certify to the FDA that (1) no patent information on the drug product that is the subject of the application has been submitted to the FDA; (2) such patent has expired; (3) the date on which such patent expires; or (4) such patent is invalid or will not be infringed upon by the manufacture, use or sale of the drug product for which the application is submitted. This last certification is known as a paragraph IV certification. A notice of the paragraph IV certification must be provided to each owner of the patent that is the subject of the certification and to the holder of the approved NDA to which the 505(b)(2) application refers. The applicant may also elect to submit a ''section viii'' statement certifying that its proposed label 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 reference NDA holder and patent owners assert a patent challenge directed to one of the Orange Book listed patents within 45 days of the receipt of the paragraph IV certification notice, the FDA is prohibited from approving the application until the earlier of 30 months from the receipt of the paragraph IV certification expiration of the patent, settlement of the lawsuit or a decision in the infringement case that is favorable to the applicant. A 505(b)(2) application also will not be approved until any applicable non-patent exclusivity listed in the Orange Book for the branded reference drug has expired as described in further detail below.

Hatch-Waxman Exclusivity

Market and data exclusivity provisions under the FDCA can delay the submission or the approval of certain applications for competing products. The FDCA provides a five-year period of non-patent data exclusivity within the United States to the first applicant to gain approval of an NDA for a new chemical entity. A drug is a new chemical entity if the FDA has not previously approved any other new drug containing the same active moiety, which is the molecule or ion responsible for the activity of the drug substance. We believe that our product candidate ZEMDRI is a new chemical entity. During the exclusivity period, the FDA may not accept for review an abbreviated new drug application ("ANDA"), or a 505(b)(2) NDA submitted by another company that references the previously approved

drug. However, an ANDA or 505(b)(2) NDA may be submitted after four years if it contains a certification of patent invalidity or non-infringement. The FDCA also provides three years of marketing exclusivity for an NDA, 505(b)(2) NDA, or supplement to an existing NDA or 505(b)(2) 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 or supplement. Three-year exclusivity may be awarded for changes to a previously approved drug product, such as new indications, dosages, strengths or dosage forms of an existing drug. This three-year exclusivity covers only the conditions of use associated with the new clinical investigations and, as a general matter, does not prohibit the FDA from approving ANDAs or 505(b)(2) NDAs for generic versions of the

original, unmodified drug product. 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 of the preclinical studies and adequate and well-controlled clinical trials necessary to demonstrate safety and effectiveness. For drug products that contain an "antibiotic" ingredient approved prior to November 21, 1997, the statute imposes certain limitations on the award of five-year non-patent exclusivity. However, we do not believe these limitations would apply to any of our investigational antibiotics.

Qualified Infectious Disease Product Exclusivity

Under the GAIN Act provisions of FDASIA, which was signed into law in July 2012, the FDA may designate a product as a "qualified infectious disease product" ("QIDP"). In order to receive this designation, a drug must qualify as an antibacterial or antifungal drug for human use intended to treat serious or life-threatening infections, including those caused by either (1) an antibacterial or antifungal resistant pathogen, including novel or emerging infectious pathogens, or (2) a so-called "qualifying pathogen" found on a list of potentially dangerous, drug-resistant organisms to be established and maintained by the FDA under the new law. A sponsor must request such designation before submitting a marketing application. FDA granted QIDP designation for ZEMDRI for the treatment of hospital-acquired bacterial pneumonia, ventilator-associated pneumonia, complicated intra-abdominal infections, complicated urinary tract infections, and catheter-related BSI on December 14, 2014. FDA also granted QIDP designation to C-Scape in January 2017.

The benefits of QIDP designation include eligibility for priority review and fast-track designation, and an extension by an additional five years of any non-patent marketing exclusivity period awarded, such as a five-year exclusivity period awarded for a new molecular entity. This extension is in addition to any pediatric exclusivity extension that may be awarded, and the extension will be awarded only to a drug first approved on or after the date of enactment.

The GAIN Act provisions prohibit the grant of an exclusivity extension where the application is a supplement to an application for which an extension is in effect or has expired, is a subsequent application for a specified change to an approved product, or is an application for a product that does not meet the definition of QIDP based on the uses for which it is ultimately approved.

Foreign Regulation

In order to market any product outside of the United States, we would need to comply with numerous and varying regulatory requirements of other countries regarding safety and efficacy and governing, among other things, clinical trials, marketing authorization, commercial sales and distribution of our products. For example, in the EU, we must obtain authorization of a clinical trial application, in each member state in which we intend to conduct a clinical trial. Whether or not we obtain FDA approval for a product, we would need to obtain the necessary approvals by the comparable regulatory authorities of foreign countries before we can commence clinical trials or marketing of the product in those countries. The approval process varies from country to country and can involve additional product testing and additional administrative review periods. The time required to obtain approval in other countries might differ from and be longer than that required to obtain FDA approval. Regulatory approval in one country does not ensure regulatory approval in another, but a failure or delay in obtaining regulatory approval in one country may negatively impact the regulatory process in others.

To obtain a marketing authorization of a drug in the EU, we may submit marketing authorization applications, either under the so-called centralized or national authorization procedures.

Centralized Procedure

The centralized procedure provides for the grant of a single marketing authorization following a favorable opinion by the EMA that is valid in all EU member states, as well as Iceland, Lichtenstein and Norway. The centralized procedure is compulsory for medicines produced by specified biotechnological processes, products designated as orphan medicinal products, advanced-therapy medicines (such as gene-therapy, somatic cell-therapy or tissue-engineered medicines), and products with a new active substance indicated for the treatment of specified diseases, such as HIV/AIDS, cancer, diabetes, neurodegenerative disorders or autoimmune diseases and other immune dysfunctions, and viral diseases. The centralized procedure is optional for products that represent a significant therapeutic, scientific or technical innovation, or whose authorization would be in the interest of public

health. Under the centralized procedure the maximum timeframe for the evaluation of an MAA by the EMA is 210 days, excluding clock stops, when additional written or oral information is to be provided by the applicant in response to questions asked by the Committee of Medicinal Products for Human Use (the "CHMP"). Accelerated assessment might be granted by the CHMP in exceptional cases, when a medicinal product is expected to be of a major public health interest, particularly from the point of view of therapeutic innovation. The timeframe for the evaluation of an MAA under the accelerated assessment procedure is 150 days, excluding stop-clocks.

National Authorization Procedures

There are also two other possible routes to authorize medicinal products in several EU countries, which are available for investigational medicinal products that fall outside the scope of the centralized procedure:

- Decentralized procedure. Using the decentralized procedure, an applicant may apply for simultaneous authorization in more than one EU country of medicinal products that have not yet been authorized in any EU country and that do not fall within the mandatory scope of the centralized procedure.
- Mutual recognition procedure. In the mutual recognition procedure, a medicine is first authorized in one EU Member State, in accordance with the national procedures of that country. Following this, further marketing authorizations can be sought from other EU countries in a procedure whereby the countries concerned agree to recognize the validity of the original, national marketing authorization.

In the EU, new products authorized for marketing (i.e., reference products) qualify for eight years of data exclusivity and an additional two years of market exclusivity upon marketing authorization. The data exclusivity period prevents generic applicants from relying on the preclinical and clinical trial data contained in the dossier of the reference product when applying for a generic marketing authorization in the EU during a period of eight years from the date on which the reference product was first authorized in the EU. The market exclusivity period prevents a successful generic applicant from commercializing its product in the EU until ten years have elapsed from the initial authorization of the reference product in the EU. The ten-year market exclusivity period can be extended to a maximum of eleven years if, during the first eight years of those ten years, the marketing authorization holder obtains an authorization for one or more new therapeutic indications which, during the scientific evaluation prior to their authorization, are held to bring a significant clinical benefit in comparison with existing therapies.

Regulation of In Vitro Diagnostic Assays

In the United States, the FDCA and its implementing regulations, and other federal and state statutes and regulations govern, among other things, medical device design and development, preclinical and clinical testing, premarket clearance or approval, registration and listing, manufacturing, labeling, storage, advertising and promotion, sales and distribution, export and import, and post-market surveillance. Diagnostic tests are classified as medical devices under the FDCA. Unless an exemption applies, diagnostic tests require marketing clearance or approval from the FDA prior to commercial distribution. The two primary types of FDA marketing authorization applicable to a medical device are premarket clearance, also called 510(k) clearance, and approval of a premarket approval application ("PMA"). The FDA classifies all medical devices into one of three classes. Devices deemed to pose lower risk are categorized as either Class I or II, which requires the manufacturer to submit to the FDA a 510(k) pre-market notification requesting clearance of the device for commercial distribution in the United States, unless an exemption applies. Devices deemed by the FDA to pose the greatest risk, such as life sustaining, life-supporting or implantable devices, or devices deemed not substantially equivalent to a previously 510(k)-cleared device are categorized as Class III, requiring a PMA.

To obtain 510(k) clearance for a medical device, a pre-market notification must be submitted to the FDA demonstrating that the proposed device is substantially equivalent to a previously 510(k)-cleared device or a device that was in commercial distribution before May 28, 1976 for which the FDA has not yet called for the submission of a PMA, or the device must be one that has been reclassified from Class III to either Class II or I. The 510(k) clearance

process usually takes from three to twelve months from the date the application is submitted and filed with the FDA, but may take significantly longer and clearance is never assured. Although many 510(k) pre-market notifications are cleared without clinical data, in some cases, the FDA requires significant clinical data to support substantial equivalence. In reviewing a pre-market notification, the FDA may request additional information, including clinical data, which may significantly prolong the review process. After a device receives 510(k)

clearance, any subsequent modification of the device that could significantly affect its safety or effectiveness, or that would constitute a major change in its intended use, will require a new 510(k) clearance or could require pre-market approval. The FDA requires each manufacturer to make this determination initially, but the FDA may review any such decision and may disagree with a manufacturer's determination. If the FDA disagrees with a manufacturer's determination, the FDA may require the manufacturer to cease marketing and/or recall the modified device until 510(k) clearance or a PMA is obtained.

To obtain FDA approval of a medical device, the applicant must submit a PMA application that must be supported by valid scientific evidence, which typically requires extensive data, including technical, preclinical, clinical and manufacturing data, to demonstrate to the FDA's satisfaction the safety and effectiveness of the device. For diagnostic tests, a PMA application typically includes data regarding analytical and clinical validation studies. As part of its review of the PMA, the FDA will conduct a pre-approval inspection of the manufacturing facility or facilities to ensure compliance with the Quality System Regulation, which requires manufacturers to follow design, testing, control, documentation and other quality assurance procedures.

In December 2018, our development partner Microgenics Corporation (a part of Thermo Fisher Scientific Inc.) ("Thermo Fisher") received clearance under the 510(k) pathway for an in vitro assay for plazomicin and has begun commercializing the device in the United States.

In the European Economic Area ("EEA"), in vitro medical devices are required to conform with the essential requirements of the EU Directive on In Vitro Diagnostic Medical Devices (Directive No 98/79/EC, as amended). To demonstrate compliance with the essential requirements, the manufacturer must undergo a conformity assessment procedure. The conformity assessment varies according to the type of medical device and its classification. For low-risk devices, the conformity assessment can be carried out internally, but for higher risk devices it requires the intervention of an accredited EEA Notified Body. If successful, the conformity assessment concludes with the drawing up by the manufacturer of an EC Declaration of Conformity entitling the manufacturer to affix the CE mark to its products and to sell them throughout the EEA. The data generated for the U.S. registration will be sufficient to satisfy the regulatory requirements for the EU and other countries.

On April 5, 2017, the European Parliament passed the Medical Devices Regulation (Regulation 2017/745), which repeals and replaces the EU Medical Devices Directive and the Active Implantable Medical Devices Directive, as well the In Vitro Diagnostic Medical Devices Regulation (Regulation 2017/746), which repeals and replaces the EU Directive on In Vitro Diagnostic Medical Devices. Unlike directives, which must be implemented into the national laws of the EEA member States, regulations are directly applicable, i.e., without the need for adoption of EEA member State laws implementing them, in all EEA member States and are intended to eliminate current differences in the regulation of medical devices among EEA member States. The Medical Devices Regulation and the In Vitro Diagnostic Medical Devices Regulation, among other things, are intended to establish a uniform, transparent, predictable and sustainable regulatory framework across the EEA for medical devices and ensure a high level of safety and health while supporting innovation.

The Medical Devices Regulation will however only become applicable three years after publication (in May 2020), while the In Vitro Diagnostic Medical Devices Regulation will only become applicable five years after publication (in May 2022). Once applicable, the new regulations will among other things:

- strengthen the rules on placing devices on the market and reinforce surveillance once they are available;
- establish explicit provisions on manufacturers' responsibilities for the follow-up of the quality, performance and safety of devices placed on the market;
- improve the traceability of medical devices throughout the supply chain to the end-user or patient through a unique identification number;

- set up a central database to provide patients, healthcare professionals and the public with comprehensive information on products available in the EU;
- strengthen rules for the assessment of certain high-risk devices, such as implants, which may have to undergo an additional check by experts before they are placed on the market.

Other Healthcare Laws

In addition to FDA restrictions on marketing of pharmaceutical products, federal and state healthcare laws govern certain business practices in the biopharmaceutical industry. These laws include, but are not limited to, anti-kickback, false claims, data privacy and security, and physician payment and drug pricing laws.

The federal Anti-Kickback Statute prohibits, among other things, any person from knowingly and willfully offering, paying, soliciting or receiving remuneration to induce or in return for purchasing, leasing, ordering, or arranging for or recommending the purchase, lease, or order of any item or service reimbursable under Medicare, Medicaid or other federal healthcare programs. The term "remuneration" has been broadly interpreted to include anything of value. The Anti-Kickback Statute has been interpreted to apply to arrangements between pharmaceutical manufacturers on one hand and prescribers, purchasers, and formulary managers on the other hand. Although there are a number of statutory exceptions and regulatory safe harbors protecting some common activities from prosecution, the exemptions and safe harbors are drawn narrowly. Practices that involve remuneration that may be alleged to be intended to induce prescribing, purchases, or recommendations may be subject to scrutiny if they do not meet the requirements of a statutory or regulatory exception or safe harbor. Several courts have interpreted the statute's intent requirement to mean that if any one purpose of an arrangement involving remuneration is to induce referrals of federal healthcare covered business, the statute has been violated. In addition, a person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation. Moreover, 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 civil False Claims Act or the civil monetary penalties statute, which imposes penalties against any person who is determined to have presented or caused to be presented a claim to a federal health program that the person knows or should know is for an item or service that was not provided as claimed or is false or fraudulent.

The federal False Claims Act prohibits any person from knowingly presenting, or causing to be presented, a false claim for payment to the federal government, knowingly making, using, or causing to be made or used a false record or statement material to a false or fraudulent claim to the federal government, or from knowingly making a false statement to avoid, decrease or conceal an obligation to pay money to the federal government. A claim includes "any request or demand" for money or property presented to the U.S. government. Several pharmaceutical and other healthcare companies have been prosecuted under these laws for allegedly providing free product to customers with the expectation that the customers would bill federal programs for the product. Other companies have been prosecuted for causing false claims to be submitted because of the companies' marketing of products for unapproved, and thus non-covered, uses. In addition, many states have similar fraud and abuse statutes or regulations that apply to items and services reimbursed under Medicaid and other state programs, or, in several states, apply regardless of the payor. The federal Civil Monetary Penalties Law prohibits, among other things, the offering or transferring of remuneration to a Medicare or Medicaid beneficiary that the person knows or should know is likely to influence the beneficiary's selection of a particular supplier of Medicare or Medicaid payable items or services. Noncompliance with such beneficiary inducement provision of the federal Civil Monetary Penalties Law can result in civil money penalties for each wrongful act, assessment of three times the amount claimed for each item or service and exclusion from the federal healthcare programs.

Federal and state government price reporting laws require manufacturers to calculate and report complex pricing metrics to government programs. Such reported prices may be used in the calculation of reimbursement and/or discounts on marketed products. Participation in these programs and compliance with the applicable requirements subject manufacturers to potentially significant discounts on products, increased infrastructure costs, and potentially limit the ability to offer certain marketplace discounts.

The federal Health Insurance Portability and Accountability Act of 1996 (“HIPAA”) prohibits, among other things, knowingly and willfully executing, or attempting to execute, a scheme to defraud any healthcare benefit program, including private third-party payors, knowingly and willfully embezzling or stealing from a healthcare benefit program, willfully obstructing a criminal investigation of a healthcare offense, and knowingly and willfully falsifying, concealing or covering up a material fact or making any materially false, fictitious or fraudulent statement in connection with the delivery of or payment for healthcare benefits, items or services.

There has also been a recent trend of increased federal and state regulation of payments made to physicians and other healthcare providers. The Patient Protection and Affordable Care Act, as amended by Health Care and

Education Reconciliation Act (collectively, the "ACA"), signed into law on March 2010, created federal requirements for reporting, by applicable manufacturers of covered drugs, payments and other transfers of value to physicians and teaching hospitals. Applicable manufacturers are also required to report annually to the government certain ownership and investment interests held by physicians and their immediate family members. In addition, certain states require implementation of commercial compliance programs and compliance with the pharmaceutical industry's voluntary compliance guidelines and the relevant compliance guidance promulgated by the federal government, impose restrictions on marketing practices, and/or require the tracking and reporting of marketing expenditures and pricing information as well as gifts, compensation and other remuneration or items of value provided to physicians and other healthcare professionals and entities.

We may also be subject to data privacy and security regulation by both the federal government and the states in which we conduct our business. HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act ("HITECH"), and its implementing regulations, imposes specified requirements relating to the privacy, security and transmission of individually identifiable health information. Among other things, HITECH makes HIPAA's privacy and security standards directly applicable to "business associates," defined as independent contractors or agents of covered entities that create, receive, maintain or transmit protected health information in connection with providing a service on behalf of a covered entity. HITECH also increased the civil and criminal penalties that may be imposed against covered entities, business associates and possibly other persons, and gave state attorneys general new authority to file civil actions for damages or injunctions in federal courts to enforce the federal HIPAA laws and seek attorney's fees and costs associated with pursuing federal civil actions. In addition, state laws govern 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 requirements, thus complicating compliance efforts.

To the extent that ZEMDRI and any of our product candidates, once approved, are sold in a foreign country, we may be subject to similar foreign laws and regulations, which may include, for instance, applicable post-marketing requirements, including safety surveillance, anti-fraud and abuse laws, data privacy laws and implementation of corporate compliance programs and reporting of payments or other transfers of value to healthcare professionals.

Coverage and Reimbursement

ZEMDRI is being utilized within the hospital environment and therefore, when treating patients in the inpatient setting they will be reimbursed under a prospective payment system, or a predetermined payment amount that is based on the diagnosis related groups ("DRGs") for Medicare patients and under a bundled payment for commercially insured patients. These payment amounts differ by the type of diagnosis, procedures performed and the severity of the patient's condition, among other things. Typically, the cost of treatment for hospital acquired infections, for which ZEMDRI would be used, is included in the DRG or bundled payment and not eligible for any separate payment. For catastrophic cases where costs greatly exceed the bundled payment amount, the hospital may be eligible for an outlier payment that is intended to cover part of the expense above the standard payment.

In August 2018, the Centers for Medicare & Medicaid Services (CMS) approved a new technology add-on payment (NTAP) for ZEMDRI when administered to Medicare beneficiaries in the hospital inpatient setting. Commencing on October 1, 2018, and continuing for a period of two to three years, the Medicare program will provide hospitals with a payment, in addition to the standard-of-care DRG reimbursement, of up to 50% of the cost of ZEMDRI not to exceed $2,722.50 for a patient treated with ZEMDRI. Cases involving ZEMDRI that are eligible for NTAP will be identified by unique ICD–10–PCS procedure codes.

ZEMDRI is also being utilized in the outpatient setting. Patients treated in the outpatient setting are reimbursed using different payment methodologies based on the site of care where infusions take place. For Medicare patients treated in hospital outpatient departments, or HOPDs, ZEMDRI obtained transitional pass through payment status and is

billed using a HCPCS Code, C9039, effective January 1, 2019. Similar to NTAP but applicable to the HOPD setting, transitional pass-through payment status enables hospitals to receive separate payment for the drug for a period of two to three years. Achaogen participates in the 340B program for eligible not-for-profit HOPDs and has a discounted price for ZEMDRI when provided to eligible outpatients of these facilities, which we believe helps to enable hospitals to transition these patients from acute care to the outpatient setting. When used in a physician office infusion center, we believe centers generally use HCPCS Code, J3490, which is an unclassified drug code, for ZEMDRI for 2019. We have applied to establish a permanent HCPCS code specific to

ZEMDRI and expect to receive a decision from CMS on that application in 2019. Treatments provided to home infusion patients may be covered using a HCPCS code, S9500, for 24-hour antibiotic infusions and billed separately for ZEMDRI using the same J3490 code. Medicare does not cover the home infusion of antibiotics but will cover ZEMDRI under the Medicare Part D prescription drug plan. Part D plans only cover a portion of the cost of the medication; the patient is typically responsible for a per diem charge for nursing and supplies, as well as any applicable cost-sharing amounts. ZEMDRI is also covered by state Medicaid plans for home infusion and other outpatient settings. Achaogen has a VA Federal Supply Schedule (FSS) agreement through which we agree to sell ZEMDRI for the treatment of veterans in various sites of care, including acute care hospitals as well as alternative sites.

Outside of the United States, the pricing of pharmaceutical products is subject to governmental control in many countries. For example, in the European Union, pricing and reimbursement schemes vary widely from country to country. Some countries provide that 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 a particular therapy to currently available therapies or so-called health technology assessments, in order to obtain reimbursement or pricing approval. Other countries may allow companies to fix their own prices for products, but monitor and control product volumes and issue guidance to physicians to limit prescriptions. Efforts to control prices and utilization of pharmaceutical products will likely continue as countries attempt to manage healthcare expenditures.

In addition, IVD assays or related diagnostic tests require coverage and reimbursement separate and apart from the coverage and reimbursement for our pharmaceutical or biological products. Similar challenges to obtaining coverage and reimbursement, applicable to pharmaceutical or biological products, will apply to such diagnostics.

Healthcare Reform

A primary trend in the U.S. healthcare industry and elsewhere is cost containment. Government authorities and other third-party payors have attempted to control costs by limiting coverage and the amount of reimbursement for particular medical products, implementing reductions in Medicare and other healthcare funding, and applying new payment methodologies.

Since taking office, the current administration has continued to support the repeal of all or portions of the ACA and we expect that the administration and U.S. Congress will continue to seek to modify, repeal, or otherwise invalidate all, or certain provisions of, the ACA. There is also a considerable amount of uncertainty as to the prospective implementation of the ACA and what similar measures or other changes might be enacted at the federal and/or state level. For example, on December 14, 2018, a Texas U.S. District Court Judge ruled that the ACA is unconstitutional in its entirety because the “individual mandate” was repealed by Congress as part of the Tax Cuts and Jobs Act of 2017. While the Texas U.S. District Court Judge, as well as the Trump administration and CMS, have stated that the ruling will have no immediate effect pending appeal of the decision, it is unclear how this decision, subsequent appeals, and other efforts to repeal and replace the ACA will impact the law. While there may be significant changes to the healthcare environment in the future, the specific changes, their timing and their potential impact on us are not yet apparent. As a result, there is considerable uncertainty surrounding the ACA including coverage and reimbursement, the exchanges, and many core aspects of the current healthcare marketplace.

In addition, other legislative changes have been proposed and adopted in the United States since the ACA to reduce healthcare expenditures, including aggregate reductions of Medicare payments to providers of 2% per fiscal year that will remain in effect through 2027 unless additional action is taken by Congress, and reductions in Medicare payments to several types of providers, including hospitals, imaging centers and cancer treatment centers. Individual states in the United States have also become increasingly active in passing legislation and implementing regulations designed to control pharmaceutical product pricing, including price or patient reimbursement constraints, discounts, restrictions on

certain product access and marketing cost disclosure and transparency measures, and, in some cases, designed to encourage importation from other countries and bulk purchasing. Recently, there has been heightened governmental scrutiny over the manner in which manufacturers set prices for their marketed products, and this will remain a prominent political issue. We anticipate continued focus, Congressional inquiries and proposed and enacted legislation designed to, among other things, reform government program reimbursement methodologies and reduce Medicaid and other healthcare funding.

Manufacturing

We currently contract with third parties for the manufacturing and testing of our product candidates and our commercial product and intend to do so in the future. We do not own or operate manufacturing facilities for the production of clinical or commercial quantities of our product candidates. We currently have no plans to build or own clinical or commercial scale manufacturing capabilities. The use of contracted manufacturing and reliance on collaboration partners is relatively capital-efficient and has eliminated the need for our direct investment in manufacturing facilities and additional staff. Although we rely on contract manufacturers, we have personnel with extensive manufacturing and quality experience to oversee our contract manufacturers.

All of our third-party manufacturers are subject to periodic audits to confirm compliance with applicable regulations and must pass inspection before we can manufacture our drugs for commercial use. Failure to comply with statutory and regulatory requirements subjects a manufacturer to possible legal or regulatory action, including warning letters, the seizure or recall of products, injunctions, consent decrees placing significant restrictions on or suspending manufacturing operations and civil and criminal penalties. These actions could have a material impact on the availability of our products.

We currently rely on a limited number of third parties for our required raw materials, drug substance, and finished drug product for our preclinical research, clinical trials and commercial production. For ZEMDRI, we source raw materials from various commercial suppliers, primarily located in Europe and the People's Republic of China, including the aminoglycoside precursor sisomicin. Our drug substance has been manufactured by Hovione Limited ("Hovione") and we have entered into a long-term agreement with Hovione for commercial production of ZEMDRI. The drug product is manufactured by Pfizer CentreOne (formerly Hospira) and we have entered into a long-term agreement with Pfizer CentreOne for commercial production of ZEMDRI.

Plazomicin

Process. ZEMDRI is an organic compound of low molecular weight, commonly referred to as a small molecule. ZEMDRI is also considered a semi-synthetic molecule since it is derived from a primary starting material that is a natural product, sisomicin, produced by microbial fermentation. ZEMDRI sulfate is prepared in four process stages (seven chemical steps) from sisomicin, with a final purification by ion-exchange chromatography and isolation by spray-drying of the amorphous sulfate salt from aqueous solution. We believe that our use of a synthetic process will enable us to have a cost of manufacturing for ZEMDRI that is similar to other modern small molecule antibiotics.

Bulk Drug Substance. In March 2017, we entered into a commercial validation and manufacturing agreement (the "Commercial Manufacturing Agreement") with Hovione, an Ireland-based company with facilities in Portugal and Ireland. Under the Commercial Manufacturing Agreement, Hovione agreed to carry out our validation program to validate and scale up our technology to manufacture the active pharmaceutical ingredient of ZEMDRI (the "Product"). The validation program was successfully completed. The Commercial Manufacturing Agreement also includes the manufacturing of commercial quantities of the Product on a commercial scale at Hovione's facilities. The Commercial Manufacturing Agreement has an initial term of seven years after the first delivery of the Product.

Pursuant to the Commercial Manufacturing Agreement, once ZEMDRI is approved by the FDA, we have minimum quantity and minimum annual purchase commitments from Hovione depending on our requirements and the period of time following approval by the FDA. For the first three years following approval of ZEMDRI by the FDA, we are required to purchase at least 80% of its required quantity of Product from Hovione. Following the initial three years after FDA approval, we are required to purchase between 40% and 66% of its required quantity from Hovione, depending on the amounts required during any such fiscal year. Contingent upon FDA's approval of ZEMDRI, we have minimum annual purchase commitments from Hovione, beginning in 2020 through 2024. Beyond the minimum

purchase obligation contained in the Manufacturing Agreement, we may use other suppliers and Hovione is obligated to cooperate with us in such efforts, including by performing certain technology transfers. The Commercial Manufacturing Agreement may be early terminated by either party for the other party's uncured material breach or insolvency of which termination fees related to the minimum annual commitments may apply.

Drug Product. We have employed the services of Pfizer CentreOne to produce our ZEMDRI IV drug product. In August 2015, we entered into a development and supply agreement with Hospira, which was amended in September 2015 to include the Pfizer CentreOne Group of Pfizer, whereby Pfizer CentreOne assists us in the

development and commercialization of ZEMDRI for IV administration. We purchase our requirement of such product for commercial sale in the U.S., Canada and the EU (the "Territory") from Pfizer CentreOne.

C-Scape

C-Scape is a combination of ceftibuten, an approved third generation cephalosporin, and clavulanate, an approved -lactamase inhibitor. We purchase clavulanate and ceftibuten from two separate third-party suppliers (or contract manufacturers) who have experience working with these compounds. The clinical drug product ("DP") for C-Scape is being supplied by a third-party contract manufacturing organization who has experience with these types of compounds.

Customer Concentration and Geographic Information

For the years ended December 31, 2018, 2017, and 2016 all of our revenue has been generated from product revenue related to sales of ZEMDRI and funding pursuant to U.S. government contracts and a non-profit foundation grant. All trade and contract receivable relate to funding from the U.S. government and product revenue. See Note 2 to our audited consolidated financial statements included elsewhere in this Annual Report on Form 10-K for additional information.

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

Employees

As of April 1, 2019, we had 42 full-time employees. None of our employees is represented by a labor union and we consider our employee relations to be good.

Additional Information

We view our operations and measure our business as one reportable segment operating primarily in the United States. See Note 2 to our audited consolidated financial statements included elsewhere in this Annual Report on Form 10-K for additional information.

We were incorporated in Delaware in June 2002 and commenced operations in 2004. We completed our initial public offering of our common stock in March 2014. Our mailing address and executive offices are located at 1 Tower Place, Suite 400, South San Francisco, CA 94080 and our telephone number at that address is (650) 800-3636. We maintain an Internet website at the following address: www.achaogen.com. The information on our website is not incorporated by reference in this annual report on Form 10-K or in any other filings we make with the SEC.

We make available on or through our website certain reports and amendments to those reports that we file with or furnish to the SEC in accordance with the Exchange Act. These include our annual reports on Form 10-K, our quarterly reports on Form 10-Q, and our current reports on Form 8-K, and amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Exchange Act. We make this information available on or through our website free of charge as soon as reasonably practicable after we electronically file the information with, or furnish it to, the SEC.

Item 1A. Risk Factors.

Risks Related to Our Business and Capital Requirements

We need substantial additional funding to fund our operations, and we cannot continue as a going concern if we are unable to obtain additional funding. Without substantial additional funding, we could be forced to delay, reduce or terminate the commercialization of ZEMDRI, our efforts to obtain regulatory approval for plazomicin from the European Medicines Agency ("EMA"), the development of C-Scape and other operations, payment of obligations in the normal course and we could be forced to default under our loan and security agreement dated February 26, 2018 (the "SVB Loan Agreement") with Silicon Valley Bank ("SVB") or seek protection under the U.S. Bankruptcy Code.

Developing and commercializing biopharmaceutical products, including launching new products into the marketplace and conducting preclinical studies and clinical trials, is an expensive and highly uncertain process that takes years to complete. We expect to incur substantial expenses as we continue to advance our commercialization efforts for our sole approved product, ZEMDRI, seek regulatory approval for plazomicin outside the United States and continue the development of C-Scape. The commercialization of ZEMDRI has involved and will continue to involve the incurrence of significant sales, marketing, manufacturing and supply expenses. We have had difficulty raising sufficient funds to advance our commercialization of ZEMDRI in the way we intended and our revenues from sales of ZEMDRI to date have been very limited. For the fiscal year ended December 31, 2018, we recognized $0.8 million in net product revenues from sales of ZEMDRI.

On February 28, 2019, we commenced a restructuring of our organization to conserve our cash resources. The majority of the roles eliminated in the restructuring are field-based sales and medical scientist positions.

As of December 31, 2018, we had negative working capital of $17.2 million and unrestricted cash, cash equivalents and short-term investments of $31.0 million. Based on our available cash resources, which excludes restricted cash (including the $25.0 million of restricted cash collateralized in connection with the SVB Loan Agreement), and we believe we have sufficient cash resources to support current planned operations into June 2019. This condition results in the assessment that there is substantial doubt about our ability to continue as a going concern.

There can be no assurance that we will obtain additional debt or equity financing or generate product revenue or revenues from collaborative partners, on terms acceptable to us, on a timely basis or at all. If we raise additional funds by issuing equity, the issuance of additional shares will result in dilution to our current stockholders. If additional financing is accomplished by the issuance of additional debt, the service cost, or interest will reduce net income or increase net loss, and we may also be required to issue shares of common stock or warrants to purchase shares of common stock in connection with issuing such debt. If we are unable to raise additional funding, a further reduction in the scope of our operations may become necessary and we may need to file for protection under the U.S. Bankruptcy code. Our ability to obtain debt financing may be limited by covenants we have made under the SVB Loan Agreement (such as our covenant not to incur indebtedness other than certain specified and limited forms of indebtedness) and our pledge to SVB of substantially all of our assets, other than our intellectual property, as collateral. The negative pledge in favor of SVB with respect to our intellectual property under the SVB Loan Agreement could further limit our ability to obtain additional debt financing. Our failure to raise capital as and when needed would adversely affect our business, results of operations, and financial condition and may cause us to seek protection under the U.S. Bankruptcy code. The amount and timing of our future financing requirements will depend on many factors, including:

- the size and timing of revenues from ZEMDRI;
- the size, timing and type of the nonclinical and clinical studies, including post-marketing commitments, that we decide to pursue in the development of ZEMDRI and C-Scape;

- our ability to identify and consummate a strategic transaction for the Company and the timing and nature of any strategic transactions that we undertake (if any);

- the timing of, and costs involved in, seeking and obtaining FDA and other regulatory approvals for C-Scape and other product candidates, and for seeking and obtaining regulatory approvals outside the United States for plazomicin;
- our ability to enter into additional collaboration, licensing or other arrangements and the terms and timing of such arrangements;
- the costs of preparing, filing, prosecuting, maintaining and enforcing any patent applications or claims and other intellectual property rights, including litigation costs and the results of such litigation;
- the emergence of competing technologies and other adverse market developments;
- the resources we devote to marketing and commercializing ZEMDRI;
- the resources we devote to marketing, and, if approved, commercializing our product candidates;
- the scope, progress, expansion, and costs of manufacturing our product or product candidates;
- our ability to enter into additional government contracts, or other collaborative agreements, to support the development of our product candidates and development efforts, including potential collaborative arrangements relating to the commercialization of ZEMDRI outside the United States, if approved; and
- the costs associated with being a public company.

Future capital requirements will also depend on the extent to which we acquire or invest in additional businesses, products and technologies. We currently have no commitments or agreements relating to any of these types of transactions.

If we are unable to raise additional funds when needed, we may be required to delay, reduce or terminate the commercialization of ZEMDRI, our efforts to obtain regulatory approval for plazomicin from the EMA, the development of C-Scape and other operations and could be forced to default under the SVB Loan Agreement or file for relief under the provisions of the U.S. Bankruptcy Code. We may also be required to sell or license to others technologies or clinical product candidates or programs that we would prefer to develop and commercialize ourselves or on terms that are less favorable that we might otherwise obtain.

Our recurring losses from operations and negative cash flows and our difficulty in raising additional capital have raised substantial doubt regarding our ability to continue as a going concern.

We may not be able to continue as a going concern for multiple reasons, many of which are not in our control. Our recurring losses from operations and negative cash flows raise substantial doubt about our ability to continue as a going concern. Based on our available cash resources, which excludes restricted cash (including the $25.0 million of restricted cash collateralized in connection with the SVB Loan Agreement), we believe we have sufficient cash to support current planned operations into June 2019. Accordingly, our ability to continue as a going concern will require us to obtain substantial additional financing to fund our operations or significantly curtail our operations to conserve our capital resources. Further, the perception of our ability to continue as a going concern may make it more difficult for us to obtain financing for the continuation of our operations, or necessitate that we obtain financing on terms that are more favorable to investors, and could result in the loss of confidence by investors, suppliers and employees.

Our activities to evaluate and pursue strategic alternatives may not be successful.

On November 5, 2018, we announced the beginning of a review of strategic alternatives to maximize stockholder value, including but not limited to the potential sale or merger of us or our assets. We have devoted significant time and resources to identifying and evaluating potential strategic alternatives, and the strategic review process continues alongside our continued focus on other corporate initiatives. We may be unable to identify strategic alternatives to maximize stockholder value, and even if we enter into a binding agreement, there is no guarantee that the transactions will be consummated due to regulatory or other obstacles, and even if executed and consummated, such strategic alternatives may not enhance stockholder value or our financial position.

30

Any such strategic transaction may require us to incur non-recurring or other charges, may increase our near-and long-term expenditures and may pose significant integration challenges or disrupt our management or business, which could adversely affect our operations and financial results. For example, these transactions may entail numerous operational and financial risks, including:

- exposure to unknown liabilities;
- incurrence of dilutive issuances of equity securities;
- higher-than-expected acquisition and integration costs;
- write-downs of assets or goodwill or impairment charges;
- increased amortization expenses;
- difficulty and cost in combining the operations and personnel of any merged businesses with our operations and personnel;
- impairment of relationships with key suppliers or customers of any merged businesses due to changes in management and ownership; and
- inability to retain our key employees.

Accordingly, although there can be no assurance that we will undertake or successfully complete any strategic transactions of the nature described above, any transactions that we do complete may be subject to the foregoing or other risks, and could have a material adverse effect on our business, financial condition and prospects. In addition, any such strategic transaction may result in substantial dilution to existing stockholders and may not result in consideration to the Company or its stockholders in an amount that enhances stockholder value. If we are unable to complete a strategic transaction of the nature described above, we could experience a reduction in stock price and we may be unable to obtain additional financing, which could result in a slowdown of our operations, further reductions in force, or other restructuring or bankruptcy protection efforts.

If we file to reorganize under the U.S. Bankruptcy Code, our future operations are uncertain and the reorganization could result in a substantial decrease in the value of our common stock, or no value at all.

We have had limited capital resources in the past year and have explored whether filing for bankruptcy protection is in the best interest of the Company and its stakeholders. If we file a voluntary petition for relief under the U.S. Bankruptcy Code, such a filing could lead to significant adverse effects on the Company’s liquidity, results of operations, business prospects, or abilities to operate. We cannot assure that the outcome of a bankruptcy proceeding would be favorable to us or our stockholders. Risks associated with such a filing could include the following:

- the inability to maintain sufficient liquidity throughout a filing;
- increased costs and expenses related to a bankruptcy filing;
- the ability to manage contracts that are critical for operations, and to obtain and maintain appropriate terms with customers, suppliers and service providers;
- the ability to develop, confirm and consummate a plan of reorganization;
- the ability of third parties to seek and obtain court approval to terminate or shorten the exclusivity period for us to propose and confirm a plan of reorganization, to appoint a trustee, or to convert a proceeding under Chapter 11 of the U.S. Bankruptcy Code to a proceeding under Chapter 7 of the U.S. Bankruptcy Code;
- the ability of the Company to continue as a going concern; and

- the ability of the Company to obtain bankruptcy court approval with respect to motions and legal proceedings in general.

These risks and uncertainties could affect our business and operations in various ways. For example, negative events associated with bankruptcy proceedings could adversely affect our relationships with our suppliers, customers, employees, and other third parties, which in turn could adversely affect our operations and financial condition. Also, we would need the prior approval of the bankruptcy court for transactions outside the ordinary course of business, which would then limit our ability to respond timely to certain events or take advantage of certain opportunities. Additionally, if we do not raise additional capital before the end of the second quarter of 2019, we believe we likely will need to file to sell our assets or reorganize under the United States Bankruptcy Code, rendering our future operations uncertain and filing for bankruptcy protection could result in a substantial decrease in the value of our common stock, or no value at all.

If we default under the SVB Loan Agreement, we could be required to repay the outstanding indebtedness and SVB could exercise its rights to take possession of our cash and substantially all of our property as collateral. SVB could also encourage us or seek to require us to file for bankruptcy protection.

As of December 31, 2018, we had $49.8 million of indebtedness outstanding under the SVB Loan Agreement, and no borrowings remain available under the SVB Loan Agreement. In December 2018, SVB collateralized $25.0 million of the borrowed funds meaning that these funds are restricted and no longer available for our use until our cash on deposit at SVB exceeds the ‘Minimum Account Threshold’ for thirty consecutive days, which is the greater of (a) $48.0 million and (b) the ‘Monthly Cash Burn’ which as defined as the difference of (1)(i) net loss plus (ii) unfinanced capital expenditures minus (2)(i) depreciation and amortization expenses, (ii) non-cash stock compensation expense and (iii) other non-cash expenses as approved by SVB.

An event of default will occur under the SVB Loan Agreement if, among other things, we fail to make payments, we breach any of our covenants, subject to specified cure periods with respect to certain breaches, we or our assets become subject to certain legal proceedings, such as bankruptcy proceedings, we are unable to pay our debts as they become due, we default on contracts with third parties which would permit the holder of indebtedness to accelerate the maturity of such indebtedness or that could have a material adverse change on us or SVB determines that a ‘material adverse change’ has occurred. The SVB Loan Agreement defines a ‘material adverse change’ as a material (a) impairment in the perfection or priority of SVB’s lien in its collateral or the value of its collateral, (b) adverse change in our business, operations, or condition (financial or otherwise) or (c) impairment of the prospect of our repayment to SVB of any portion of our obligations under the SVB Loan Agreement.

Upon the occurrence and for the duration of an event of default, including a determination by SVB that a ‘material adverse change’ has occurred, an additional default interest rate equal to 4.0% per annum will apply to all obligations owed under the SVB Loan Agreement. In addition, we may be required to repay the outstanding indebtedness if an event of default occurs under the SVB Loan Agreement. We may not have enough available cash or be able to raise additional funds through equity or debt financings to repay such indebtedness at the time any such event of default occurs. In this case, we may be required to delay, reduce or terminate the commercialization of ZEMDRI, our efforts to obtain regulatory approval for plazomicin from the EMA, the development of C-Scape and other operations and could be forced to file for relief under the U.S. Bankruptcy Code. SVB could also exercise its rights as collateral agent to take possession of and to dispose of the collateral securing the term loans, which collateral includes our cash held in our bank accounts with SVB and substantially all of our property (excluding intellectual property, which is subject to a negative pledge). Our business, financial condition and results of operations would be materially adversely affected as a result of any of these events.

Our operating activities are restricted as a result of covenants in the SVB Loan Agreement.

The SVB Loan Agreement subjects us to various customary affirmative and negative covenants, including, among others, requirements as to financial reporting and insurance and restrictions on our ability to dispose of our business or property, to change our line of business, to liquidate or dissolve, to enter into any change in control transaction, to merge or consolidate with any other entity or to acquire all or substantially all the capital stock or property of another entity, to incur additional indebtedness, to incur liens on our property, to pay any dividends or other distributions on capital stock other than dividends payable solely in capital stock, to redeem capital stock, to

enter into licensing agreements, to engage in transactions with affiliates, and to encumber our intellectual property. Our business may be adversely affected by these restrictions on our ability to operate our business.

We have a limited operating history, have incurred net losses in each year since our inception and anticipate that we will continue to incur significant losses for the foreseeable future, and if we are unable to reduce our losses and achieve profitability, the market value of our common stock will likely decline.

We are a commercial-stage biopharmaceutical company with a limited operating history. We generated revenue from the sale of products for the first time in the third quarter of 2018 and have incurred losses in each year since we commenced operations in 2004. Our sole product approved for sale, ZEMDRI, has only recently been commercialized. In the years ended December 31, 2018 and 2017, we derived all of our revenue from sales of ZEMDRI and from non-profit foundation and government contracts for research and development. We may seek continued revenue from non-profit foundations and government contracts for research and development and additional sources of public health funding. Revenues from such contracts and other sources can be uncertain because milestones or other contingent payments under them may not be achieved or received. In addition, we may not be able to enter into other contracts that will generate significant cash. Our net losses for the years ended December 31, 2018 and 2017 were $186.5 million and $125.6 million, respectively. As of December 31, 2018, we had an accumulated deficit of $559.4 million.

We expect to continue incurring significant expenses and increasing operating losses for the foreseeable future as we continue to advance our commercialization efforts for our sole approved product, ZEMDRI, seek marketing approvals for plazomicin from the EMA, build commercial supply and conduct commercialization activities for ZEMDRI in the United States, and continue the development of C-Scape. Our expenses will also increase substantially if and as we:

- conduct additional clinical trials for our product or product candidates;
- establish a sales, marketing and distribution infrastructure to commercialize ZEMDRI and any product candidates for which we may obtain marketing approval;
- establish a manufacturing and supply chain sufficient for commercial quantities of ZEMDRI and any product candidates for which we may obtain marketing approval;
- maintain, expand and protect our intellectual property portfolio;
- hire additional clinical, scientific and commercial personnel;
- add operational, financial and management information systems and personnel; and
- acquire or in-license other products, product candidates and technologies.

If the commercialization of ZEMDRI is unsuccessful, or if our product candidates fail to demonstrate safety and efficacy in clinical trials, do not gain regulatory approval, or do not achieve market acceptance following regulatory approval and commercialization, we may never become profitable. Even if we achieve profitability in the future, we may not be able to sustain profitability in subsequent periods. Our prior losses, combined with expected future losses, have had and will continue to have an adverse effect on our stockholders' equity and working capital. If we are unable to achieve and sustain profitability, the market value of our common stock will likely decline. Because of the numerous risks and uncertainties associated with developing biopharmaceutical products, we are unable to predict the extent of any future losses or when, if ever, we will become profitable.

We are substantially dependent on the success of our sole approved product, ZEMDRI. If we are unable to successfully commercialize ZEMDRI, or experience significant delays in doing so, our business would be materially harmed.

We currently have one product approved for sale, ZEMDRI, and since 2007, we have invested a significant portion of our efforts and financial resources in the development of ZEMDRI. Our future success is substantially dependent on

our ability to successfully commercialize ZEMDRI, which was first made available for ordering on

July 20, 2018. Our ability to successfully commercialize ZEMDRI will depend on several factors, including the following:

- acceptance of ZEMDRI by patients, the medical community and third-party payors;
- establishing market share while competing with other therapies;
- successfully executing our pricing and reimbursement strategy;
- maintaining commercial manufacturing and supply arrangements;
- maintaining a commercial infrastructure;
- receipt of marketing approvals for ZEMDRI from regulatory authorities outside the United States;
- the commercial impact of the prescribing information for ZEMDRI, including the boxed warning;
- identifying and successfully establishing one or more collaborations to commercialize ZEMDRI outside the United States;
- a continued acceptable safety and adverse event profile of ZEMDRI; and
- qualifying for, identifying, registering, maintaining, enforcing and defending intellectual property rights and claims covering ZEMDRI.

In addition, we are seeking, but have not yet received, FDA approval for, an indication for ZEMDRI to treat bloodstream infections ("BSI"). In December 2018, we filed a Formal Dispute Resolution Request with the FDA regarding the indication for plazomicin for the treatment of BSI for which the FDA issued a Complete Response Letter in June 2018. The failure to obtain approval for the BSI indication for ZEMDRI may adversely impact the commercial uptake of ZEMDRI by healthcare professionals. For the fiscal year ended December 31, 2018, we recognized $0.8 million in net product revenue from sales of ZEMDRI.

Clinical drug development involves a lengthy and expensive process with uncertain outcomes that may lead to delayed timelines and increased cost, and may prevent us from being able to complete clinical trials.

Clinical testing is expensive, can take many years to complete, and its outcome and timeline are inherently uncertain. The results of preclinical and clinical studies of our product candidates may not be predictive of the results of later-stage clinical trials. Product candidates in later stages of clinical trials may fail to show the desired safety and efficacy despite having progressed through preclinical studies and initial clinical trials. A number of companies in the pharmaceutical industry have suffered significant setbacks in advanced clinical trials due to lack of efficacy or adverse safety profiles, notwithstanding promising results in earlier studies, and we cannot be certain that we will not face similar setbacks.

We cannot be certain that our future clinical trials for ZEMDRI (if any), C-Scape, or other product candidates, will progress as expected, not need to be redesigned, enroll an adequate number of patients on time or be completed on schedule, if at all, or support continued clinical development of the associated product candidate.

Clinical trials can be delayed, aborted or fail for a variety of reasons, including an inability:

- to obtain regulatory approval to commence a trial in the countries where the trial is to be conducted;
- to successfully initiate a clinical trial, enroll patients, and complete clinical trial activities in foreign countries;
- to recruit and enroll suitable patients to participate in a trial;
- to reach agreement on acceptable terms with prospective contract research organizations ("CROs") or clinical trial sites, the terms of which can be subject to extensive negotiation and may vary significantly among different CROs and trial sites;

- to obtain institutional review board ("IRB") approval at each site;
- to have patients complete a trial or return for post-treatment follow-up;
- to obtain a sufficient number of clinical sites to participate in a trial and adhere to trial protocols;
- to address any patient safety concerns that arise during the course of a trial;
- to address any conflicts with new or existing laws or regulations;
- to manufacture sufficient quantities of product supply for use in clinical trials; or
- to ensure clinical trial sites comply with Good Clinical Practice ("GCP") guidelines.

Enrollment delays in our clinical trials may result in increased development costs for our product candidates, slow down or halt our product development and approval processes, and jeopardize our ability to commence product sales and generate revenue, which would cause the value of our company to decline and limit our ability to obtain additional financing if needed. Patient enrollment in clinical trials is a function of many factors, including: the nature of clinical trial protocols, existence of competing protocols or treatments (if any), the size and longevity of the target patient population, proximity of patients to clinical sites and eligibility criteria for the clinical trials. Although we will continue to look for opportunities for faster regulatory approvals, we cannot guarantee that additional opportunities will arise, that the FDA or other regulatory authorities will agree with any additional proposals we make or that such additional proposals, even if approved, will be successful.

We could also encounter delays if a clinical trial is suspended or terminated by us upon recommendation of the data monitoring committee for such trial, by the IRBs of the institutions in which such trials are being conducted, or by the FDA or other regulatory authorities. Such authorities may suspend or terminate a clinical trial due to a number of factors, including failure to conduct the clinical trial in accordance with regulatory requirements or our clinical protocols, inspection of the clinical trial operations or trial site by the FDA or other regulatory authorities resulting in the imposition of a clinical hold, unforeseen safety issues or adverse side effects, failure to demonstrate a benefit from using a drug, changes in governmental regulations or administrative actions, or lack of adequate funding to continue the clinical trial.

If we experience delays in the completion of, or termination of, any clinical trial of our product candidates, the commercial prospects of our product candidates may be harmed, and our ability to generate revenue from the sale of any of these product candidates will be delayed. In addition, any delays in completing our clinical trials will increase our costs, slow down our product candidate development and approval processes, and jeopardize our ability to commence product sales and generate revenue. Any of these occurrences may significantly harm our business, financial condition and prospects.

Failure to ensure that a plazomicin IVD assay or related diagnostic is generally available could harm our commercialization strategy for ZEMDRI.

An important element of our commercialization strategy for ZEMDRI is the availability of IVD assays or related diagnostics to support the Therapeutic Drug Management ("TDM") of certain patients dosed with ZEMDRI. The plazomicin IVD assay is intended to measure levels of plazomicin in the blood so such patients can receive safe and efficacious doses of ZEMDRI. There are currently two assays for plazomicin that are commercially available. Even once assays are commercially available, there are regulatory bases for them to be withdrawn or limited in use.

Should an IVD assay or related diagnostic not be available generally, it could impact our ability to successfully commercialize ZEMDRI for the treatment of certain patients. Moreover, IVD assays may not be readily available or economically feasible in all territories where ZEMDRI could ultimately be commercialized. Failure to have an IVD assay generally available for ZEMDRI could impact our ability to optimize commercialization of ZEMDRI.

If the FDA does not conclude that our product candidate, C-Scape, satisfies the requirements for the 505(b)(2) regulatory approval pathway, or if the requirements for approval under Section 505(b)(2) are not as we expect,

35

the approval pathway for C-Scape will likely take significantly longer, cost significantly more and encounter significantly greater complications and risks than anticipated, and in any case may not be successful.

We may pursue clinical trials and, if successful, seek FDA approval through the 505(b)(2) regulatory pathway for our product candidate, C-Scape, which is a combination of two previously FDA-approved drugs. The Drug Price Competition and Patent Term Restoration Act of 1984, also known as the Hatch-Waxman Act, added Section 505(b)(2) to the Federal Food, Drug and Cosmetic Act, (the "FDCA"). Section 505(b)(2) permits the filing of an NDA where at least some of the information required for approval comes from studies that were not conducted by or for the applicant and for which the applicant has not obtained a right of reference. If the FDA does not allow us to pursue the 505(b)(2) regulatory pathway for C-Scape as anticipated, we may need to conduct additional clinical trials beyond our current expectations, provide additional data and information and meet additional standards for regulatory approval. If this were to occur, the time and financial resources required to obtain FDA approval for C-Scape would likely substantially increase. Moreover, the inability to pursue the 505(b)(2) regulatory pathway could result in new competitive products reaching the market faster than C-Scape, which could materially adversely impact our competitive position and prospects. Even if we are allowed to pursue the 505(b)(2) regulatory pathway for C-Scape, we cannot assure you that we will receive the requisite or timely approvals for commercialization of such product candidate. In addition, it is possible competitors or others will file citizens' petitions with the FDA in an attempt to persuade the FDA that C-Scape, or the clinical studies that support their approval, contain deficiencies. Such actions by our competitors or others could delay or even prevent the FDA from approving any NDA that we submit under Section 505(b)(2).

If we fail to demonstrate the safety and efficacy of product candidates that we develop to the satisfaction of the FDA or comparable foreign regulatory authorities, we may incur additional costs or experience delays in completing, or ultimately be unable to complete, the development and commercialization of such product candidates. This would adversely impact our ability to generate revenue, our business and our results of operations.

We are not permitted to commercialize, market, promote, or sell any product candidate in the United States without obtaining marketing approval from the FDA or in other countries without obtaining approvals from comparable foreign regulatory authorities, such as the EMA. To gain approval to market a product candidate, we must complete extensive preclinical development and clinical trials that demonstrate the safety and efficacy of the product for the intended indication to the satisfaction of the FDA or other regulatory authority.

In June 2018, we obtained approval from the FDA for the treatment of cUTI, including pyelonephritis, with ZEMDRI. We submitted a Marketing Authorization Application to the EMA in October of 2018. We cannot be certain that ZEMDRI will receive regulatory approval from the EMA and any other foreign regulatory authorities in a timely manner, or at all. Even if we successfully obtain regulatory approval to market ZEMDRI outside the United States, our revenue from this approval will be dependent, in part, upon our or a commercial partner's ability to obtain regulatory clearance or approval of an IVD assay or related diagnostic to be used with ZEMDRI outside the United States, as well as upon the size of the markets in the territories for which we gain regulatory approval and have commercial rights. Moreover, we cannot be certain that any product candidates other than ZEMDRI, such as C-Scape, will receive regulatory approval from the FDA, EMA and other foreign regulatory authorities in a timely manner, or at all.

The FDA, EMA or any other foreign regulatory authorities can delay, limit, or deny approval of our product candidates for many reasons, including:

- our inability to demonstrate to the satisfaction of the FDA or the applicable foreign regulatory agency that the product candidate is safe and effective for the requested indication;
-

- the FDA's or the applicable foreign regulatory agency's disagreement with the interpretation of data from preclinical studies or clinical trials;
- our inability to demonstrate that the clinical and other benefits of the product candidate outweigh any safety or other perceived risks;
- the FDA's or the applicable foreign regulatory agency's requirement for additional preclinical or clinical studies;

- the FDA's or the applicable foreign regulatory agency's non-approval of the formulation, labeling or the specifications of the product candidate;
- the FDA's or the applicable foreign regulatory agency's failure to approve the manufacturing processes or facilities of third-party manufacturers with which we contract;
    - the potential for approval policies or regulations of the FDA or the applicable foreign regulatory agencies to significantly change in a manner rendering our clinical data insufficient for approval; or
- failure to adequately demonstrate study conduct oversight, ensure data integrity, and that clinical study sites complied with the principles of Good Clinical Practice, such that we do not pass pre-approval inspections by the FDA or other foreign regulatory agencies.

Even if we receive approval of an NDA or foreign regulatory filing for product candidates, the FDA or the applicable foreign regulatory agency may grant approval contingent on the performance of costly additional clinical trials which may be required after approval. The FDA or the applicable foreign regulatory agency also may approve ZEMDRI for a more limited indication or a narrower patient population than we originally requested, and the FDA, or applicable foreign regulatory agency, may not approve the labeling that we believe is necessary or desirable for the successful commercialization of the product candidate. Any delay in obtaining, or inability to obtain, applicable regulatory approval would delay or prevent commercialization of the product candidates and would materially adversely impact our business and prospects.

ZEMDRI may cause undesirable side effects. Serious adverse events or other unexpected properties of ZEMDRI and our product candidates may be identified during development or after approval that could delay, prevent or cause the withdrawal of regulatory approval, limit the commercial potential, or result in significant negative consequences following marketing approval.

ZEMDRI includes a boxed warning about its use. Serious adverse events or undesirable side effects caused by, or other unexpected properties of, our product and product candidates could result in a more restrictive label, the imposition of distribution or use restrictions or the delay or denial of regulatory approval by the FDA or comparable foreign regulatory authorities. If ZEMDRI or any of our product candidates are associated with serious adverse events or undesirable side effects or have properties that are unexpected, we may need to abandon their sale or development or limit sales or development to certain uses or subpopulations in which the undesirable side effects or other characteristics are less prevalent, less severe or more acceptable from a risk-benefit perspective. Many compounds that initially showed promise in clinical or earlier stage testing have later been found to cause undesirable or unexpected side effects that prevented further development of the compound.

Undesirable side effects or other unexpected adverse events or properties of ZEMDRI or any of our other product candidates could arise or become known either during clinical development or, if approved, after the approved product has been marketed. If such an event occurs during development, our 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, ZEMDRI or our other product candidates. If such an event occurs after ZEMDRI or such other product candidates are approved, a number of potentially significant negative consequences may result, including:

- regulatory authorities may withdraw the approval of such product;
- regulatory authorities may require additional warnings on the label or impose distribution or use restrictions;
- regulatory authorities may require one or more post-market studies;
- we may be required to create a medication guide outlining the risks of such side effects for distribution to patients;
- we could be sued and held liable for harm caused to patients;

- healthcare providers may choose to treat patients with other drugs; and
- our reputation may suffer.

Any of these events could prevent us from achieving or maintaining market acceptance of the affected product candidate, if approved, or could substantially increase commercialization costs and expenses, which could delay or prevent us from generating revenue from the sale of our products and harm our business and results of operations.

We cannot predict to what extent bacteria may develop resistance to ZEMDRI, C-Scape, or other product candidates, or how resistance could spread, which could affect the revenue potential for these products.

We developed ZEMDRI and are developing C-Scape and other product candidates to treat multi-drug resistant ("MDR") infections. The bacteria responsible for these infections evolve quickly and readily transfer their resistance mechanisms within and between species. Furthermore, some resistance to ZEMDRI and C-Scape already exists and we cannot predict how the prevalence of bacterial resistance to ZEMDRI and C-Scape will change over time.

As with some other commercially available aminoglycosides, ZEMDRI is not active against organisms expressing a resistance mechanism known as ribosomal methyltransferase. Although occurrence of this resistance mechanism among CRE varies regionally and is currently rare in the United States, there have been isolated cases of infections by bacteria carrying ribosomal methyltransferase in the United States. We cannot predict whether ribosomal methyltransferase will become widespread in regions where we intend to market ZEMDRI if it is approved. The growth of MDR infections in community settings or in countries with poor public health infrastructures, or the potential use of ZEMDRI outside of controlled hospital settings, could contribute to the rise of ZEMDRI resistance. If resistance to ZEMDRI becomes prevalent, our ability to generate revenue from ZEMDRI could suffer. If resistance to C-Scape and other product candidates becomes prevalent, our ability to generate revenue from them, if approved, could similarly suffer.

We may become dependent on our partners, including but not limited to Thermo Fisher, to commercialize IVD or related assays.

We have entered into a collaboration with Thermo Fisher for the commercialization of a plazomicin IVD assay. We may be dependent on Thermo Fisher with respect to such manufacturing and supply and with respect to commercialization in the United States and EU. This reduces our control over these activities but would not relieve us of our responsibility to ensure compliance with all required legal, regulatory and scientific standards with respect to ZEMDRI.

We or Thermo Fisher may encounter difficulties in developing an assay for commercial application in one or more countries, including issues in relation to regulatory approval, automation, selectivity/specificity, analytical validation, reproducibility, or clinical validation of such assay. If Thermo Fisher does not perform its contractual duties or obligations, experiences work stoppages, does not meet expected deadlines, terminates its agreements with us or needs to be replaced, or if they otherwise do not meet our expectations for manufacture or commercialization of the assay, we may need to enter into new arrangements with one or more alternative third parties for development, manufacture or commercialization of the assay or an alternative assay. We may not be able to do so on commercially reasonably terms, or within the terms of the commercialization agreement without amending such terms, or at all, which could adversely impact our business and results of operations related to ZEMDRI.

Even if a product candidate does obtain regulatory approval it may never achieve market acceptance by physicians, patients, hospitals, third-party payors and others in the medical community necessary for commercial success and the market opportunity may be smaller than we estimate.

Even though we have obtained FDA approval for ZEMDRI and even if we obtain FDA or other regulatory approvals and are able to launch other product candidates commercially, our products or product candidates may not achieve market acceptance among physicians, patients, hospitals (including pharmacy directors) and third-party payors and, ultimately, may not be commercially successful. Market acceptance and market opportunity of any product candidate for which we receive approval depends on a number of factors, including:

- the efficacy and safety of the product candidate as demonstrated in clinical trials;
- relative convenience and ease of administration;
- the clinical indications for which the product candidate is approved;
- the potential and perceived advantages and disadvantages of the product candidates, including cost and clinical benefit relative to alternative treatments;
- the willingness of physicians to prescribe the product;
- the willingness of hospital pharmacy directors to purchase our products for their formularies;
- acceptance by physicians, operators of hospitals and treatment facilities and parties responsible for reimbursement of the product;
- the availability of adequate coverage and reimbursement by third-party payors and government authorities;
- the effectiveness of sales and marketing efforts, including the effectiveness of the sales and marketing efforts of any collaboration partners, if any;
- the strength of our marketing and distribution support, including the strength of marketing and distribution support of any collaboration partners, if any;
- limitations or warnings, including distribution or use restrictions, contained in the product's approved labeling or an approved risk evaluation and mitigation strategy;
- whether and how the product is designated under physician treatment guidelines for particular infections;
- continued development of MDR infections such as CRE;
- the approval of other new products for the same indications;
- the timing of market introduction of the approved product as well as competitive products;
- adverse publicity about the product or favorable publicity about competitive products;
- the emergence of bacterial resistance to the product candidate; and
- the rate at which resistance to other drugs in the target infections grow.

Any failure by ZEMDRI or any product candidate that obtains regulatory approval to achieve market acceptance or commercial success would adversely affect our business prospects.

The availability of adequate third-party coverage and reimbursement for approved products is uncertain, and failure to obtain adequate coverage and reimbursement from government and other third-party payors could impede our ability to market any future products we may develop and could limit our ability to generate revenue.

There is significant uncertainty related to the third-party payor coverage and reimbursement of newly approved medical products. In addition, there is uncertainty for continued levels of reimbursement for any medical products in consideration of competition, issues concerning the global healthcare infrastructure and other issues that may be beyond our control. The commercial success of ZEMDRI and our future products in both domestic and international markets depends on whether third-party coverage and reimbursement is available and ongoing for such products. Governmental payors, including Medicare and Medicaid, health maintenance organizations and other third-party payors are increasingly attempting to manage their healthcare expenditures by limiting both coverage and the level of reimbursement of new drugs and biologics and, as a result, they may not cover or provide adequate reimbursement for ZEMDRI, our future products or related diagnostics. These payors may not view ZEMDRI or our future products as cost-effective, and coverage and reimbursement may not be available to our customers or may not be sufficient to allow our future products to be marketed on a competitive basis.

Third-party payors are exerting increasing influence on decisions regarding the use of, and coverage and reimbursement levels for, particular treatments. Such third-party payors, including Medicare, are challenging the prices charged for medical products and services, and many third-party payors limit or delay coverage and reimbursement for newly approved healthcare products. In particular, third-party payors may limit the covered indications. Cost-control initiatives could cause us to decrease the price we might establish for products, which could result in lower than anticipated revenue from the sale of ZEMDRI or our product candidates. If we decrease the prices for ZEMDRI or our product candidates or are unable to occasionally increase prices because of competitive pressures or if governmental and other third-party payors do not provide adequate coverage or reimbursement, our prospects for revenue and profitability will suffer.

In addition, to the extent that ZEMDRI or our product candidates will be used in a hospital inpatient setting, hospitals often receive fixed reimbursement for all of a patient's care, including the cost of our drug products and IVD assay, based on the patient's diagnosis. For example, Medicare reimbursement for hospital inpatient stays is generally made under a prospective payment system that is determined by a classification system known as the Medicare severity diagnosis-related groups. Our patients' access to adequate coverage and reimbursement by government and private insurance plans is central to the acceptance of ZEMDRI and our future products. We may be unable to sell ZEMDRI and our future products on a profitable basis if third-party payors reduce their current levels of payment, or if our costs of production increase faster than increases in reimbursement levels.

We developed ZEMDRI for the treatment of serious bacterial infections due to MDR Enterobacteriaceae, which constitutes a growing but relatively small patient population. Antibiotics have historically been marketed towards broad patient populations at relatively low prices. Based on the high unmet medical need in the treatment of these infections and the high costs of treating antibiotic resistant infections, we are targeting value-based pricing for ZEMDRI. If hospitals or governmental or other third-party payors do not view the benefits of ZEMDRI as worth the cost, we will be unable to achieve our pricing and reimbursement objectives and our prospects for revenue and profitability will suffer.

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

We rely on medical institutions, clinical investigators, contract laboratories and other third parties, such as CROs, to conduct our preclinical studies and clinical trials on our product candidates in compliance with applicable regulatory

requirements. These third parties are not our employees and, except for restrictions imposed by our contracts with such third parties, we have limited ability to control the amount or timing of resources that they devote to our programs. These third parties are located around the world and many of them are outside the United States. Although we rely on these third parties to conduct our preclinical studies and clinical trials, we remain responsible for ensuring that each of our preclinical studies and clinical trials is conducted in accordance with its investigational plan and protocol and the applicable legal, regulatory, and scientific standards, and our reliance on these third parties does not relieve us of our regulatory responsibilities, including with respect to FDA inspections. The FDA and regulatory authorities in other jurisdictions require us to comply with regulations and standards,

commonly referred to as current good clinical practices ("cGCPs"), for conducting, monitoring, recording and reporting the results of clinical trials, in order to ensure that the data and results are scientifically credible and accurate and that the trial subjects are adequately informed of the potential risks of participating in clinical trials. If we or any of our third-party contractors fail to comply with applicable cGCPs, the clinical data generated in our clinical trials may be deemed unreliable and the FDA or comparable foreign regulatory authorities may require us to perform additional clinical trials before approving our marketing applications. In addition, we are required to report certain financial interests of our third-party investigators if these relationships exceed certain financial thresholds and meet other criteria. The FDA or comparable foreign regulatory authorities may question the integrity of the data from those clinical trials conducted by principal investigators who previously served or currently serve as scientific advisors or consultants to us from time to time and receive cash compensation in connection with such services. Our clinical trials must also generally be conducted with products produced under current good manufacturing practice ("cGMP") regulations. Our failure to comply with these regulations may require us to repeat clinical trials, which would delay the regulatory approval process.

Many of the third parties with whom we contract may also have relationships with other commercial entities, some of which may compete with us. If the third parties conducting our preclinical studies or our clinical trials do not perform their contractual duties or obligations or comply with regulatory requirements we may need to enter into new arrangements with alternative third parties. This could be costly, and our preclinical studies or clinical trials may need to be extended, delayed, terminated or repeated, and we may not be able to obtain regulatory approval in a timely fashion, or at all, for the applicable product candidate, or to commercialize such product candidate being tested in such studies or trials. If any of our relationships with these third parties terminate, we may not be able to enter into arrangements with alternative third-party contractors or to do so on commercially reasonable terms. Though we carefully manage our relationships with our CROs, there can be no assurance that we will not encounter similar challenges or delays in the future or that these delays or challenges will not have a material adverse impact on our business, financial condition and prospects.

We rely on third-party contract manufacturing organizations to manufacture and supply ZEMDRI and C-Scape, for us, as well as certain raw materials and other ingredients used in the production thereof. If one of our suppliers or manufacturers fails to perform adequately we may be required to incur significant delays and costs to find new suppliers or manufacturers.

We currently have limited experience in, and we do not own facilities for, manufacturing our product candidates, including ZEMDRI and C-Scape. We rely upon third-party manufacturing organizations to manufacture and supply our product candidates and certain raw materials and other ingredients used in the production thereof. Some of our key components for the production of ZEMDRI have a limited number of suppliers. In particular, sisomicin, the aminoglycoside precursor for ZEMDRI, is supplied by a single manufacturer in China for which we do not have a commercial supply agreement.

The facilities used by our contract manufacturers to manufacture ZEMDRI and our product candidates must be approved by the FDA pursuant to inspections that will be conducted after we submit an NDA to the FDA. We do not control the manufacturing process of, and are completely dependent on, our contract manufacturing partners for compliance with cGMP regulations for manufacture of ZEMDRI and our product candidates. If any of our contract manufacturers cannot successfully manufacture material that conforms to our specifications and the strict regulatory requirements of the FDA or others, they may not be able to secure and/or maintain regulatory approval for their manufacturing facilities. If any of our contract manufacturers receive warning letters or other notices of violations from the FDA or other regulatory authorities, they may be unable to address the issues raised in such warnings or notices in a timely basis, or at all. This could cause a delay or inability to supply materials or services on a timely basis, or at all. There could also be a delay if we are required to seek additional or backup sources for any aspects of the manufacturing process. In addition, we have no control over the ability of our contract manufacturers to maintain

adequate quality control, quality assurance and qualified personnel. If the FDA or a comparable foreign regulatory authority does not approve these facilities for the manufacture of our product candidates or if it delays or withdraws any such approval in the future, we may need to find alternative manufacturing facilities, which would significantly impact our ability to develop, obtain and maintain regulatory approval for or market our product and product candidates, if approved.

Our third-party suppliers may not be able to meet our supply needs or timelines and this may negatively affect our business. A majority of the manufacturing process is operated internationally, and therefore may be subject to

similar risks of the sort described by the risk factor entitled “A variety of risks associated with international operations could materially adversely affect our business.”

The failure of third-party manufacturers or suppliers to perform adequately or the termination of our arrangements with any of them may adversely affect our business.

A variety of risks associated with international operations could materially adversely affect our business.

Certain existing suppliers we use are located outside of the United States, including our sole source supplier for sisomicin, a key raw material for the production of ZEMDRI, which is located in China, and for which we do not have a commercial supply agreement. Additionally, if ZEMDRI is approved for commercialization outside the United States, we will likely seek to enter into agreements with third parties to market ZEMDRI outside the United States. Our product candidates are also likely to rely upon certain suppliers and other third parties outside the United States. We are, or we expect that we will be, subject to additional risks related to these international business relationships, including:

- different regulatory requirements for drug approvals in foreign countries;
- differing U.S. and foreign drug import and export costs and rules;
- reduced protection for intellectual property rights in certain foreign countries;
- unexpected changes in tariffs, trade barriers and regulatory requirements;
- different reimbursement systems;
- economic weakness, including inflation, or political instability in particular foreign economies and markets;
- compliance with tax, employment, immigration and labor laws for employees living or traveling abroad;
- foreign currency fluctuations, which could result in increased operating expenses and reduced revenue, and other obligations incident to doing business in another country;
- potential liability resulting from development work conducted by these third parties; and
- business interruptions resulting from geopolitical events, including war and terrorism, or natural disasters.

If the testing or use of ZEMDRI or our product candidates harms people or is perceived to harm them even when such harm is unrelated to our product or product candidates, we may be subject to costly and damaging product liability claims that may not be fully covered by our insurance.

Because we have a commercialized product, ZEMDRI, and because we conduct clinical trials with human patients as part of our business for product and product candidates, we face the risk that the use of our products and product candidates may cause harm or adverse side effects to patients. The FDA-approved label for ZEMDRI contains a boxed warning about its risks related to nephrotoxicity, ototoxicity, neuromuscular blockade and fetal harm. There are additional warnings, precautions and contraindications in our FDA-approved label as well. As only limited clinical safety and efficacy data for ZEMDRI are currently available, ZEMDRI is labeled to be reserved for use in cUTI patients who have limited or no alternative treatment options. Although we have product liability insurance, our insurance may be insufficient to reimburse us for any expenses or losses we may suffer. We do not know whether we will be able to continue to obtain product liability coverage and obtain expanded coverage if we require it, on acceptable terms, if at all. We may not have sufficient resources to pay for any liabilities resulting from a claim excluded from, or beyond the limits of, our insurance coverage. Where we have provided indemnities in favor of third parties under our agreements with them, there is also a risk that these third parties could incur liability and bring a claim under such indemnities. An individual may bring a product liability claim against us alleging that one of our product candidates or products causes, or is claimed to have caused, an injury or is found to be unsuitable for consumer use. Any product liability claim brought against us, with or without merit, could result in:

- withdrawal of clinical trial volunteers, investigators, patients or trial sites;
- the inability to commercialize our product candidates;
- decreased demand for our product candidates;
- regulatory investigations that could require costly recalls or product modifications;
- loss of revenue;
- substantial costs of litigation;
- liabilities that substantially exceed our product liability insurance, which we would then be required to pay ourselves;
- an increase in our product liability insurance rates or the inability to maintain insurance coverage in the future on acceptable terms, if at all;
- the diversion of management’s attention from our business; and
- damage to our reputation and the reputation of our products.

Product liability claims may subject us to the foregoing and other risks, which could have a material adverse effect on our business, results of operations, financial condition and prospects.

If an effective distribution process is not maintained for ZEMDRI and any associated IVD assays, which includes cold-chain logistics, our business may be adversely affected.

We do not currently have our own infrastructure necessary for distributing pharmaceutical products to patients. We have contracted with a third-party logistics company to warehouse and distribute ZEMDRI, and we require ZEMDRI to be maintained at a controlled temperature for some of the distribution chain. Similarly, Thermo Fisher and others will be responsible for warehousing and distributing an IVD assay associated with ZEMDRI, which will also require cold-chain logistics. If we or Thermo Fisher are unable to effectively manage the distribution process of ZEMDRI or an associated IVD assay, sales of ZEMDRI and an associated IVD assay may be severely compromised and our results of operations may be harmed.

In addition, the use of third-party distributors, including with respect to cold-chain logistics for ZEMDRI and an associated IVD assay, involves certain risks, including, but not limited to, risks that distributors or pharmacies will:

- not provide us with accurate or timely information regarding their inventories, the number of patients who are using ZEMDRI or the IVD assay, or complaints regarding them;
- not effectively sell or support ZEMDRI or an associated IVD assay with sufficient cold storage;
- reduce their efforts or discontinue to sell or support ZEMDRI or the IVD assay;
- not devote the resources necessary to sell ZEMDRI or the IVD assay in the volumes and within the time frames that we expect;
- fail to comply with applicable laws and regulatory requirements;
- be unable to satisfy financial obligations to us or others; or
- cease operations.

Currently cold-chain logistics are required for ZEMDRI. If we do not effectively maintain our cold-chain supply logistics, then we may experience an unusual number of product returns or out of date product. Any such failure may result in decreased product sales and lower product revenue, which would harm our business. If cold chain logistics are required for IVD assays associated with ZEMDRI, failure to maintain such logistics may also result in decreased sales and lower product revenues of ZEMDRI.

If we are unable to develop an adequate sales and marketing and distribution capability on our own or through third parties for commercializing ZEMDRI and our candidates outside the United States, we will not be successful in commercializing ZEMDRI and our future products outside the United States.

We currently seek to collaborate with companies that can provide a commercial presence and experience in targeted geographic markets outside of the United States for the commercialization of ZEMDRI, if approved. If we rely on third parties for selling, marketing and distributing our approved products outside the United States, any revenue we receive outside the United States will depend upon the efforts of third parties, which may not be successful and are only partially within our control, and our product revenue may be lower than if we directly sold or marketed our products. If we are unable to enter into arrangements with third parties to sell, market and distribute products for which we have received regulatory approval outside the United States on acceptable terms or at all, we will need to market these products ourselves. This is likely to be expensive and logistically difficult, as it would require us to build our own sales, marketing and distribution capacity outside the United States. We have no historical operations in this area, and if such efforts were necessary, we may not be able to successfully commercialize our future products. If we are not successful in commercializing our future products outside the United States, either on our own or through third parties, any future product revenue from product sales outside the United States will be materially and adversely affected, which would harm our business.

We face substantial competition and our competitors may discover, develop or commercialize products faster or more successfully than us.

The development and commercialization of new drug products is highly competitive. We face competition from major pharmaceutical companies, specialty pharmaceutical companies and biotechnology companies worldwide with respect to ZEMDRI and our product candidates that we may seek to develop or commercialize in the future. There are a number of pharmaceutical and biotechnology companies that currently market and sell products or are pursuing the development of product candidates for the treatment of MDR infections. Potential competitors also include academic institutions, government agencies and other public and private research organizations. Our competitors may succeed in developing, acquiring or licensing technologies and drug products that are more effective, safer or less costly than ZEMDRI or our product candidates that we are currently developing or that we may develop, which could render ZEMDRI and our product candidates obsolete and noncompetitive.

44

There are a variety of available therapies marketed for the treatment of MDR infections that we would expect could compete with ZEMDRI, including but not limited to Avycaz® (ceftazadime/avibactam), which is marketed by Allergan plc in the United States and marketed by Pfizer outside the United States, Vabomere™ (meropenem/vaborbactam), which is marketed by Melinta Therapeutics, Zerbaxa™ (ceftolozane/tazobactam) which is marketed by Merck, meropenem marketed by Pfizer as Merrem®, ertapenem which is marketed by Merck at Envanz™, Xerava™ (eravacycline), which is marketed by Tetraphase Pharmaceuticals, Inc., other aminoglycosides that are generically available (such as gentamicin, amikacin, tobramycin), and polymixins that are generically available (colistin and polymixin B). Many of the available therapies are well-established and widely accepted by physicians, patients and third-party payors. Insurers and other third-party payors may also encourage the use of generic products.

There are also a number of products in late-stage clinical development by third parties to treat MDR gram-negative infections. Merck & Co., Inc. is developing imipenem/relebactam for certain life-threatening infections caused by MDR strains, including infections due to metallo-beta-lactamase producing gram-negative pathogens. Nabriva Therapeutics plc is developing Contepo™ (intravenous fosfomycin) for cUTI. Shionogi is developing cefiderocol for carbapenem-resistant gram-negative pathogens. Allergan plc and Pfizer Inc. are developing aztreonam/avibactam for infections caused by MDR strains. Iterum is developing sulopenem for uUTI and cUTI and Spero Therapeutics is developing tebipenem for cUTI. We may also eventually face competition from products in earlier development stage. If our competitors obtain marketing approval from the FDA or comparable foreign regulatory authorities for their product candidates more rapidly than us, it could result in our competitors establishing a strong market position before we are able to enter the market.

In July 2012, the Food and Drug Administration Safety and Innovation Act was passed, which included the Generating Antibiotics Incentives Now (“GAIN”) Act. The GAIN Act provides incentives for the development of new, qualified infectious disease products, including adding five years to the otherwise applicable regulatory exclusivity period. The incentives provided under the GAIN Act, along with government contract funding and other incentives for antibiotic research, may result in more competition in the market for new antibiotics.

In addition to the GAIN Act, the 21st Century Cures Act was signed into law in December 2016. This act establishes a new mechanism to help streamline the development programs for certain antibacterial and antifungal drugs that are intended to treat serious or potentially fatal infections in limited populations of patients where unmet need exists due to lack of available therapies. This mechanism, referred to as the limited population pathway for certain antibacterial and antifungal drugs, would permit FDA to rely on data primarily targeting these limited populations and approve such drugs for limited patient populations, notwithstanding a lack of evidence to fully establish a favorable benefit-risk profile in a population that is broader than the intended limited population. The statement “Limited Population” would appear prominently next to the drug’s name in labeling, which would provide notice to healthcare providers that the drug is indicated for use in a limited and specific population of patients. The limited population statement, additional labeling statements describing the data, and FDA review of promotional materials, are intended to help assure these drugs are used narrowly to treat these serious and life-threatening infections while additional evidence is generated to assess safety and effectiveness for broader use. The 21st Century Cures Act also provides a mechanism to establish, update, and communicate susceptibility test interpretive criteria for antimicrobial drugs. Although the 21st Century Cures Act and other contemplated acts in this space may help or support us, they also increase competition in the market for antimicrobials and provide incentives for the potential of new competitors in this disease area.

Many of our competitors have materially greater name recognition and financial, manufacturing, marketing, research and drug development resources than we do. Additional mergers and acquisitions in the biotechnology and pharmaceutical industries may result in even more resources being concentrated in our competitors. Large pharmaceutical companies in particular have extensive expertise in preclinical and clinical testing and in obtaining

regulatory approvals for drugs. In addition, academic institutions, government agencies, and other public and private organizations conducting research may seek patent protection with respect to potentially competitive products or technologies. These organizations may also establish exclusive collaborative or licensing relationships with our competitors.

Finally, the success of any product that is successfully commercialized will depend in large part on our ability to prevent competitors from launching a generic version that would compete with such product. If such competitors are able to establish that our patents are invalid or not infringed by the generic version of our product, they may be

able to launch a generic product prior to the expected expiration of our relevant patents, and any generic competition could have a material adverse effect on our business, results of operations, financial condition and prospects.

We may also attempt to form collaborations in the future with respect to ZEMDRI and our technology and product candidates, but we may not be able to do so, which may cause us to alter our development and commercialization plans.

We may form strategic alliances, create joint ventures or collaborations or enter into licensing arrangements with third parties with respect to our programs that we believe will complement or augment our existing business. We face significant competition in seeking appropriate strategic partners, and the negotiation process to secure appropriate terms is time-consuming and complex. We may not be successful in our efforts to establish strategic partnerships for ZEMDRI or our product candidates and programs on terms that are acceptable to us, or at all.

Any delays in identifying suitable collaborators and entering into agreements to develop or commercialize our products or product candidates could negatively impact the development or commercialization of our products or product candidates in geographic regions where we do not have development and commercialization infrastructure. Absent a collaboration partner for the commercialization of ZEMDRI or for our product candidates, we would need to undertake development or commercialization activities at our own expense. If we elect to fund and undertake development or commercialization activities on our own, we may need to obtain additional expertise and additional capital, which may not be available to us on acceptable terms or at all. If we are unable to do so, we may not be able to develop our products or product candidates or bring them to market within or outside of the United States in a timely manner or at all and our business may be materially and adversely affected.

We may be unable to realize the potential benefits of any collaboration.

Even if we are successful in entering into a collaboration with respect to the development or commercialization of one or more products or product candidates, there is no guarantee that the collaboration will be successful. Collaborations may pose a number of risks, including:

- collaborators often have significant discretion in determining the efforts and resources that they will apply to the collaboration, and may not commit sufficient resources to the development, marketing or commercialization of the product or products that are subject to the collaboration;
- collaborators may not perform their obligations as expected;
- collaborators may cease to devote resources to the development or commercialization of our products or product candidates if the collaborators view our products or product candidates as competitive with their own products or product candidates;
- disagreements with collaborators, including disagreements over proprietary rights, contract interpretation or the course of development, might cause delays or termination of the development or commercialization of product candidates, and might result in legal proceedings, which would be time-consuming, distracting and expensive;
- collaborators may be impacted by changes in their strategic focus or available funding, or business combinations involving them, which could cause them to divert resources away from the collaboration;
- collaborators may infringe the intellectual property rights of third parties, which may expose us to litigation and potential liability;
- the collaborations may not result in us achieving revenue to justify such transactions; and
- collaborations may be terminated and, if terminated, may result in a need for us to raise additional capital to pursue further development or commercialization of the applicable product or product candidate.

As a result, a collaboration may not result in the successful development or commercialization of our products or product candidates.

46

We are highly dependent on the services of our executive team and our ability to attract and retain qualified personnel.

We may not be able to attract or retain qualified management and scientific and clinical personnel in the future due to the intense competition for qualified personnel among biotechnology, pharmaceutical and other businesses, particularly in the San Francisco Bay Area. We are highly dependent on the principal members of our management and scientific staff, particularly our executive team. If we are not able to retain our executive team or are not able to attract, on acceptable terms, additional qualified personnel necessary for the continued development of our business, we may not be able to sustain our operations or grow. Although we have executed employment agreements with each member of our current executive management team, we may not be able to retain their services as expected. In addition to the competition for personnel, the San Francisco Bay Area in particular is characterized by a high cost of living. We may be required to expend significant financial resources in our employee recruitment and retention efforts, particularly if we file for bankruptcy protection.

In addition, we have scientific and clinical advisors who assist us in formulating our product development and clinical strategies. These advisors are not our employees and may have commitments to, or consulting or advisory contracts with, other entities that may limit their availability to us, or may have arrangements with other companies to assist in the development of products that may compete with ours.

Our ability to attract, retain and motivate necessary personnel may further be challenged by our recent corporate restructurings. These restructurings may make future potential executives and employees wary to accept roles with us.

If we are not able to attract, retain and motivate necessary personnel to accomplish our business objectives, we may experience constraints that will significantly impede the achievement of our development objectives, our ability to raise additional capital and our ability to implement our business strategy.

Our recent corporate restructurings and any similar changes in the future may serve as a significant distraction for our management and employees and may negatively affect our product revenues from ZEMDRI.

We have conducted three significant corporate restructurings since July 2018, including one which commenced on February 28, 2019, which each resulted in the elimination of a significant amount of our workforce. In addition, we may file a voluntary petition for relief under the U.S. Bankruptcy Code, which may result in further restructurings. Such changes, or any other future changes in our executive leadership or in our workforce generally, may disrupt our operations as we assimilate new leadership and potential differing perspectives on our strategic direction and as we adjust to the reallocation of responsibilities among our workforce. If transitions in executive leadership, our workforce or corporate structure are not smooth, the resulting disruption could negatively affect our operations and employees' morale and could impede our ability to attract and retain personnel and execute our strategic plan. In addition, the corporate restructuring and similar changes in the future could lead to legal claims which may be time consuming and expensive to manage. If such costs are substantial, this could significantly harm our financial condition and results of operations. Moreover, the corporate restructurings may negatively affect our product revenues from ZEMDRI as a result of reductions in the number of our employees focused on commercialization of ZEMDRI.

Our business could be negatively affected as a result of a proxy contest or certain other stockholder actions or disputes.

Responding to certain stockholder actions and disputes can be costly, disruptive and time-consuming, and could also impact our ability to attract, retain and motivate our employees. For example, a proxy contest for our annual meeting of stockholders relating to stockholder proposals or director nominees would require significant time and could divert the attention of our management, other employees and our board of directors. In addition, a proxy contest would require us to incur significant costs, including legal fees and proxy solicitation expenses. Any disputes with

stockholders, including stockholder litigation, would similarly be distracting, time consuming and expensive to manage.

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

Our third-party manufacturers' activities and our own activities involve the controlled storage, use and disposal of hazardous materials, including the components of our pharmaceutical products and product candidates, test samples and reagents, biological materials and other hazardous compounds. We and our manufacturers are subject to federal, state, local and foreign laws and regulations governing the use, generation, manufacture, storage, handling and disposal of these hazardous materials. We currently carry no insurance specifically covering environmental claims relating to the use of hazardous materials. Although we believe that our safety procedures for handling and disposing of these materials and waste products comply with the standards prescribed by these laws and regulations, we cannot eliminate the risk of accidental injury or contamination from the use, storage, handling or disposal of hazardous materials. In the event of an accident, state or federal or other applicable authorities may curtail our use of these materials and/or interrupt our business operations. In addition, if an accident or environmental discharge occurs, or if we discover contamination caused by prior operations, including by prior owners and operators of properties we acquire, we could be liable for cleanup obligations, damages and fines. If such unexpected costs are substantial, this could significantly harm our financial condition and results of operations.

Our internal computer systems, or those of our CROs or other contractors or consultants, may fail or suffer security breaches, which could result in a material disruption of our business operations.

Despite the implementation of security measures, our internal computer systems and those of our CROs and other contractors and consultants are vulnerable to damage or disruption from computer viruses, software bugs, unauthorized access, natural disasters, terrorism, war, and telecommunication, equipment and electrical failures. While we have not, to our knowledge, experienced any significant 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 programs. For example, the loss of clinical trial data from completed or ongoing clinical trials for any of our product candidates 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 or theft of confidential or proprietary information, we could incur liability, or adversely affect our business operations and/or financial condition.

We rely significantly on information technology and services that utilize the cloud computing environment and any failure, inadequacy, interruption or security lapse of that technology, including any cybersecurity incidents, could harm our ability to operate our business effectively.

We rely significantly on our information technology to effectively manage and maintain our clinical records, internal infrastructure systems and internal reports. Any failure, inadequacy or interruption of that infrastructure or security lapse of that technology, including cybersecurity incidents, could harm our ability to operate our business effectively. Cybersecurity attacks in particular are evolving and include, but are not limited to, malicious software, attempts to gain unauthorized access to data and other electronic security breaches that could lead to disruptions in systems, misappropriation of our confidential or otherwise protected information and corruption of data. A breach in security, unauthorized access resulting in misappropriation, theft, or sabotage with respect to our proprietary and confidential information, including research or clinical data, could require significant capital investments to remediate and could adversely affect our business, financial condition and results of operations.

Our employees, independent contractors, principal investigators, CROs, consultants and vendors 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, CROs, consultants and vendors may engage in fraudulent or other illegal activity. Misconduct by these parties could include intentional, reckless and/or negligent conduct or disclosure of unauthorized activities to us that violates: (1) FDA regulations, including those laws requiring the reporting of true, complete and accurate information to the FDA; (2) manufacturing standards; (3) federal and state healthcare fraud and abuse laws and regulations; or (4) laws that require the true, complete and accurate reporting of financial information or data. Specifically, sales, marketing and business arrangements in the healthcare industry are subject to extensive laws and regulations intended to prevent fraud, kickbacks, self-dealing and other abusive practices. These laws and regulations may restrict or prohibit a wide range of 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, which could result in regulatory sanctions and serious harm to our reputation. It is not always possible to identify and deter misconduct by our employees and other third parties, and the precautions we take to detect and prevent this activity may not be effective in controlling unknown or unmanaged risks or losses or in protecting us from governmental investigations or other actions or lawsuits stemming from a failure to be in compliance with such laws or regulations. If any such actions are instituted against us, and we are not successful in defending ourselves or asserting our rights, those actions could have a significant impact on our business, including the imposition of civil, criminal and administrative penalties, damages, monetary fines, possible exclusion from participation in Medicare, Medicaid and other federal healthcare programs, 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 results of operations.

We incur significant costs as a result of operating as a public company, and our management devotes substantial time to new compliance initiatives.

Prior to our initial public offering ("IPO") in March 2014, we had not been subject to the reporting requirements of the Exchange Act of 1934, as amended (the "Exchange Act"), or the other rules and regulations of the Securities and Exchange Commission (the "SEC") or any securities exchange relating to public companies. We continue to identify those areas in which changes should be made to our financial and management control systems to manage our growth and our obligations as a public company. These areas include corporate governance, corporate control, disclosure controls and procedures and financial reporting and accounting systems. We have made, and will continue to make, changes in these and other areas. Expenses associated with being a public company are material. Compliance with the various reporting and other requirements applicable to public companies requires considerable time and attention of management. In addition, the changes we make may not be sufficient to allow us to satisfy our obligations as a public company on a timely basis.

In addition, certain types of insurance, including directors' and officers' liability insurance are more expensive as a public company. Being a public company makes it more difficult for us to attract and retain qualified persons to serve on our board of directors, our board committees or as executive officers.

If we are not able to adequately comply with the requirements of Section 404 of the Sarbanes-Oxley Act of 2002, we may be subject to sanctions by regulatory authorities.

Section 404 of the Sarbanes-Oxley Act of 2002 requires that we evaluate and determine the effectiveness of our internal controls over financial reporting and provide a management report on the internal control over financial reporting. If we have a material weakness in our internal controls over financial reporting, as occurred in for the quarter ended June 30, 2017, we may not detect errors on a timely basis and our financial statements may be materially misstated. As of December 31, 2018, our management believes our internal controls were effective, and our independent auditors have attested that the operation of our internal controls was effective as of December 31, 2018; however, there can be no assurance that management and our independent auditors will be able to make similar reports in the future.

If in the future we are not able to comply with the requirements of Section 404 in a timely manner, or if we or our independent registered public accounting firm identifies deficiencies in our internal controls that are deemed to be material weaknesses, as occurred for the quarter ended June 30, 2017, we could be subject to sanctions or investigations by The Nasdaq Stock Market LLC, the SEC or other regulatory authorities, which would entail expenditure of additional financial and management resources and could materially adversely affect our stock price. Deficient internal controls could also cause us to fail to meet our reporting obligations or cause investors to lose confidence in our reported financial information, which could have a negative effect on our stock price.

Our disclosure controls and procedures may not prevent or detect all errors or acts of fraud.

We have designed our disclosure controls and procedures to reasonably assure that information we must disclose in reports we file or submit under the Exchange Act is accumulated and communicated to management, and recorded, processed, summarized and reported within the time periods specified in the rules and forms of the SEC. We believe that any disclosure controls and procedures or internal controls and procedures, no matter how well-conceived and operated, can provide only reasonable, not absolute, assurance that the objectives of the control system are met.

These inherent limitations include the realities that judgments in decision-making can be faulty, and that breakdowns can occur because of simple errors or mistakes. Additionally, controls can be circumvented by the acts of some individuals, by collusion of two or more people or by an unauthorized override of the controls. Accordingly, because of the inherent limitations in our control system, misstatements due to error or fraud may occur and not be detected.

For example, in connection with the preparation of our interim financial statements for the quarter ended June 30, 2017, we identified a material weakness in our internal control over financial reporting related to a design deficiency in our internal controls over the preparation and review of our earnings per share calculation. A material weakness is a deficiency, or a combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of our annual or interim consolidated financial statements will not be prevented or detected and corrected on a timely basis. Specifically, our controls were not adequately designed to ensure that all potentially dilutive securities were accurately reflected in the calculation of our diluted earnings per share.

We implemented a remediation plan to address the underlying causes of the material weakness described above. The remediation plan included:

- Reassessing the design and operation of internal controls over financial reporting, including setting up a model with sufficient detail to ensure that all potentially dilutive securities were accurately reflected in the calculation of our diluted earnings per share;
- Training of accounting personnel to further educate the staff on the accounting of new and ongoing complex and/or technical transactions relevant to us; and
- Increasing staffing levels and expertise to implement this remediation plan.

As of December 31, 2018, our management believes our internal controls were effective, and our independent auditors have attested that the operation of our internal controls was effective as of December 31, 2018, however there can be no assurance that management and our independent auditors will be able to make similar reports in the future. We cannot assure that the measures we took in response to this material weakness are sufficient to avoid potential future material weaknesses.

Additionally, we cannot provide assurance that a similar material weakness will not recur, or that we will be able to conclude on an ongoing basis that we have effective internal control over financial reporting in accordance with Section 404 of the Sarbanes-Oxley Act of 2002 and the related rules and regulations of the SEC when required. If we cannot in the future favorably assess, or our independent registered public accounting firm, when required, is unable to provide an unqualified attestation report on, the effectiveness of our internal control over financial reporting, investor confidence in the reliability of our financial reports may be adversely affected, which could have a material adverse effect on our stock price. In addition, any failure to report our financial results on an accurate and timely basis could result in sanctions, lawsuits, delisting of our shares from The Nasdaq Global Market or other adverse consequences that would materially harm our business.

We or the third parties upon whom we depend may be adversely affected by earthquakes or other natural disasters and our business continuity and disaster recovery plans may not adequately protect us from a serious disaster.

Our corporate headquarters is located in the San Francisco Bay Area, which in the past has experienced severe earthquakes. We do not carry earthquake insurance. Earthquakes or other natural disasters could severely disrupt our operations, and have a material adverse effect on our business, results of operations, financial condition and prospects.

If a natural 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 our information technology systems, or that otherwise disrupted operations, it may be difficult or, in certain cases, impossible for us to continue our business for a substantial

period of time. The disaster recovery and business continuity plans we have in place currently are limited and are unlikely to prove adequate in the event of a serious disaster or similar event. We may incur substantial expenses as a result of the limited nature of our disaster recovery and business continuity plans, which,

particularly when taken together with our lack of earthquake insurance, could have a material adverse effect on our business.

Furthermore, integral parties in our supply chain are geographically concentrated and operating from single sites, increasing their vulnerability to natural disasters or other sudden, unforeseen and severe adverse events. If such an event were to affect our supply chain, it could have a material adverse effect on our business.

Our ability to utilize our net operating loss carryforwards and certain other tax attributes may be limited.

Under Sections 382 and 383 of the Internal Revenue Code of 1986, as amended, if a corporation undergoes an "ownership change" (generally defined as a greater than 50 percentage points change (by value) in the ownership of its equity by certain significant stockholders over a rolling three year period), the corporation's ability to use its pre-change net operating loss carryforwards and certain other pre-change tax attributes to offset its post-change income and taxes may be limited. We may have experienced such ownership changes in the past, and we may experience ownership changes in the future and/or subsequent shifts in our stock ownership, some of which would be outside our control. If our ability to use our net operating losses and other tax attributes is limited by ownership changes, we may be unable to utilize a material portion of our net operating losses and other tax attributes.

Risks Related to Our U.S. Government Contracts and to Certain Grant Agreements

Our use of government funding for certain of our programs adds uncertainty to our research and commercialization efforts with respect to those programs and may impose requirements that increase the costs of commercialization and production of product candidates developed under those government-funded programs.

Our development of products has been funded in significant part through contracts with BARDA. Contracts funded by the U.S. government and its agencies include provisions that reflect the government's substantial rights and remedies, many of which are not typically found in commercial contracts, including powers of the government to:

- terminate agreements, in whole or in part, for any reason or no reason;
- reduce or modify the government's obligations under such agreements without the consent of the other party;
- claim rights, including intellectual property rights, in products and data developed under such agreements;
- audit contract-related costs and fees, including allocated indirect costs;
- suspend the contractor 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 from doing future business with the government;
- control and potentially prohibit the export of products; and
- pursue criminal or civil remedies under the False Claims Act ("FCA"), the False Statements Act and similar remedy provisions specific to government agreements.

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

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

- specialized accounting systems unique to government contracts;
- 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 information, which may enable competitors to gain insights into our research program; and
- mandatory socioeconomic compliance requirements, including labor standards, anti-human-trafficking, non-discrimination, and affirmative action programs and environmental compliance requirements.

If we fail to maintain compliance with these requirements, we may be subject to potential contract or FCA liability and to termination of our contracts.

U.S. government agencies have special contracting requirements that give them the ability to unilaterally control our contracts.

U.S. government contracts typically contain unfavorable termination provisions and are subject to audit and modification by the government at its sole discretion, which will subject us to additional risks. These risks include the ability of the U.S. government to unilaterally:

- audit and object to our BARDA contract-related costs and fees, and require us to reimburse all such costs and fees;
- suspend or prevent us for a set period of time from receiving new contracts or extending our existing contracts based on violations or suspected violations of laws or regulations;
- cancel, terminate or suspend our contracts based on violations or suspected violations of laws or regulations;
- terminate our contracts if in the government's interest, including if funds become unavailable to the applicable governmental agency;
- reduce the scope and value of our contract; and
- change certain terms and conditions in our contract.

The U.S. government will be able to terminate any of its contracts with us, either for convenience or if we default by failing to perform in accordance with or to achieve the milestones set forth in the contract schedules and terms. Termination-for-convenience provisions generally enable us to recover only our costs incurred or committed and settlement expenses on the work completed prior to termination. Except for the amount of services received by the government, termination-for-default provisions do not permit these recoveries and would make us liable for excess costs incurred by the U.S. government in procuring undelivered items from another source.

The U.S. government's determination to award a future contract or contract option may be challenged by an interested party, such as another bidder, at the U.S. Government Accountability Office (the "GAO"), or in federal court. If such a challenge is successful, our BARDA contracts or any future contract we may be awarded may be terminated.

The laws and regulations governing the procurement of goods and services by the U.S. government provide procedures by which other bidders and interested parties may challenge the award of a government contract. If we are awarded a government contract, such challenges or protests could be filed even if there are not any valid legal grounds on which to base the protest. If any such protests are filed, the government agency may decide to suspend our performance under the contract while such protests are being considered by the GAO or the applicable federal court, thus potentially delaying delivery of payment. In addition, we could be forced to expend considerable funds to

defend any potential award. If a protest is successful, the government may be ordered to terminate any one or more of our contracts and reselect bids. The government agencies with which we have contracts could even be directed to award a potential contract to one of the other bidders.

Our business is subject to audit by the U.S. government and other potential sources for grant funding, including under our contract with BARDA, and a negative outcome in an audit could adversely affect our business.

U.S. government agencies such as the Department of Health and Human Services ("DHHS") and the Defense Contract Audit Agency (the "DCAA") routinely audit and investigate government contractors. These agencies review a contractor's performance under its contracts, cost structure and compliance with applicable laws, regulations and standards.

The DHHS and the DCAA also review the adequacy of, and a contractor's compliance with, its internal control systems and policies, including the contractor's purchasing, property, estimating, compensation and management information systems. Any costs found to be improperly allocated to a specific contract will not be paid, while such costs already paid must be refunded. If an audit uncovers improper or illegal activities, we may be subject to civil and criminal penalties and administrative sanctions, including:

- termination of contracts;
- forfeiture of profits;
- suspension of payments;
- fines; and
- suspension or prohibition from conducting business with the U.S. government.

In addition, we could suffer serious reputational harm if allegations of impropriety were made against us, which could cause our stock price to decrease.

Laws and regulations affecting government contracts make it more expensive and difficult for us to successfully conduct our business.

We must comply with numerous laws and regulations relating to the formation, administration and performance of government contracts, which can make it more difficult for us to retain our rights under our BARDA contracts. These laws and regulations affect how we conduct business with government agencies. Among the most significant government contracting regulations that affect our business are:

- the Federal Acquisition Regulations ("FAR") and agency-specific regulations supplemental to the FAR, which comprehensively regulate the procurement, formation, administration and performance of government contracts;
- business ethics and public integrity obligations, which govern conflicts of interest and the hiring of former government employees, restrict the granting of gratuities and funding of lobbying activities and include other requirements such as the Anti-Kickback Statute and Foreign Corrupt Practices Act;
- export and import control laws and regulations; and
- laws, regulations and executive orders restricting the use and dissemination of information classified for national security purposes and the exportation of certain products and technical data.

Any changes in applicable laws and regulations could restrict our ability to maintain our existing BARDA contracts and obtain new contracts, which could limit our ability to conduct our business and materially adversely affect our results of operations.

Risks Related to Intellectual Property

If we are unable to obtain and maintain sufficient intellectual property protection for our product or product candidates, or if the scope of the intellectual property protection is not sufficiently broad, our competitors could develop and commercialize products similar or identical to ours, and our ability to successfully commercialize our product candidates may be adversely affected.

We rely upon a combination of patents, trade secret protection and confidentiality agreements to protect the intellectual property related to our technologies. If we do not adequately protect our intellectual property, competitors may be able to use our technologies and erode or negate any competitive advantage we may have, which could harm our business and ability to achieve profitability. In particular, our success depends in large part on our ability to obtain and maintain patent protection in the United States and other countries with respect to our product and product candidates. However, we may not be able to file and prosecute all necessary or desirable patent applications at a reasonable cost or in a timely manner. We may also fail to identify patentable aspects of our research and development before it is too late to obtain patent protection.

Further, the patentability of inventions, and the validity, enforceability and scope of patents in the biotechnology and pharmaceutical field involve complex legal and scientific questions and can be uncertain. As a result, patent applications that we own or license may fail to result in issued patents in the United States or in other foreign countries for many reasons. For example, there is no assurance that we were the first to invent or the first to file patent applications in respect of the inventions claimed in our patent applications. Since patent applications in the United States and most other countries are confidential for a period of time after filing, we cannot be certain that we were the first to file any patent application related to our product candidates. We may also be unaware of certain prior art relating to our patent applications and patents, which could prevent a patent from issuing from a pending patent application, or result in an issued patent being invalidated. Even if patents have issued, or do successfully issue, from patent applications, third parties may challenge the validity, enforceability or scope thereof, which may result in such patents being narrowed, invalidated or held unenforceable. Furthermore, even if they are unchallenged, our patents and patent applications may not adequately protect our intellectual property or prevent others from designing around our claims. If the breadth or strength of protection provided by the patents and patent applications we hold, license or pursue with respect to our product candidates is threatened, it could threaten our ability to commercialize our product candidates. Further, if we encounter delays in our clinical trials, the period of time during which we could market any of our product candidates under patent protection, if approved, would be reduced. Changes to the patent laws in the United States and other jurisdictions could also diminish the value of our patents and patent applications or narrow the scope of our patent protection.

Further, one of our product candidates, C-Scape, involves an innovative treatment combination of two previously-identified and approved products. In addition to all of the risks and uncertainties with pharmaceutical candidates in general, these prior products have extensive patent and intellectual property portfolios that once protected them and may continue to protect certain aspects of these products. Such portfolios create additional risks and uncertainties for our own ability to obtain material patent or intellectual property protection on our combination development candidate, including the possibility that existing patents or applications relate to and cover combinations of these same products or product classes and the possibility that prior patent positions on these compounds will make it more difficult for us to obtain our own affirmative patents in this area. Antibacterial products are commonly used in combination with one another in research, development and treatment. We may not be aware of all the ways these prior products have been used in combination and of the various intellectual property that may relate to such combination or combinations or the prior uses of these compounds that may prevent us from obtaining our own intellectual property.

If we are unable to protect the confidentiality of our trade secrets, the value of our technology could be materially adversely affected and our business would be harmed.

In addition to the protection afforded by patents, we rely on confidential proprietary information, including trade secrets, and know-how to develop and maintain our competitive position. Any disclosure to or misappropriation by third parties of our confidential proprietary information could enable competitors to quickly duplicate or surpass our technological achievements, thus eroding our competitive position in our market. We seek to protect our confidential proprietary information, in part, by confidentiality agreements and invention assignment agreements with our employees, consultants, scientific advisors, contractors and collaborators. These agreements are

designed to protect our proprietary information. However, we cannot be certain that such agreements have been entered into with all relevant parties, and we cannot be certain that our trade secrets and other confidential proprietary information will not be disclosed or that competitors will not otherwise gain access to our trade secrets or independently develop substantially equivalent information and techniques. For example, any of these parties may breach the agreements and disclose our proprietary information, including our trade secrets, and we may not be able to obtain adequate remedies for such breaches. We also seek to preserve the integrity and confidentiality of our confidential proprietary information by maintaining physical security of our premises and physical and electronic security of our information technology systems, but it is possible that these security measures could be breached. If any of our confidential proprietary information were to be lawfully obtained or independently developed by a competitor, we would have no right to prevent such competitor from using that technology or information to compete with us, which could harm our competitive position. Further, the laws of some foreign countries, including China, where we currently source raw materials for ZEMDRI, do not protect proprietary rights to the same extent or in the same manner as the laws of the United States. As a result, we may encounter significant problems in protecting and defending our intellectual property both in the United States and abroad. If we are unable to prevent material disclosure of the intellectual property related to our technologies to third parties, we will not be able to establish or maintain a competitive advantage in our market, which could materially adversely affect our business, results of operations and financial condition.

If we are sued for infringing intellectual property rights of third parties, such litigation could be costly and time consuming and could prevent or delay us from developing or commercializing our product and/or product candidates.

There is a substantial amount of intellectual property litigation in the biotechnology and pharmaceutical industries, and we may become party to, or threatened with, litigation or other adversarial proceedings regarding intellectual property rights with respect to our technology, ZEMDRI or our product candidates, including proceedings such as post-grant review and inter partes review (“IPR”) before the U.S. Patent and Trademark Office (“USPTO”). Third parties may assert infringement claims against us based on existing or future intellectual property rights. The outcome of intellectual property litigation is subject to uncertainties that cannot be adequately quantified in advance. The pharmaceutical and biotechnology industries have produced a significant number of patents, and it may not always be clear to industry participants, including us, which patents cover various types of products or methods of use. The coverage of patents is subject to interpretation by the courts, and the interpretation is not always uniform. If we are sued for patent infringement, we would need to demonstrate that our product candidates, products or methods either do not infringe the patent claims of the relevant patent or that the patent claims are invalid, and we may not be able to do this. Proving that a patent is invalid is difficult. For example, in the United States, proving invalidity requires a showing of clear and convincing evidence to overcome the presumption of validity enjoyed by issued patents. Even if we are successful in these proceedings, we may incur substantial costs and the time and attention of our management and scientific personnel could be diverted in pursuing these proceedings, which could have a material adverse effect on us. In addition, we may not have sufficient resources to bring these actions to a successful conclusion.

If we are found to infringe a third party’s intellectual property rights, we could be forced, including by court order, to cease developing, manufacturing or commercializing the infringing product candidate or product. Alternatively, we may be required to obtain a license from such third party in order to use the infringing technology and continue developing, manufacturing or marketing the infringing product candidate or product. However, we may not be able to obtain any required license on commercially reasonable terms or at all. Even if we were able to obtain a license, it could be non-exclusive, thereby giving our competitors access to the same technologies licensed to us. In addition, we could be found liable for monetary damages, including treble damages and attorneys’ fees if we are found to have willfully infringed a patent. A finding of infringement could prevent us from commercializing our product or product candidates or force us to cease some of our business operations, which could materially harm our business. We may also elect to enter into license agreements in order to settle patent infringement claims or to resolve disputes prior to litigation, and any such license agreements may require us to pay royalties and other fees that could be significant.

Claims that we have misappropriated the confidential information or trade secrets of third parties could have a similar negative impact on our business.

We may be involved in lawsuits to protect or enforce our intellectual property rights, which could be expensive, time consuming and unsuccessful.

Competitors may infringe or otherwise violate our patents, the patents of our licensors, or our other intellectual property rights. To counter infringement or unauthorized use, we may be required to file infringement claims, which can be expensive and time-consuming. Any claims that we assert against perceived infringers could also provoke these parties to assert counterclaims against us alleging that we infringe their intellectual property rights. In addition, in an infringement proceeding, a court may decide that a patent of ours is not valid or is unenforceable, in whole or in part, or may refuse to stop the other party in such infringement proceeding from using the technology at issue on the grounds that our patents do not cover the technology in question. An adverse result in any litigation or defense proceedings could put one or more of our patents at risk of being invalidated, held unenforceable or interpreted narrowly, and could put any of our patent applications at risk of not yielding an issued patent.

Interference or derivation proceedings provoked by third parties or brought by the USPTO or any foreign patent authority may be necessary to determine the priority of inventions or other matters of inventorship with respect to our patents or patent applications. We may also become involved in other proceedings, such as re-examination or opposition proceedings, before the USPTO or its foreign counterparts relating to our intellectual property or the intellectual property rights of others. An unfavorable outcome in any such proceedings could require us to cease using the related technology or to attempt to license rights to it from the prevailing party, or could cause us to lose valuable intellectual property rights. Our business could be harmed if the prevailing party does not offer us a license on commercially reasonable terms, if any license is offered at all. Litigation or other proceedings may fail and, even if successful, may result in substantial costs and distract our management and other employees. We may also become involved in disputes with others regarding the ownership of intellectual property rights. For example, we jointly develop intellectual property with certain parties, and disagreements may therefore arise as to the ownership of the intellectual property developed pursuant to these relationships. If we are unable to resolve these disputes, we could lose valuable intellectual property rights.

We may not be able to prevent misappropriation of our trade secrets or confidential information, particularly in countries where the laws may not protect those rights as fully as in the United States. Furthermore, because of the substantial amount of discovery required in connection with intellectual property litigation, there is a risk that some of our confidential information could be compromised by disclosure during this type of litigation. In addition, there could be public announcements of the results of hearings, motions or other interim proceedings or developments. If securities analysts or investors perceive these results to be negative, it could have a substantial adverse effect on the price of our common stock.

Even if resolved in our favor, litigation or other legal proceedings relating to intellectual property claims may cause us to incur significant expenses, and could distract our technical and/or management personnel from their normal responsibilities. In addition, there could be public announcements of the results of hearings, motions or other interim proceedings or developments and if securities analysts or investors perceive these results to be negative, it could have a substantial adverse effect on the market price of our common stock. Such litigation or proceedings could substantially increase our operating losses and reduce the resources available for development activities or any future sales, marketing or distribution activities. Uncertainties resulting from the initiation and continuation of intellectual property litigation or other proceedings could have a material adverse effect on our ability to compete in the marketplace.

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

Filing, prosecuting and defending patents on all of our product and product candidates throughout the world would be prohibitively expensive. Competitors may use our technologies in jurisdictions where we have not obtained patent

protection to develop their own products and, further, may export otherwise infringing products to territories where we have patent protection but where enforcement is not as strong as in the United States. These products may compete with our products in jurisdictions where we do not have any issued patents and our patent claims or other intellectual property rights may not be effective or sufficient to prevent them from so competing. Many companies have encountered significant problems in protecting and defending intellectual property rights in foreign jurisdictions, including China, where we currently source raw materials for ZEMDRI. 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 biopharmaceuticals, which could make it difficult for us to stop the infringement of our patents or marketing of competing products in violation of our proprietary rights generally. Proceedings to enforce our patent rights in foreign jurisdictions could result in substantial cost and divert our efforts and attention from other aspects of our business.

If we breach any of the agreements with third parties under which we license certain use, development and commercialization rights to ZEMDRI and our product candidates, we could lose license rights that are important to our business.

While we own the primary patent family covering ZEMDRI, our development and commercialization of ZEMDRI is subject to our license agreement with Ionis Pharmaceuticals, Inc. (formerly known as Isis Pharmaceuticals, Inc.). Under our existing license agreements, we are subject to various obligations, including diligence obligations with respect to development and commercialization activities, payment obligations for achievement of certain milestones and royalties on product sales, as well as other material obligations. If we fail to comply with any of these obligations or otherwise breach our license agreements, our licensing collaborators may have the right to terminate the applicable license in whole or in part. In particular, the loss of our license agreement with Ionis Pharmaceuticals, Inc. could materially adversely affect our ability to continue commercializing ZEMDRI.

The risks described elsewhere pertaining to our patents and other intellectual property rights also apply to the intellectual property rights that we license, and any failure by us or our licensors to obtain, maintain and enforce these rights could have a material adverse effect on our business. In some cases, we do not have control over the prosecution, maintenance or enforcement of the patents that we license, and may not have sufficient ability to consult and input into the patent prosecution and maintenance process with respect to such patents, and our licensors may fail to take the steps that we believe are necessary or desirable in order to obtain, maintain and enforce the licensed patents.

Intellectual property rights do not necessarily address all potential threats to our competitive advantage.

The degree of future protection afforded by our intellectual property rights is uncertain because intellectual property rights have limitations, and may not adequately protect our business or permit us to maintain our competitive advantage. The following examples are illustrative:

- others may be able to make compounds that are similar to ZEMDRI or our product candidates but that are not covered by the claims of the patents that we own or license;
- we or our licensors or collaborators might not have been the first to make the inventions covered by an issued patent or pending patent application that we own or license;
- we or our licensors or collaborators might not have been the first to file patent applications covering an invention;
- others may independently develop similar or alternative technologies or duplicate any of our technologies without infringing our intellectual property rights;
- pending patent applications that we own or license may not lead to issued patents;
- issued patents that we own or license may not provide us with any competitive advantages, or may be held invalid or unenforceable, as a result of legal challenges by our competitors;
- our competitors might conduct research and development activities in countries where we do not have patent rights and then use the information learned from such activities to develop competitive products for sale in our major commercial markets;
- we may not develop or in-license additional proprietary technologies that are patentable; and
- the patents of others may have an adverse effect on our business.

Should any of these events occur, they could significantly harm our business, results of operations and prospects.

57

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

Periodic maintenance fees, renewal fees, annuity fees and various other governmental fees on patents and/or applications will be due to be paid to the USPTO and various governmental patent agencies outside of the United States in several stages over the lifetime of the patents and/or applications. The USPTO and various non-U.S. governmental patent agencies require compliance with a number of procedural, documentary, fee payment and other similar provisions during the patent application process. In many cases, an inadvertent lapse can be cured by payment of a late fee or by other means in accordance with the applicable rules. However, there are situations in which noncompliance can result in abandonment or lapse of the patent or patent application, resulting in partial or complete loss of patent rights in the relevant jurisdiction. In such an event, our competitors might be able to use our technologies and this circumstance would have a material adverse effect on our business.

We do not have exclusive rights to intellectual property we developed under U.S. federally-funded research grants and contracts in connection with certain neglected diseases initiatives, including our collaboration with the Gates Foundation, and, in the case of those funded research activities, we could ultimately share or lose the rights we do have under certain circumstances. Provisions in our U.S. government contracts, including our contracts with BARDA, may affect our intellectual property rights.

Certain of our activities have been funded, and may in the future be funded, by the U.S. government, including our contracts with BARDA. When new technologies are developed with U.S. government funding, the government obtains certain rights in any resulting patents, including the right to a nonexclusive license authorizing the government to use the invention under these rights that may permit the government to disclose our confidential information to third parties and to exercise “march-in” rights to use or allow third parties to use our patented technology. The government can exercise its march-in rights if it determines that action is necessary because we fail to achieve practical application of the U.S. government-funded technology, because action is necessary to alleviate health or safety needs, to meet requirements of federal regulations, or to give preference to U.S. industry. In addition, U.S. government-funded inventions must be reported to the government, U.S. government funding must be disclosed in any resulting patent applications, and our rights in such inventions may be subject to certain requirements to manufacture products in the United States.

If we do not obtain patent term extension in the United States under the Hatch-Waxman Act and in foreign countries under similar legislation, thereby potentially extending the term of our marketing exclusivity for our product candidates, our business may be materially harmed.

Depending upon the timing, duration and specifics of FDA marketing approval of our product candidates, if any, one or more of our U.S. patents, if any, covering our approved product(s) or the use thereof may be eligible for up to five years of patent term restoration under the Hatch-Waxman Act. The Hatch-Waxman Act allows a maximum of one patent to be extended per FDA approved product. Patent term extension also may be available in certain foreign countries upon regulatory approval of our product candidates. Nevertheless, we may not be granted patent term extension either in the United States or in any foreign country because of, for example, failing to apply within applicable deadlines, failing to apply prior to expiration of relevant patents or otherwise failing to satisfy applicable requirements. Moreover, the term of extension, as well as the scope of patent protection during any such extension, afforded by the governmental authority could be less than we request.

If we are unable to obtain patent term extension or restoration, or the term of any such extension is less than we request, the period during which we will have the right to exclusively market our product will be shortened and our competitors may obtain approval of competing products following our patent expiration, and our revenue could be

reduced, possibly materially.

Risks Related to Government Regulation

The regulatory approval process is expensive, time consuming and uncertain and may prevent us from obtaining, or cause delays in obtaining, approvals for the commercialization of some or all of our product candidates, and of ZEMDRI outside the United States, which will materially impair our ability to generate revenue.

The design, development, research, testing, manufacturing, labeling, storage, recordkeeping, approval, selling, import, export, advertising, promotion, and distribution of drug products are subject to extensive and evolving regulation by federal, state and local governmental authorities in the United States, principally by the FDA, and foreign regulatory authorities, with regulations differing from country to country. Failure to obtain marketing approval for a product candidate will prevent us from commercializing the product candidate. Neither we nor any future collaboration partner is permitted to market any product candidate in the United States until we receive regulatory approval of an NDA from the FDA.

In June 2018, we announced the receipt of FDA approval for ZEMDRI for adults with cUTI, including pyelonephritis, caused by certain Enterobacteriaceae in patients with limited or no alternative treatment options. In December 2018, we filed a Formal Dispute Resolution Request with the FDA regarding the indication for plazomicin for the treatment of bloodstream infections (BSI), for which the FDA issued a Complete Response Letter in June 2018. In October 2018, we filed a Marketing Authorization Application (MAA) for plazomicin with the European Medicines Agency (EMA) in the fourth quarter of 2018. We recently received the Day 120 questions and we continue to advance the regulatory process with the rapporteurs and the EMA.

Other than the NDA for ZEMDRI and the MAA for plazomicin, we have not submitted an application or obtained marketing approval for ZEMDRI or any product candidate anywhere in the world. An NDA must include extensive preclinical and clinical data and supporting information to establish to the FDA’s satisfaction the product candidate’s safety and efficacy for each desired indication. An NDA must also include significant information regarding the chemistry, manufacturing and controls for the product candidate. Obtaining regulatory approval of an NDA can be a lengthy, expensive and uncertain process. In addition, failure to comply with FDA and other applicable U.S. and foreign regulatory requirements may subject us to administrative or judicially imposed sanctions, including:

- warning letters;
- civil and criminal penalties;
- injunctions;
- withdrawal of approved products;
- product seizure or detention;
- product recalls;
- total or partial suspension of production; and
- refusal to approve pending NDAs or supplements to approved NDAs.

Prior to receiving approval to commercialize any of our product candidates in the United States or abroad, we and any applicable collaboration partners must demonstrate with substantial evidence from well-controlled clinical trials, and to the satisfaction of the FDA and other regulatory authorities abroad, that such product candidates are safe and effective for their intended uses. Preclinical testing and clinical trials are long, expensive and uncertain processes. We may spend several years completing our testing for any particular product candidate, and failure can occur at any stage. Negative or inconclusive results or adverse medical events during a clinical trial could also cause the FDA or us to terminate a clinical trial or require that we repeat it or conduct additional clinical trials. Additionally, data obtained from preclinical studies and clinical trials can be interpreted in different ways and the FDA or other regulatory authorities may interpret the results of our studies and trials less favorably than we do. Even if we believe the preclinical or clinical data for a product candidate is promising, such data may not be sufficient to support approval by the FDA and other regulatory authorities. Administering any product candidates to

59

humans may produce undesirable side effects, which could interrupt, delay or halt clinical trials of such product candidates and result in the FDA or other regulatory authorities denying approval of such product candidates for any or all targeted indications. The FDA or other regulatory authorities may determine that ZEMDRI or any product candidate that we develop is not effective, or is only moderately effective, or has undesirable or unintended side effects, toxicities, safety profile or other characteristics that preclude marketing approval or prevent or limit commercial use. In addition, any marketing approval we ultimately obtain may be limited or subject to restrictions or post-approval commitments that render the approved product not commercially viable.

The regulatory approval process is expensive and may take several years to complete. The FDA and foreign regulatory entities have substantial discretion in the approval process. Despite the time and expense exerted, failure can occur at any stage, and we could encounter problems that cause us to abandon or repeat clinical trials, or perform additional preclinical studies and clinical trials. The number of preclinical studies and clinical trials that will be required for FDA approval varies depending on the product candidate, the disease or condition that the product candidate is designed to address, and the regulations applicable to any particular product candidate. The FDA can delay, limit or deny approval of a product candidate for many reasons, including, but not limited to, the following:

- product candidate may not be deemed safe or effective;
- FDA officials may not find the data from preclinical studies and clinical trials sufficient;
- the FDA may request additional analyses, reports, data and studies;
- the FDA may ask questions regarding, or adopt different interpretations of, data and results;
- the FDA might not approve our or our third-party manufacturer's processes or facilities; or
- the FDA may change its approval policies or adopt new regulations.

If any of our product candidates fails to demonstrate safety and efficacy in clinical trials or does not gain regulatory approval, or if we experience delays in obtaining regulatory approval, our business and results of operations will be materially and adversely harmed.

Even after we receive regulatory approval for a product candidate, we are subject to ongoing regulatory obligations and continued regulatory review, which may result in significant additional expense and subject us to restrictions, withdrawal from the market, or penalties if we fail to comply with applicable regulatory requirements or if we experience unanticipated problems with our product and/or product candidates, when and if approved.

Even after regulatory approval has been granted, the approved product and its manufacturer are subject to continual review by the FDA and/or non-U.S. regulatory authorities. Any regulatory approval that we receive for our product candidates may be subject to limitations on the indicated uses for which the product may be marketed or contain requirements for potentially costly post-marketing follow-up studies or surveillance to monitor the safety and efficacy of the product. In addition, if the FDA and/or non-U.S. regulatory authorities approve any of our product candidates, we will be subject to extensive and ongoing regulatory requirements by the FDA and other regulatory authorities with regard to labeling, packaging, adverse event reporting, storage, distribution, advertising, promotion, recordkeeping and submission of safety and other post-market information. Manufacturers of our products and manufacturers' facilities are required to comply with cGMP regulations, which include requirements related to quality control and quality assurance as well as the corresponding maintenance of records and documentation. Further, regulatory authorities must approve these manufacturing facilities before they can be used to manufacture our products, and these facilities are subject to continual review and periodic inspections by the FDA and other regulatory authorities for compliance with cGMP regulations. Accordingly, we and others with whom we work must continue to expend time, money and effort in all areas of regulatory compliance, including manufacturing, production and quality control. We will also be required to report certain adverse reactions and production problems, if any, to the FDA and to comply with requirements concerning advertising and promotion for our products. If we, any future collaboration partner or a regulatory authority discovers previously unknown problems with a product, such as adverse events of unanticipated severity or frequency, or problems with the facility where the product is manufactured, a regulatory authority may

impose restrictions on that product, the collaboration partner, the manufacturer or us, including requiring withdrawal of the product from the market or suspension of manufacturing.

The FDA closely regulates the post-approval marketing and promotion of drugs to ensure drugs are marketed only for the approved indications and in accordance with the provisions of the approved labeling and regulatory requirements. The FDA also imposes stringent restrictions on manufacturers' communications regarding off-label use and if we do not restrict the marketing of our products only to their approved indications, we may be subject to enforcement action for off-label marketing. If we, our product and product candidates or the manufacturing facilities for our product and product candidates fail to comply with regulatory requirements of the FDA and/or other non-U.S. regulatory authorities, we could be subject to administrative or judicially imposed sanctions, including:

- warning letters or untitled letters;
- mandated modifications to promotional materials or the required provision of corrective information to healthcare practitioners;
- restrictions imposed on the product or its manufacturers or manufacturing processes;
- restrictions imposed on the labeling or marketing of the product;
- restrictions imposed on product distribution or use;
- requirements for post-marketing clinical trials;
- suspension of any ongoing clinical trials;
- suspension of or withdrawal of regulatory approval;
- voluntary or mandatory product recalls and publicity requirements;
- refusal to approve pending applications for marketing approval of new products or supplements to approved applications filed by us;
- restrictions on operations, including costly new manufacturing requirements;
- seizure or detention of our products;
- refusal to permit the import or export of our products;
- required entry into a consent decree, which can include imposition of various fines (including restitution or disgorgement of profits or revenue), reimbursements for inspection costs, required due dates for specific actions and penalties for noncompliance;
- civil or criminal penalties; or
- injunctions.

Widely publicized events concerning the safety risk of certain drug products have resulted in the withdrawal of drug products, revisions to drug labeling that further limit use of the drug products and the imposition by the FDA of risk evaluation and mitigation strategies ("REMS") to ensure that the benefits of the drug outweigh its risks. In addition, because of the serious public health risks of high profile adverse safety events with certain products, the FDA may require, as a condition of approval, costly REMS programs.

The regulatory requirements and policies may change and additional government regulations may be enacted for which we may also be required to comply. For example, in December 2016, the 21st Century Cures Act, or Cures Act, was signed into law. The Cures Act, among other things, is intended to modernize the regulation of drugs and spur innovation, but its ultimate implementation is unclear. If we are slow or unable to adapt to changes in existing requirements or the adoption of new requirements or policies, or if we or any future collaboration partner are not able to maintain regulatory compliance, we may lose any marketing approval that we may have obtained, which would adversely affect our business, prospects and ability to achieve or sustain profitability.

We cannot predict the likelihood, nature or extent of government regulation that may arise from future legislation or administrative action, either in the United States or in other countries. For example, certain policies of the current presidential administration may impact our business and industry. The current administration has taken several executive actions, including the issuance of a number of Executive Orders, that could impose significant burdens on, or otherwise materially delay, FDA's ability to engage in routine regulatory and oversight activities such as implementing statutes through rulemaking, issuance of guidance, and review and approval of marketing applications. It is difficult to predict how these Executive Orders will be implemented, and the extent to which they will impact the FDA's ability to exercise its regulatory authority. If these executive actions impose constraints on FDA's ability to engage in oversight and implementation activities in the normal course, our business may be negatively impacted.

Failure to obtain regulatory approvals in foreign jurisdictions will prevent us from marketing our product or product candidates internationally.

We may seek a distribution and marketing collaborator for ZEMDRI or our product candidates commercialized outside of the United States. In order to market our product or product candidates in the European Economic Area (the "EEA"), which is comprised of the 28 Member States of the EU, plus Norway, Iceland and Liechtenstein, and many other foreign jurisdictions, we or our collaboration partners must obtain separate regulatory approvals. More concretely, in the EEA, medicinal products can only be commercialized after obtaining a Marketing Authorization ("MA"). There are two types of marketing authorizations:

- the Community MA, which is issued by the European Commission through the Centralized Procedure, based on the opinion of the Committee for Medicinal Products for Human Use of the EMA, and which is valid throughout the entire territory of the EEA. The Centralized Procedure is mandatory for certain types of products, such as for drugs produced through certain specified biotechnological processes (such as 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, orphan medicinal products, and medicinal products with a new active substance indicated for the treatment of specified diseases, such as HIV/AIDS, cancer, neurodegenerative disorders, diabetes, auto-immune diseases and other immune dysfunctions and viral diseases. The Centralized Procedure is optional for products containing a new active substance not yet authorized in the EEA, or for products that constitute a significant therapeutic, scientific or technical innovation or which are in the interest of public health in the EU.
- national MAs, which are issued by the competent authorities of the Member States of the EEA and only cover their respective territory, are available for products not falling within the mandatory scope of the Centralized Procedure. Where a product has already been authorized for marketing in a Member State of the EEA, this National MA can be recognized in another Member State through the Mutual Recognition Procedure. If the product has not received a National MA in any Member State at the time of application, it can be approved simultaneously in various Member States through the Decentralized Procedure.

Under the above described procedures, before granting the MA, the EMA or the competent authorities of the Member States of the EEA make an assessment of the risk-benefit balance of the product on the basis of scientific criteria concerning its quality, safety and efficacy.

We have had limited interactions with foreign regulatory authorities, and approval procedures vary among countries and can involve additional clinical testing. In addition, the time required to obtain approval from foreign regulatory authorities may differ from that required to obtain FDA approval. Clinical trials conducted in one country may not be accepted by regulatory authorities in other countries. Approval by the FDA does not ensure approval by regulatory authorities in other countries, and approval by one or more foreign regulatory authorities does not ensure approval by regulatory authorities in other foreign countries or by the FDA. However, a failure or delay in obtaining regulatory approval in one country may have a negative effect on our ability to obtain approval in other countries. The foreign regulatory approval process 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 may or may not obtain foreign

regulatory approvals on a timely basis, if at all. We may not be able to file for regulatory approvals and even if we file, we may not receive necessary approvals to commercialize our product candidates in any market.

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

In the United States, there have been, and we expect there will continue to be, a number of legislative and regulatory changes to the healthcare system that could affect our future revenue and profitability and the future revenue and profitability of our potential customers. Federal and state lawmakers regularly propose and, at times, enact legislation that results in significant changes to the healthcare system, some of which is intended to contain or reduce the costs of medical products and services. For example, in March 2010, the President signed one of the most significant healthcare reform measures in decades, the Affordable Care Act ("ACA"). It contains a number of provisions, including those governing enrollment in federal healthcare programs, reimbursement changes and fraud and abuse measures, all of which will impact existing government healthcare programs and will result in the development of new programs. The ACA, among other things:

- imposes a non-deductible annual fee on pharmaceutical manufacturers or importers who sell "branded prescription drugs" to specified federal government programs;
- increases the minimum level of Medicaid rebates payable by manufacturers of brand-name drugs from 15.1% to 23.1%;
- imposes a 2.3% medical device excise tax that manufacturers and importers will be required to pay on their sales of certain medical devices, which is suspended from January 1, 2016 to December 31, 2019, and, absent further legislative action, will be reinstated starting January 1, 2020;
- requires collection of rebates for drugs paid by Medicaid managed care organizations;
- addresses new methodologies by which rebates owed by manufacturers under the Medicaid Drug Rebate Program are calculated for drugs that are inhaled, infused, instilled, implanted or injected, and for drugs that are line extension products;
- requires manufacturers to participate in a coverage gap discount program, under which they must agree to offer point-of-sale discounts off negotiated prices of applicable brand drugs to eligible beneficiaries during their coverage gap period, as a condition for the manufacturer's outpatient drugs to be covered under Medicare Part D; and
- expands eligibility criteria for Medicaid programs by, among other things, allowing states to offer Medicaid coverage to additional individuals and by adding new mandatory eligibility categories for certain individuals with income at or below 133% of the federal poverty level, thereby potentially increasing a manufacturer's Medicaid rebate liability.

Since its enactment, there have been judicial and Congressional challenges to certain aspects of the ACA. As a result, there have been delays in the implementation of, and action taken to repeal or replace, certain aspects of the ACA. We expect that the current administration and U.S. Congress may continue to seek to modify, repeal, or otherwise invalidate all, or certain provisions of, the ACA. We cannot predict the ultimate content, timing or effect of any healthcare reform legislation or the impact of potential legislation on us.

Other legislative changes have been proposed and adopted in the United States since the ACA was enacted. These changes included aggregated reductions to Medicare payments to providers of 2% per fiscal year, which went into effect on April 1, 2013, and, due to subsequent legislative amendments, will remain in effect through 2027 unless additional Congressional action is taken. On January 2, 2013, President Obama signed into law the American Taxpayer Relief Act of 2012, which, among other things, further reduced Medicare payments to several providers, including hospitals, imaging centers and cancer treatment centers, and increased the statute of limitations period for the government to recover overpayments to providers from three to five years. Individual states in the United States have also become increasingly active in passing legislation and implementing regulations designed to control pharmaceutical product pricing, including price or patient reimbursement constraints, discounts, restrictions on certain product access and marketing cost disclosure and transparency measures, and, in some cases, designed to encourage importation from other countries and bulk purchasing. Recently, there has also been heightened

63

governmental scrutiny over the manner in which drug manufacturers set prices for their marketed products, which has resulted in several Congressional inquiries and proposed and enacted legislation designed to, among other things, bring more transparency to product pricing, review the relationship between pricing and manufacturer patient programs, and reform government program reimbursement methodologies for drug products. We expect that additional state and federal healthcare reform measures will be adopted in the future, any of which could limit the amounts that federal and state governments will pay for healthcare products and services, which could result in reduced demand for our products once approved or additional pricing pressures.

In the EU, similar political, economic and regulatory developments may affect our ability to profitably commercialize our product and product candidates, if approved. In addition to continuing pressure on prices and cost containment measures, legislative developments at the EU or member state level may result in significant additional requirements or obstacles that may increase our operating costs. The delivery of healthcare in the EU, including the establishment and operation of health services and the pricing and reimbursement of medicines, is almost exclusively a matter for national, rather than EU, law and policy. National governments and health service providers have different priorities and approaches to the delivery of health care and the pricing and reimbursement of products in that context. In general, however, the healthcare budgetary constraints in most EU member states have resulted in restrictions on the pricing and reimbursement of medicines by relevant health service providers. Coupled with ever-increasing EU and national regulatory burdens on those wishing to develop and market products, this could prevent or delay marketing approval of our product and product candidates, restrict or regulate post-approval activities and affect our ability to commercialize our product and product candidates, if approved.

In markets outside of the United States and EU, reimbursement and healthcare payment systems vary significantly by country, and many countries have instituted price ceilings on specific products and therapies.

We expect that additional foreign, federal and state healthcare reform measures will be adopted in the future, any of which could limit the amounts that governmental programs will pay for healthcare products and services, which could result in reduced demand for our products once approved or additional pricing pressures.

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

Even though we do not and will not control referrals of healthcare services or bill directly to Medicare, Medicaid or other third-party payors, certain U.S. federal and state healthcare laws and regulations pertaining to fraud and abuse and patients' rights are and will be applicable to our business. We could be subject to healthcare fraud and abuse and patient privacy regulation by both the federal government and the states in which we conduct our business. The regulations that may affect our ability to operate include, without limitation:

- the federal Anti-Kickback Statute, which prohibits, among other things, any person from knowingly and willfully offering, soliciting, receiving or providing remuneration, directly or indirectly, to induce either the referral of an individual, for an item or service or the purchasing or ordering of a good or service, for which payment may be made under federal healthcare programs such as the Medicare and Medicaid programs;
- federal civil and criminal false claims laws, including the federal False Claims Act, which prohibits, among other things, individuals or entities from knowingly presenting, or causing to be presented, false claims, or knowingly using false statements, to obtain payment from the federal government, and which may apply to entities that provide coding and billing advice to customers;
- federal criminal laws that prohibit executing a scheme to defraud any healthcare benefit program or making false statements relating to healthcare matters;
- federal civil monetary penalties laws, which impose civil fines for, among other things, the offering or transfer of remuneration to a Medicare or state healthcare program beneficiary if the person knows or should know it is likely to

influence the beneficiary's selection of a particular provider, practitioner, or supplier of services reimbursable by Medicare or a state healthcare program, unless an exception applies;

- federal consumer protection and unfair competition laws, which broadly regulate marketplace activities and activities that potentially harm consumers;
- the federal physician sunshine requirements under the 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 to physicians, other healthcare providers, and teaching hospitals, and ownership and investment interests held by physicians and other healthcare providers and their immediate family members;
- the federal Health Insurance Portability and Accountability Act of 1996, as amended by the Health Information Technology for Economic and Clinical Health Act, which governs the conduct of certain electronic healthcare transactions and protects the security and privacy of protected health information;
- federal price reporting laws, which require manufacturers to calculate and report complex pricing metrics to government programs, where such reported prices may be used in the calculation of reimbursement and/or discounts on approved products;
- 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 made 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 physicians and other healthcare providers or marketing expenditures and pricing information; 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; and
- similar healthcare laws and regulations in the European Union and other jurisdictions, including reporting requirements detailing interactions with and payments to healthcare providers and requirements regarding the collection, distribution, use, security, and storage of personally identifiable information and other data relating to individuals (including the European Union enacted Regulation (EU) 2016/679 (General Data Protection Regulation)).

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, healthcare reform legislation has strengthened these laws. For example, the ACA, among other things, amends the intent requirement of the Federal Anti-Kickback Statute and 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 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 and other related 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 and regulations that apply to us, we may be subject to penalties, including civil and criminal penalties, damages, fines, the exclusion from participation in federal and state healthcare programs, imprisonment, additional reporting obligations and oversight if we become subject to a corporate integrity agreement or other agreement to resolve allegations of non-compliance, or the curtailment or restructuring of our operations, any of which could adversely affect our ability to operate our business and our financial results.

Risks Related to Our Common Stock

The price of our common stock is extremely volatile and our stockholders may not be able to resell shares of our common stock at or above the price they paid.

The trading volume of our common stock on The Nasdaq Global Market has been limited since our IPO which occurred in March 2014, and there can be no assurance that an active and liquid trading market for our common stock will be sustained. We cannot predict the extent to which investor interest in our company will lead to an active trading market on The Nasdaq Global Market or otherwise or how liquid that market might become. If an active public market is not sustained, it may be difficult for stockholders to sell their shares of common stock at prices that are attractive to them, or at all. Further, an inactive market may also impair our ability to raise capital by selling shares of our common stock and may impair our ability to enter into strategic partnerships or acquire companies or products, product candidates or technologies by using our shares of common stock as consideration. The trading price of our common stock is highly volatile and could be subject to wide fluctuations in response to various factors, some of which are beyond our control. Factors that could cause volatility in the market price of our common stock include, but are not limited to:

- commercial success and market acceptance of ZEMDRI or our product candidates following regulatory approval;
- results from, or any delays in, clinical trial programs relating to ZEMDRI or our product candidates;
- delays in commercializing or obtaining regulatory approvals for ZEMDRI or our product candidates;
- results or announcements (if any) from, or any delays in, our evaluation of strategic alternatives for the Company focusing on enhancing stockholder value and the timing and nature of any strategic transactions that we undertake (if any);
- any need to suspend or discontinue clinical trials due to side effects or other safety risks, or any need to conduct studies on the long-term effects associated with the use of ZEMDRI or our product candidates;
- capital fundraising or other financing activities that contain onerous or unfavorable terms;
- manufacturing issues related to ZEMDRI or our product candidates for clinical trials or future products for commercialization;
- undesirable side effects caused by ZEMDRI or our product candidates after they have entered the market;
- spread of bacterial resistance to ZEMDRI or our product candidates;
- ability to discover, develop and commercialize additional product candidates;
- announcements relating to collaborations that we may enter into with respect to the development or commercialization of ZEMDRI or our product candidates, or the timing of payments we may make or receive under these arrangements;
- announcements relating to the receipt, modification or termination of government contracts or grants, or the timing of payments we may receive under these arrangements;
- success of our competitors in discovering, developing or commercializing products;
- delay or failure to successfully develop, validate and obtain regulatory clearance or approval of plazomicin IVD assay or related diagnostic;
- strategic transactions undertaken by us;
- additions or departures of key personnel;

- product liability claims related to our clinical trials, ZEMDRI or product candidates;
- prevailing economic conditions;
- business disruptions caused by earthquakes or other natural disasters;
- disputes concerning our intellectual property or other proprietary rights;
- litigation or the threat of litigation;
- FDA or other U.S. or foreign regulatory actions affecting us or our industry;
- healthcare reform measures in the United States or other countries;
- sales of our common stock by our officers, directors or significant stockholders;
- future sales or issuances of equity or debt securities by us;
- fluctuations in our quarterly operating results; and
- the issuance of new or changed securities analysts' reports or recommendations regarding us.

In addition, the stock markets in general, and the markets for pharmaceutical, biopharmaceutical and biotechnology stocks in particular, have experienced extreme volatility that has been often unrelated to the operating performance of the issuer. These broad market fluctuations may adversely affect the trading price or liquidity of our common stock. In the past, when the market price of a stock has been volatile, holders of that stock have sometimes instituted securities class action litigation against the issuer. If any of our stockholders were to bring such a lawsuit against us, we could incur substantial costs defending the lawsuit and the attention of our management would be diverted from the operation of our business, which could seriously harm our financial position. Any adverse determination in litigation could also subject us to significant liabilities.

We may not meet the continued listing standards of The Nasdaq Global Market, which requires a minimum closing bid price of $1.00 per share, which could result in our delisting and negatively impact the price of our common stock and our ability to access the capital markets.

Our common stock is currently listed on The Nasdaq Global Market. Nasdaq provides various continued listing requirements that a company must meet in order for its stock to continue trading on The Nasdaq Global Market. Among these requirements is the requirement that the Company's stock trades at a minimum bid price of $1.00 per share. Our stock price first traded at below $1.00 on February 15, 2019 and has closed at a price less than $1.00 every trading day since that date. If our stock price closes with a bid price below $1.00 per share for 30 consecutive trading days, we would expect to receive a notice from Nasdaq providing us with 180 calendar days to regain compliance with the rule. After this 180 day period is up, if we still do not comply with the minimum $1.00 bid price we may be eligible for an additional 180 day period to regain compliance. However, if we fail to comply with the minimum stock price of $1.00 per share or any other continued listing standards of Nasdaq, including maintaining a minimum market value of listed securities of $35 million, or alternative standards under Nasdaq Listing Rules 5550(b)(1) and 5550(b)(3), our common stock may be delisted. If that were to occur, our stock would be subject to rules that impose additional sales practice requirements on broker-dealers who sell our securities. The additional burdens imposed upon broker-dealers by these requirements could discourage broker-dealers from effecting transactions in our common stock. This would significantly affect the ability of investors to trade our securities and would significantly negatively affect the value and liquidity of our common stock. These factors could contribute to lower prices and larger spreads in the bid and ask prices for our common stock.

We are currently considering actions that we may take in order to regain compliance with continued listing requirements. For example, in order to regain compliance with Nasdaq's minimum bid price requirement, we may seek stockholder approval of a reverse stock split at our 2019 annual meeting of the stockholders, although there can be no assurance that stockholder approval will be obtained or that the reverse stock split will cure the issue. Also, the announcement and/or implementation of a reverse stock split could significantly negatively affect the price of our common stock.

Alternatively, the Company may apply to transfer the listing of its common shares to the Nasdaq Capital Market if it satisfies all criteria for initial listing on the Nasdaq Capital Market, other than compliance with the minimum bid price requirement. If such application to the Nasdaq Capital Market is approved, then the Company may be eligible for an additional 180 day period to regain compliance with the minimum bid price requirement. If our common stock is not eligible for quotation on another exchange, trading of our common stock could be conducted in the over-the-counter market or on an electronic bulletin board established for unlisted securities such as Pink Quote (formerly known as the Pink Sheets) or the OTC Bulletin Board. In such event, it could become more difficult to dispose of, or obtain accurate quotations for the price of our common stock, and there would likely also be a reduction in our coverage by security analysts and the news media, which could cause the price of our common stock to decline further.

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

Our principal stockholders, including management, may continue to have significant influence over the outcome of corporate actions requiring stockholder approval, including the election of directors, any merger, consolidation or sale of all or substantially all of our assets or any other significant corporate transaction. The interests of these stockholders may not be the same as or may even conflict with your interests. For example, these stockholders could delay or prevent a change of control of our company, even if such a change of control would benefit our other stockholders, which could deprive our stockholders of an opportunity to receive a premium for their common stock as part of a sale of our company or our assets and might affect the prevailing market price of our common stock. The concentration of stock ownership may adversely affect the trading price of our common stock due to investors' perception that conflicts of interest may exist or arise.

Raising additional funds by issuing securities or through licensing or lending arrangements may cause dilution to our existing stockholders, restrict our operations or require us to relinquish proprietary rights.

To the extent that we continue to raise additional capital by issuing equity securities, the share ownership of existing stockholders will continue to be diluted. For example, on February 27, 2018, we filed an amended Registration Statement on Form S-3 (the "2018 Shelf Registration Statement") covering the offering of up to $250.0 million of common stock, preferred stock, debt securities, warrants and units. In addition, on February 27, 2018, we filed a prospectus supplement to the 2018 Shelf Registration Statement covering the offering, issuance and sale of up to $50.0 million shares of our common stock in "at the market" ("ATM") offerings pursuant to a Common Stock Sales Agreement entered into with Cowen and Company, LLC (the "2018 Sales Agreement"). During the fiscal year ended December 31, 2018, we sold 3,089,358 shares of common stock under the 2018 Sales Agreement, at a weighted-average price of approximately $2.46 per share for aggregate gross proceeds of $7.6 million and net proceeds of $7.4 million. We have not sold any additional shares of common stock under the 2018 Sales Agreement since December 2018.

Moreover, on February 20, 2019, we announced the completion of an underwritten public offering of 15,000,000 shares of our common stock and accompanying short-term warrants to purchase up to 15,000,000 shares of our common stock and long-term warrants to purchase up to 15,000,000 shares of our common stock. To the extent these warrants are exercised, the share ownership of existing stockholders may experience significant additional dilution.

Any future debt financing may involve covenants that restrict our operations, including, among other restrictions, limitations on our ability to incur liens or additional debt, pay dividends, redeem our stock, make certain investments, and engage in certain merger, consolidation, or asset sale transactions. In addition, if we raise additional funds through licensing arrangements, it may be necessary to grant potentially valuable rights to our product candidates or grant licenses on terms that are not favorable to us. Further, we may choose to raise additional capital due to market conditions or strategic considerations even if we believe we have sufficient funds for our current or future operating

plans. To the extent that additional capital is raised through the sale of equity or convertible debt securities, including pursuant to the 2018 Shelf Registration Statement or the 2018 Sales Agreement, or the exercise of outstanding warrants to purchase shares of common stock, the issuance of these securities could result in further dilution to our stockholders or result in downward pressure on the price of our common stock.

Future sales by our existing holders of our common stock or securities convertible or exchangeable for our common stock may depress our stock price.

If our existing stockholders or holders of our options or warrants sell, or indicate an intention to sell, substantial amounts of our common stock in the public market, the market price of our common stock could decline. In the first quarter of 2019, our largest shareholder has publicly disclosed repeated sales of our common stock and continued sales could impact our stock price. The perception in the market that any such sales may occur could also cause the trading price of our common stock to decline. As of March 25, 2019, we have outstanding a total of 63,879,995 shares of common stock. Other than any shares held by our directors, officers and certain existing investors, all of these are currently freely tradable.

In addition, based on the number of shares subject to outstanding awards under our Amended and Restated 2003 Stock Plan (our "2003 Plan") or subject to outstanding awards or available for issuance under our 2014 Equity Incentive Award Plan (our "2014 Plan"), our 2014 Employment Commencement Incentive Plan (our "Inducement Plan") and our 2014 Employee Stock Purchase Plan (our "ESPP"), in each case, as of March 25, 2019, 9,381,072 shares of common stock that are either subject to outstanding awards, outstanding but subject to vesting, or reserved for future issuance under our 2003 Plan, 2014 Plan, Inducement Plan or ESPP will become eligible for sale in the public market to the extent permitted by the provisions of various vesting schedules. We have filed registration statements permitting shares of common stock issued in the future pursuant to the 2003 Plan, 2014 Plan, Inducement Plan or ESPP to be freely resold by plan participants in the public market and, for shares held by directors, executive officers and other affiliates, subject to compliance with Rule 144. The 2014 Plan and ESPP also contain a provision for the annual increase of the number of shares reserved for issuance under such plan, which shares we also intend to register in the future as such annual increases occurs. If the shares we may issue from time to time under the 2003 Plan, 2014 Plan, the Inducement Plan or ESPP are sold, or if it is perceived that they will be sold, by the award recipient in the public market, the trading price of our common stock could decline.

As of March 25, 2019, certain holders of 1,746,461 shares of our common stock and warrants exercisable for 17,514 shares of our common stock are entitled to rights with respect to the registration of their shares under the Securities Act. Registration of these shares under the Securities Act would result in the shares becoming freely tradable without restriction under the Securities Act, except for shares purchased by affiliates. Sales of such shares could also cause the trading price of our common stock to decline.

Provisions of our charter documents or Delaware law could delay or prevent an acquisition of our company, even if the acquisition would be beneficial to our stockholders, and could make it more difficult for you to change management.

Provisions in our certificate of incorporation and our bylaws may discourage, delay or prevent a merger, acquisition or other change in control that stockholders may consider favorable, including transactions in which stockholders might otherwise receive a premium for their shares. In addition, these provisions may frustrate or prevent any attempt by our stockholders to replace or remove our current management by making it more difficult to replace or remove our board of directors. These provisions include:

- a classified board of directors so that not all directors are elected at one time;
- a prohibition on stockholder action through written consent;
- no cumulative voting in the election of directors;
- the exclusive right of our board of directors to elect a director to fill a vacancy created by the expansion of the board of directors or the resignation, death or removal of a director;
- a requirement that special meetings of stockholders be called only by the board of directors, the chairman of the board of directors, the chief executive officer or, in the absence of a chief executive officer, the president;

- an advance notice requirement for stockholder proposals and nominations;

- directors may not be removed without cause and may only be removed with cause by the affirmative vote of 66 2/3% of all outstanding shares of our capital stock with the power to vote in the election of directors;
- the authority of our board of directors to issue preferred stock with such terms as our board of directors may determine; and
- a requirement of approval of not less than 66 2/3% of all outstanding shares of our capital stock with the power to vote to amend any bylaws by stockholder action, or to amend specific provisions of our certificate of incorporation.

In addition, Delaware law prohibits a publicly held Delaware corporation from engaging in a business combination with an interested stockholder, generally a person who, together with its affiliates, owns or within the last three years has owned 15% or more of our voting stock, for a period of three years after the date of the transaction in which the person became an interested stockholder, unless the business combination is approved in a prescribed manner. Accordingly, Delaware law may discourage, delay or prevent a change in control of our company. Furthermore, our amended and restated certificate of incorporation specifies that the Court of Chancery of the State of Delaware will be the sole and exclusive forum for most legal actions involving actions brought against us by stockholders. We believe this provision benefits us by providing increased consistency in the application of Delaware law by chancellors particularly experienced in resolving corporate disputes, efficient administration of cases on a more expedited schedule relative to other forums and protection against the burdens of multi-forum litigation. However, the provision may have the effect of discouraging lawsuits against our directors and officers. The enforceability of similar choice of forum provisions in other companies' certificates of incorporation has been challenged in legal proceedings, and it is possible that, in connection with any applicable action brought against us, a court could find the choice of forum provisions contained in our amended and restated certificate of incorporation to be inapplicable or unenforceable in such action.

Provisions in our charter and other provisions of Delaware law could limit the price that investors are willing to pay in the future for shares of our common stock.

We do not anticipate paying any cash dividends on our capital stock in the foreseeable future; as a result, capital appreciation, if any, of our common stock will be your sole source of gain for the foreseeable future.

We have never declared or paid cash dividends on our capital stock. We do not anticipate paying any cash dividends on our capital stock in the foreseeable future. We currently intend to retain all available funds and any future earnings to fund the development and growth of our business. In addition, the terms of any future debt financing arrangement may contain terms prohibiting or limiting the amount of dividends that may be declared or paid on our common stock. As a result, capital appreciation, if any, of our common stock will be your sole source of gain for the foreseeable future.

If securities or industry analysts do not 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 will depend, in part, on the research and reports that securities or industry analysts publish about us or our business. If one or more of the analysts who cover us downgrade our stock or publish inaccurate or unfavorable research about our business, our stock price would likely decline. In addition, if our operating results fail to meet the forecast of analysts, our stock price would likely decline. If one or more of these analysts cease coverage of our company or fail to publish reports on us regularly, demand for our stock could decrease, which might cause our stock price and trading volume to decline.

Item 1B. Unresolved Staff Comments.

None.

Item 2. Properties.

In August 2016, we entered into an office lease agreement for our corporate headquarters in South San Francisco, California for 47,118 square feet of office, research and laboratory space. Upon commencement of the

new lease in March 2017, we ceased use of our previous corporate headquarter as the Company formerly occupied approximately 16,000 and 6,000 square feet which expired in April 2017 and August 2017, respectively. In July 2017, the Company entered an amendment to lease an additional 51,866 square feet for a total of 98,984 square feet. The Company moved into 18,888 of the additional square feet in August 2017 and into the remaining approximately 33,000 square feet in 2018. The lease term is through January 2028 and contains a five-year extension option.

In November 2018 and January 2019, we entered into two sub-lease agreements with separate third parties for 32,978 square feet and 32,909 square feet of our corporate headquarters.

We believe that our existing facilities will be sufficient to meet our current needs.

Item 3. Legal Proceedings.

We are not currently a party to any material legal proceedings.

Item 4. Mine Safety Disclosures.

Not applicable.

Part II

Item 5. Market for Registrant's Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities.

Our common stock has been listed on the Nasdaq Global Market under the symbol "AKAO" since March 12, 2014. Prior to that date, there was no public trading market for our common stock.

On March 29, 2019, the last trading day prior to April 1, 2019, the closing price for our common stock as reported by the Nasdaq Global Market was $0.46.

Holders of Common Stock

As of March 25, 2019, there were approximately 14 holders of record of our common stock. This number does not include beneficial owners whose shares are held by nominees in street name.

Dividend Policy

We have never declared or paid cash dividends on our capital stock. We intend to retain all available funds and any future earnings, if any, to fund the development and expansion of our business and we do not anticipate paying any cash dividends in the foreseeable future. Any future determination related to dividend policy will be made at the discretion of our board of directors.

Recent Sales of Unregistered Securities

From January 1, 2018 through December 31, 2018, we have not issued any securities in a transaction not registered under the Securities Act that have not been previously disclosed in a Quarterly report on Form 10-Q or Current Report on Form 8-K.

Use of Proceeds

Not applicable.

Issuer Purchases of Equity Securities

(1) On December 27, 2018, we entered into a License Confirmation Agreement and a Redemption Agreement with the Gates Foundation (together, the "2018 Agreements") in connection with the amendment of certain provisions of the Grant Agreement and the Letter Agreement each previously entered into with the Gates Foundation and dated as of May 4, 2017. The 2018 Agreements were entered into following the de-prioritization of our antibody work, which was the focus of our collaboration with the Gates Foundation. Among other things, the 2018 Agreements (a) terminated our obligations to conduct mutually agreed upon work, including work related to our platform technology to develop and launch a product intended to prevent neonatal sepsis, (b) terminated the obligations of the Company to discover drug candidates intended to prevent neonatal sepsis and the obligation of the Gates Foundation to fund approximately $7.1 million in grants not yet received by us and (c) granted the Gates Foundation a non-exclusive license to intellectual property developed by us pursuant to the Grant Agreement and Letter Agreement in specified developing countries.

The Redemption Agreement also provided for the redemption by us of the 407,331 shares of our common stock (the "Gates Shares") purchased by the Gates Foundation pursuant to a Common Stock Purchase Agreement with the Gates Foundation dated as of May 4, 2017 (the "Purchase Agreement") for an aggregate redemption price of $5.7 million. We paid for the redemption of the Gates Shares with the unused portion of the restricted cash received pursuant to the original purchase of the Gates Shares under the Purchase Agreement. No unrestricted cash was used to fund the redemption.

Item 6. Selected Financial Data

Not applicable.

Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations.

You should read the following discussion and analysis of our financial condition and results of operations together with our consolidated financial statements and related notes included elsewhere in this Annual Report on Form 10-K. This discussion and other parts of this report contain forward-looking statements that involve risk and uncertainties, such as statements of our plans, objectives, expectations, and intentions. As a result of many factors, including those factors set forth in the "Risk Factors" section of this Annual Report on Form 10-K, our actual results could differ materially from the results described in or implied by these forward-looking statements.

Overview

We are a biopharmaceutical company that develops and commercializes innovative antibacterial agents for multi-drug resistant (MDR) gram-negative infections. On June 25, 2018, the U.S. Food and Drug Administration (FDA) approved our first commercial product ZEMDRI® (plazomicin) for adults with complicated urinary tract infections (cUTI), including pyelonephritis, caused by certain Enterobacteriaceae in adult patients with limited or no alternative treatment options. ZEMDRI is an intravenous (IV) infusion, administered once daily over a 30-minute IV. The approval of ZEMDRI was supported by data from the EPIC (Evaluating Plazomicin in cUTI) clinical trial, which evaluated the safety and efficacy of plazomicin in patients with serious infections caused by gram-negative pathogens. ZEMDRI became commercially available in July 2018. In December 2018, we also filed a Formal Dispute Resolution Request with the FDA regarding a bloodstream infection (BSI) indication for plazomicin, for which the FDA issued a Complete Response Letter (CRL) in June 2018. We have global commercialization rights to ZEMDRI, which has patent protection in the United States estimated until 2031 or 2032. On October 17, 2018, we announced the submission of a Marketing Authorization Application (MAA) to the European Medicines Agency (EMA) for plazomicin. ZEMDRI was funded in part by a $124.4 million contract with the Biomedical Advanced Research and Development Authority (BARDA).

ZEMDRI is an aminoglycoside with once-daily dosing that has activity against certain Enterobacteriaceae, including carbapenem-resistant Enterobacteriaceae (CRE) and ESBL-producing Enterobacteriaceae. ZEMDRI was designed by our scientists to overcome the most common aminoglycoside resistance mechanisms, the aminoglycoside modifying enzymes (AMEs). We developed ZEMDRI by chemically modifying an existing aminoglycoside, sisomicin, a natural product isolated from bacteria, to shield the regions of the molecule that are targeted by the enzymes responsible for aminoglycoside resistance. As a result of these modifications, ZEMDRI has the potential to remain active against MDR organisms where most other major drug classes, including commercially available aminoglycosides, such as gentamicin and amikacin, have limited activity. Based on this profile, we developed ZEMDRI as an IV therapy for the treatment of serious bacterial infections due to MDR Enterobacteriaceae.

We consider the following to be key attributes that support the clinical utility and ultimate commercial value of ZEMDRI:

- Met the objective of non-inferiority compared to meropenem in the Phase 3 EPIC trial in patients with cUTI and pyelonephritis for the FDA-specified primary efficacy endpoint, and achieved superiority for the EMA-specified primary efficacy endpoint. ZEMDRI was well tolerated with no new safety concerns identified in this trial.
- Convenient administration as once-daily, 30-minute IV therapy.
- Potential to reduce the healthcare costs associated with the treatment of serious infections.
- Potential to improve dosing strategy compared to existing aminoglycosides and alternative therapeutic options, and individualized patient dosing using an in vitro assay.
- Potential to be used in combination with other antibiotics for the treatment of serious infections due to CRE.
- Potent in vitro activity against MDR Enterobacteriaceae, including ESBL- producers and CRE.

Based on these key attributes above, we believe that ZEMDRI has the potential to become a new standard of care for the treatment of multi-drug resistant recurrent cUTI infections and as an important part of the treatment algorithm for serious infections due to CRE.

On February 28, 2019, we commenced a restructuring of the organization to conserve our cash resources. The majority of the roles eliminated in the restructuring were field-based sales and medical scientist positions. Following the restructuring, which the Company expects to be complete by the end of the second quarter of 2019, the Company expects to have approximately 40 full-time employees, of which approximately 25% are expected to be commercial and medical affairs personnel.

On February 21, 2019, the New England Journal of Medicine published the results from the Phase 3 EPIC (Evaluating Plazomicin In cUTI) study of ZEMDRI. The publication described the efficacy and safety of ZEMDRI in adult patients with cUTI, including acute pyelonephritis. On the same day, The New England Journal of Medicine also published plazomicin's Phase 3 CARE results in a Letter to the Editor. In this published study, the efficacy and safety of plazomicin versus colistin was evaluated in patients with serious bloodstream infections or hospital-acquired/ventilator-associated bacterial pneumonia caused by carbapenem-resistant Enterobacteriaceae (CRE).

In December 2018, our secured lender Silicon Valley Bank (SVB) collateralized $25.0 million of the $50.0 million we previously borrowed under our loan and security agreement with SVB. Collateralization of this $25.0 million means that these funds are restricted and no longer available for our use until our cash on deposit at SVB exceeds the "Minimum Account Threshold" for thirty consecutive days, which is the greater of (a) $48.0 million and (b) the "Monthly Cash Burn," which is defined as the difference of (1)(i) net loss plus (ii) unfinanced capital expenditures minus (2)(i) depreciation and amortization expenses, (ii) non-cash stock compensation expense and (iii) other non-cash expenses as approved by SVB.

On November 5, 2018, we announced the beginning of a review of strategic alternatives to maximize shareholder value, including but not limited to the potential sale or merger of the Company or its assets. The strategic review process continues alongside our continued focus on the commercialization of ZEMDRI and other corporate initiatives. We may be unable to identify or execute such strategic alternatives for us, and even if executed such strategic alternatives may not enhance stockholder value, and even if executed, such strategic alternatives may not enhance stockholder value or our financial position.

On October 29, 2018, we borrowed $25.0 million under our existing Loan and Security Agreement with SVB dated as of February 26, 2018 ("SVB Loan Agreement").

On October 17, 2018, we announced the submission of a Marketing Authorization Application ("MAA") to the EMA for plazomicin in the European Union.

On August 2, 2018, the Centers for Medicare & Medicaid Services ("CMS") granted a new technology add-on payment ("NTAP") for ZEMDRI when administered to Medicare beneficiaries in the hospital inpatient setting. The NTAP program will provide certain eligible hospitals with a payment, in addition to the standard-of-care Diagnostic Related Group ("DRG") reimbursement, of up to 50% of the cost of ZEMDRI for a period of two to three years, effective in the 2019 fiscal year starting on October 1, 2018. CMS has assigned a maximum payment of $2,722.50 for a patient treated with ZEMDRI.

On July 26, 2018, we announced a strategic update and corporate restructuring to focus our resources on the successful commercialization of ZEMDRI in the United States, the filing of a Marketing Authorization Application for plazomicin in the European Union and continued development of its C-Scape and novel aminoglycoside programs.

The restructuring resulted in an elimination of approximately 28% of the Company's workforce.

On June 25, 2018, the FDA indicated that it would not approve our NDA, in its current form, that seeks approval of plazomicin for the treatment of bloodstream infections ("BSI"). The FDA issued a Complete Response Letter ("CRL") stating that clinical trials did not provide substantial evidence of effectiveness of plazomicin for the treatment of BSI. In December 2018, we filed a Formal Dispute Resolution Request with the FDA regarding the BSI indication for plazomicin. We believe that the data submitted in the NDA for plazomicin provides substantial evidence of efficacy in treating BSI and that plazomicin should be approved for the proposed BSI indication. The FDA denied our first-round FDRR and we are evaluating our current options, including the potential to request a further meeting with the reviewing division or further pursue our appeal.

We are developing C-Scape, an orally administered antibiotic to address a serious unmet need for an effective oral treatment for patients with cUTI, including pyelonephritis, caused by ESBL-producing Enterobacteriaceae. C-Scape is a b-lactam/b-lactamase inhibitor combination comprised of ceftibuten, an approved third generation cephalosporin, and clavulanate, an approved b-lactamase inhibitor. The FDA awarded Qualified Infectious Disease Product (QIDP) status to C-Scape for the treatment of cUTI in 2017. QIDP status provides incentives for the development of new antibiotics, including priority review and an extension by an additional five years of any existing non-patent market exclusivity the product may be awarded upon approval. Our C-Scape program is funded in part by a contract with BARDA for up to $18.0 million, of which $12.0 million is committed.

On January 2, 2018, we announced positive Phase 1 top-line results for C-Scape. The Phase 1 top-line results demonstrated that, in healthy subjects, C-Scape was well tolerated across all doses studied, with no drug-drug interactions observed between the previously approved compounds when dosed in combination. We completed additional in vitro and in vivo experiments with a revised drug product and, based on these results, believe this revised drug product is optimized for a subsequent Phase 1 clinical pharmacology study.

Critical Accounting Policies and Use of Estimates

Our management's discussion and analysis of our financial condition and results of operations is based on our consolidated financial statements, which have been prepared in accordance with generally accepted accounting principles in the United States. The preparation of these financial statements requires us to make estimates and assumptions that affect the reported amounts of assets and liabilities at the date of the consolidated financial statements, as well as the reported expenses incurred during the respective reporting periods. Our estimates are based on our historical experience and on various other factors that we believe are reasonable under the circumstances, the results of which form the basis for making judgments about the carrying value of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions. We believe that the accounting policies discussed below are most critical to understanding our historical and future performance, as these policies relate to the more significant areas involving management's judgments and estimates.

Impairment of Long-Lived Assets

We review long-lived assets, including property and equipment, for impairment whenever events or changes in business circumstances indicate that the carrying amount of the assets may not be fully recoverable. If indicators of impairment exist, an impairment loss would be recognized when the estimated undiscounted future cash flows expected to result from the use of the asset and its eventual disposition are less than it's carrying amount. The impairment charge is determined based upon the excess of the carrying value of the asset over its estimated fair value, with estimated fair value determined based upon an estimate of discounted future cash flows or other appropriate measures of estimated fair value. For the year ended December 31, 2018, we recorded an impairment charge related to property and equipment in connection with the restructurings effected in July and November 2018 (see Note 4 to the Financial Statements). There were no impairment charges for the year ended December 31, 2017.

Trade and contract receivables, net

Our trade accounts receivable are recorded net of prompt-payment discounts, incentive fees, chargebacks, and doubtful accounts. Estimates for chargebacks, prompt-payment discounts and incentive fees are based on contractual terms, historical trends and expectations regarding the utilization rates for these programs.

Inventory

Inventory is stated at lower of cost and net realizable value with costs determined under the first-in, first-out (FIFO) cost method and consists of raw materials, work-in-process and finished goods. Costs to be capitalized as inventory include third party manufacturing costs, associated compensation-related costs of personnel indirectly involved in the manufacturing process and other overhead costs. We use a combination of standard and actual costs to determine our cost basis for inventory. Standard costs are reviewed and updated annually or as needed. The inventory capitalization process began to be applied to ZEMDRI upon FDA approval on June 25, 2018. Prior to regulatory approval of ZEMDRI, we incurred expenses related to the manufacturing of the product and recorded all such costs as research and development expenses. Beginning on June 25, 2018, we began to capitalize inventory

costs associated with ZEMDRI when it was determined that the inventory had a probable future economic benefit and the related costs were expected to be realized through commercialization of ZEMDRI. If information becomes available that suggest that inventories may not be realizable, we may be required to expense a portion or all of its previously capitalized inventory. We periodically analyze our inventory levels, and evaluate for potential excess inventory by analyzing current and future product demand relative to the remaining product shelf life. We build demand forecasts by considering factors such as, but not limited to, overall market potential, market share, market acceptance and patient usage.

Sisomicin is our raw material, used to produce the active pharmaceutical ingredient ("API") in ZEMDRI. The API is converted into liquid plazomicin ("drug product") before being stored in vials, serialized, and packaged into cartons. Because the API and drug product undergo significant manufacturing specific to its intended purpose, the Company classifies them as work-in-process inventory. Once the product is packaged into cartons and ready to be shipped to the third-party logistics provider, the inventory is classified as finished goods.

Revenue Recognition

We adopted the Accounting Standards Update ("ASU") No 2014-09, Revenue from Contracts with Customers (Topic 606) at the time of our first commercial sale of ZEMDRI in the third quarter of 2018. Pursuant to ASC 606, we recognize revenue when the customer obtains control of promised goods or services, in an amount that reflects the consideration that we expect to receive in exchange for those goods or services. To determine revenue recognition for arrangements that we determine that are within the scope of ASC 606, we perform the following five steps: (i) identify the contract(s) with a customer; (ii) identify the performance obligations in the contract; (iii) determine the transaction price; (iv) allocate the transaction price to the performance obligations in the contract; and (v) recognize revenue when (or as) we satisfy a performance obligation. We only apply the five-step model to contracts when it is probable that we will collect the consideration we are entitled to in exchange for the goods or services we transfer to the customer. At contract inception, once the contract is determined to be within the scope of ASC 606, we assess the goods or services promised within each contract, determine those that are performance obligations, and assess whether each promised good or service is distinct. We then recognize revenue in the amount of the transaction price that is allocated to the respective performance obligation as the performance obligation is satisfied.

Product Revenue, Net

Our product revenue consists of the U.S. sales of ZEMDRI, which we began shipping to customers in July 2018. Prior to July 2018, we had no product revenues. We recognize revenue on product sales when the customer obtains control of the Company's product, which occurs at a point in time (upon delivery). We record product revenues net of applicable reserves for variable consideration, including discounts and allowances.

Reserves for Variable Consideration

We record revenues from product sales at the net sales price (transaction price), which includes estimates of variable consideration for which reserves are established and which result from discounts, returns, chargebacks, rebates, and other allowances that are offered within contracts between us and our customers, payors and other indirect customers relating to product sales. These reserves are based on the amounts earned or to be claimed on the related sales and are classified as reductions of accounts receivable (if the amount is payable to the customer) or a current liability (if the amount is payable to a party other than a customer).

Cost of Sales

Cost of sales represents primarily the costs associated with manufacturing ZEMDRI and ZEMDRI net sales-based royalties payable to Ionis Pharmaceuticals.

Research and Development Costs

Research and development costs are expensed as incurred. Research and development expenses include certain payroll and personnel expenses, laboratory supplies, consulting costs, medical affairs, external contract research and development expenses, and allocated overhead, including rent, equipment depreciation, and utilities and relate to both programs sponsored by us as well as costs incurred pursuant to collaboration agreements, non-

profit grants and government contracts. Nonrefundable advance payments for goods or services that will be used or rendered for future research and development activities on our behalf are deferred and expensed as the goods are delivered or the related services are performed.

For certain research and development services where we have not yet been invoiced or otherwise notified of actual cost from the third-party contracted service providers, we are required to estimate the extent of the services that have been performed on our behalf and the associated costs incurred at each reporting period. The majority of our service providers invoice us monthly in arrears for services performed. We make estimates of our accrued expenses as of each balance sheet date in our consolidated financial statements based on facts and circumstances known to us at that time. We periodically confirm the accuracy of our estimates with the service providers and make adjustments if necessary. Examples of estimated accrued research and development expenses include services from:

- contract research organizations ("CROs") and other service providers in connection with clinical studies;
- contract manufacturers in connection with the production of clinical trial materials; and
- vendors in connection with preclinical development activities.

We base our expenses related to preclinical studies and clinical trials on our estimates of the services received and efforts expended pursuant to contracts with multiple research institutions and CROs that conduct and manage such studies and trials on our behalf. The financial terms of these agreements are subject to negotiation, vary from contract to contract, and may result in uneven payment flows and expense recognition. Payments under some of these contracts depend on factors such as the successful enrollment of patients and the completion of clinical trial milestones. In accruing service fees, we estimate the time period over which these services will be performed and the level of effort to be expended and costs to be incurred during each reporting period. If the actual timing of the performance of services or the level of effort varies from our estimate, we adjust the accrual accordingly. Our estimation of the status and timing of services performed relative to the actual status and timing of services performed may vary and may result in our reporting changes in estimates in any particular period. To date, there have been no material adjustments from our estimates to the amount actually incurred.

Advance payments for goods or services that will be used or rendered for future research and development activities are capitalized as prepaid expenses and recognized as an expense as the goods are delivered or the related services are performed. Prior to the approval of ZEMDRI, all commercial manufacturing of ZEMDRI had been recognized as research and development expense.

Stock-Based Compensation

Stock-based compensation expense for all stock-based compensation awards is based on the grant date fair value. Grant date fair value of time-based and milestone-based stock options are estimated using the Black-Scholes option pricing model ("Black-Scholes") and the Monte-Carlo simulation model for stock options with a market condition. The grant date fair value of restricted stock units is based on the closing price of our stock on the date of grant. We have limited historical information available to support the underlying estimates of certain assumptions required to value stock options. The expected term of options is estimated based on the simplified method. We do not have sufficient trading history to solely rely on the volatility of our own common stock for establishing expected volatility. Therefore, we based our expected volatility on the historical stock volatilities of our common stock as well as several comparable publicly listed companies over a period equal to the expected term of the options. The risk-free interest rate is based on the U.S. Treasury yield curve in effect at the time of grant for the expected term of the stock option. We estimate our forfeiture rate based on an analysis of our actual forfeitures and will continue to evaluate the adequacy of the forfeiture rate based on actual forfeiture experience, analysis of employee turnover behavior and other factors. The impact from a forfeiture rate adjustment will be recognized in full in the period of adjustment, and if the actual number of future forfeitures differs from that estimated, we may be required to record adjustments to stock-based compensation expense in future periods. We recognize compensation expense on a straight-line basis over the

requisite service period.

The assumptions used in calculating the fair value of share-based payment awards represent management's best estimates, but these estimates involve inherent uncertainties and the application of management judgment. As a result, if factors change and we use different assumptions, our stock-based compensation expense could be

materially different in the future. In addition, if our actual forfeiture rate is materially different from our estimate, the stock-based compensation expense could be significantly different from what we have recorded in the current period.

Income Taxes

We are subject to income tax in the United States. We use the asset and liability method of accounting for income taxes in which deferred tax assets and liabilities are recognized for the future tax consequences attributable to differences between the consolidated financial statement carrying amounts of existing assets and liabilities and their respective tax bases. Deferred tax assets and liabilities are measured using enacted tax rates expected to apply to taxable income in the years in which those temporary differences are expected to be reversed. The effect on deferred tax assets and liabilities of a change in tax rates is recognized as income in the period that includes the enactment date. A valuation allowance is established if it is more likely than not that all or a portion of the deferred tax asset will not be realized.

Our tax positions are subject to income tax audits by multiple tax jurisdictions. We recognize the tax benefit of an uncertain tax position only if it is more likely than not that the position is sustainable upon examination by the taxing authority, based on the technical merits. The tax benefit recognized is measured as the largest amount of benefit which is more likely than not (greater than 50% likely) to be realized upon settlement with the taxing authority. We recognize interest and penalties accrued on any unrecognized tax benefits as a component of income tax expense.

We calculate the current and deferred income tax provision based on estimates and assumptions that could differ from the actual results reflected in income tax returns filed in subsequent years. Adjustments based on our filed income tax returns are recorded when identified. The amount of income taxes paid is subject to examination by U.S. federal and state tax authorities. The estimate of the potential outcome of any uncertain tax issue is subject to management’s assessment of relevant risks, facts, and circumstances existing at that time. To the extent the assessment of such tax position changes, the change in estimate is recorded in the period in which the determination is made.

Warrant Liability

We have warrants outstanding to purchase shares of common stock. The fair value of the warrants outstanding in connection with the Private Placement is classified as a liability on our consolidated balance sheets as the warrants contain certain material terms which require us to settle the warrants, in a case of certain change of control transactions, for cash equal to the estimated fair value, determined by a Black-Scholes analysis.

The initial fair value of the warrants was determined using a calibration model that involved using Black-Scholes, which requires inputs such as the risk-free interest rate, expected share price volatility, underlying price per share of our common stock and remaining term of the warrants. The warrants are subject to remeasurement at each balance sheet date, using Black-Scholes, with any changes in the fair value of the outstanding warrants included in “change in warrant and derivative liabilities” in the consolidated statements of operations.

Financial Overview and Results of Operations

General

We have not generated net income from operations and, at December 31, 2018, we had an accumulated deficit of $559.4 million, primarily as a result of research and development and general and administrative expenses. While we may in the future generate revenue from potential other sources, our current revenue is generated solely from product sales, research and development funding pursuant to government, and non-profit foundation contracts. Depending on our level of investment to support these areas, the amount of revenue we generate in the future is uncertain.

Revenues

Our revenues relate to product revenue from sales of ZEMDRI and contract revenue from services performed for the development of our product candidates under non-profit foundation and U.S. government contracts

(collectively, the "Revenue Contracts"). For the years ended December 31, 2018 and 2017, net product revenue was $0.8 million and zero, and contract revenue was $7.9 million and $11.2 million, respectively. We have derived all of our revenue to-date from product revenue and funding provided under the Revenue Contracts in connection with the development of our product candidates.

Biomedical Advanced Research and Development Authority (BARDA)

We have received funding for our lead product candidate, ZEMDRI, under a contract with BARDA, an agency of the U.S. Department of Health and Human Services for the development, manufacturing, nonclinical and clinical evaluation of, and regulatory filings for, ZEMDRI as a countermeasure for disease caused by antibiotic-resistant pathogens and biothreats. Our BARDA contract (the "BARDA-plazo Contract") provides for payments to us based on direct costs incurred and allowances for overhead, plus a fee, where applicable. The total committed funding under our BARDA contract was $124.4 million. Through December 31, 2018, the total committed amount of $124.4 million under the BARDA Contract has been recorded as revenue.

In September 2017, BARDA awarded us funding to support the development, including Phase 1 and Phase 3 clinical studies and manufacturing and analytical testing, of C-Scape ("BARDA C-Scape Contract"). This contract provides for payments to us based on direct costs incurred and allowances for overhead, plus a fee, where applicable. The total committed funding under this contract is $12.0 million, including subsequent option periods that, if exercised, would bring the total value of the award to $18.0 million. Through December 31, 2018, a total of $5.2 million was recorded as revenue under this BARDA contract, with $6.8 million of funding remaining.

For the years ended December 31, 2018 and 2017, total revenue recognized under these contracts was $4.3 million and $8.7 million, respectively, of which $0.4 million and $1.0 million were included in contracts receivable at December 31, 2018 and 2017, respectively.

Combating Antibiotic Resistant Bacteria Biopharmaceutical Accelerator (CARB-X)

In April 2018, we were awarded $2.4 million, with a possibility of up to $9.6 million in additional funding based on achievement of certain project milestones, from CARB-X ("CARB-X contract"). The funding was awarded to support the development of a next-generation broad-spectrum aminoglycoside antibiotic capable of overcoming clinically-relevant resistance mechanisms and potentially treating highly-resistant gram-negative pathogens such as the Enterobacteriaceae family, Acinetobacter baumannii, and Pseudomonas aeruginosa. Through December 31, 2018, total of $1.3 million was recorded as revenue under this CARB-X contract, with $1.1 million of funding remaining.

Bill & Melinda Gates Foundation

In May 2017, we entered into an agreement with the Gates Foundation to discover drug candidates against gram-negative bacterial pathogens intended to prevent neonatal sepsis. The Gates Foundation awarded up to approximately $10.5 million in grant funding ("Grant Agreement") over a three-year research term, of which, approximately $3.2 million of funding was received in May 2017 and fully utilized as of December 31, 2018. In December 2018, the Grant Agreement was amended to reduce the total grant amount by $7.1 million. Through December 31, 2018, total of $3.3 million was recorded as revenue under this Grant Agreement, with no more funding available.

For the years ended December 31, 2018 and 2017, total revenue recognized under the Grant Agreement was $2.2 million and $1.1 million, respectively.

Comparison of Years Ended December 31, 2018 and 2017

	Year Ended December 31,		
	2018	2017	Change
	(in thousands)		
Revenues			
Product revenue, net	$783	$—	783
Contract revenue	7,945	11,175	(3,230)
Total revenues	8,728	11,175	(2,447)
Operating expenses:			
Cost of sales	31	—	31
Research and development	102,959	95,598	7,361
Selling, general and administrative	71,385	41,903	29,482
Restructuring charges	23,518	—	23,518
Loss from operations	(189,165)	(126,326)	(62,839)
Interest expense	(2,112)	(2,855)	743
Change in warrant and derivative liabilities	9,053	1,928	7,125
Loss on debt extinguishment	(819)	—	(819)
Loss on redeemable common stock settlement	(5,179)	—	(5,179)
Other income, net	1,710	1,635	75
Net loss	$(186,512)	$(125,618)	$(60,894)

Revenues

Product revenues relates solely to sales of the Company's only approved product, ZEMDRI. For the years December 31, 2018 and 2017, $0.8 million and zero, respectively, of net product sales of ZEMDRI were recognized. Product revenues from the sale of ZEMDRI are recorded net of applicable reserves for variable consideration, including discounts and allowances.

Contract revenue in each period related solely to funding pursuant to our Revenue Contracts. Contract revenue decreased $3.2 million to $7.9 million for the year ended December 31, 2018 from $11.2 million for the year ended December 31, 2017. This decrease was primarily due to lower BARDA contract revenues.

Cost of Sales

We began capitalizing inventory costs after FDA approval of ZEMDRI as the related costs were expected to be recoverable through the commercialization of the product. Costs incurred prior to FDA approval have been recorded as research and development expenses in our consolidated statement of operations. As a result, we expect cost of sales for the next several quarters will reflect a lower average per unit cost of materials.

Research and Development Expenses

Research and development expenses consist primarily of costs associated with research, discovery and preclinical studies of potential new drug compounds, plus product development efforts related to clinical trials and materials manufacturing processes as well as our medical affairs and pharmacovigilance costs. Research and development expenses increased $7.4 million to $103.0 million for the year ended December 31, 2018 from $95.6 million for the comparable period in 2017. This was primarily due to increases of $2.9 million in personnel and facility related costs

including the facilities and IT allocations as we expanded our footprint offset by our restructurings, an increase of $8.0 million in external expenses related to our ZEMDRI program, mainly attributable to the $7.5 million milestone license fee associated with FDA approval and manufacturing of ZEMDRI pre-FDA approval, offset by a decrease of $3.2 million in external expenses related to C-Scape, and a decrease of $0.2 million in external non-clinical costs for other research programs.

We record research and development expenses by program where directly identifiable. In the table below, we have allocated indirect research and development costs based on time charged directly to programs by research and development employees. Indirect research and development costs include employee benefit expenses, employee time not charged directly to a program, laboratory supplies and expenses, and allocated facility expenses.

The following table illustrates the components of our research and development expenses during the periods indicated:

	Year Ended December 31,		
	2018	2017	Change
	(in thousands)		
Research and development expenses by program:			
ZEMDRI	$71,964	$58,898	$13,066
C-Scape	12,764	16,866	(4,102)
Other research programs	18,231	19,834	(1,603)
Total research and development expenses	$102,959	$95,598	$7,361

Selling, General and Administrative Expenses

Selling, general and administrative expenses consist principally of personnel-related costs, professional fees for legal, consulting, finance, audit and tax services, IT software, projects and services, commercialization activities, rent and other general operating expenses not otherwise included in research and development. Selling, general and administrative expenses increased $29.5 million to $71.4 million for the year ended December 31, 2018 from $41.9 million for the comparable period in 2017. The increase in general and administrative expenses was primarily due to an increase of $15.3 million in personnel and facility related costs, as due to the hiring of our field sales team in the second quarter of 2018 and other hires in 2018 related to commercialization offset by the costs of our restructurings, an increase of $6.0 million in costs to prepare for commercialization of ZEMDRI and an increase of $8.2 million in consulting and professional fees.

Interest Expense

Interest expense decreased $0.7 million to $2.1 million for the year ended December 31, 2018 from $2.9 million for the year ended December 31, 2017. The decrease was attributable to the lower interest costs associated with the SVB Loan Agreement compared to the prior Solar Capital debt facility.

Change in Warrant and Derivative Liabilities

Change in warrant and derivative liabilities increased $7.1 million to a $9.1 million gain for the year ended December 31, 2018 from a $1.9 million in gain for the year ended December 31, 2017. The increase is primarily due to the change in the estimated fair value of the warrant liability, which decreased mainly due to the change in our stock price.

Restructuring Charges

Restructuring charges increased by $23.5 million as a result of the restructurings announced in July and November 2018. The charges primarily consist of $14.0 million in non-cash fixed asset impairment and facility exit costs, $7.5 million in severance and payroll related costs, and $2.0 million in stock-based compensation costs. No restructuring charges were recorded for the year ended December 31, 2017.

Loss on Redeemable Common Stock Settlement

Loss on redeemable common stock settlement increased by $5.2 million as a result of the repurchase of the contingently redeemable common stock from the Gates Foundation. The loss represents the difference between the redemption purchase price and the fair value of the stock on the day of the settlement. No loss on redeemable common stock was recorded for the year ended December 31, 2017.

Liquidity and Capital Resources

Since our inception, we have financed our operations with the proceeds from the underwritten public offerings of our common stock, proceeds from sales of our common stock through the use of our ATM equity offering programs, private placements of our equity securities and certain debt-related financing arrangements. In addition, we have historically received funding provided under U.S. government contracts and non-profit foundations in connection with the development of ZEMDRI and our product candidates. We have had difficulty raising sufficient

funds to advance our commercialization of ZEMDRI in the way we intended and our revenues from sales of ZEMDRI to date have been very limited. For the fiscal year ended December 31, 2018, we recognized $0.8 million in net product revenue from sales of ZEMDRI.

Our ZEMDRI and C-Scape programs have been funded in part with contracts from BARDA. Historically, our preclinical programs have received funding support from organizations such as the Gates Foundation and CARB-X as well as through our company funds.

In September 2017, we were awarded a C-Scape Contract valued at up to $18.0 million in grant funding from BARDA to support the development of C-Scape. The C-Scape Contract includes a base period with committed funding of $12.0 million and subsequent option periods that, if exercised, would bring the total value of the award to $18.0 million.

On February 26, 2018, we entered into a new loan and security agreement with Silicon Valley Bank, pursuant to which Silicon Valley Bank agreed to make available to us term loans with an aggregate principal amount of up to $50.0 million, $20.9 million of which was used to repay our loan with Solar Capital Ltd., $4.1 million of which was provided to us on February 26, 2018.

On February 27, 2018, we filed an amended Registration Statement on Form S-3 (the "2018 Shelf Registration Statement") covering the offering of up to $250.0 million of common stock, preferred stock, debt securities, warrants and units. In addition, on February 27, 2018, we filed a prospectus supplement to the 2018 Shelf Registration Statement covering the offering, issuance and sale of up to $50.0 million shares of our common stock in ATM offerings pursuant to a Common Stock Sales Agreement entered into with Cowen and Company, LLC (the "2018 Sales Agreement") on February 27, 2018. During the twelve months ended December 31, 2018, the Company sold 3,089,358 shares of common stock under the 2018 Sales Agreement, at a weighted-average price of approximately $2.46 per share for aggregate gross proceeds of $7.6 million and aggregate net proceeds of $7.4 million.

On April 24, 2018, we were awarded $2.4 million, with a possibility of up to $9.6 million in additional funding based on achievement of certain project milestones, from CARB-X. The funding was awarded to support the development of a next-generation broad-spectrum aminoglycoside antibiotic capable of overcoming clinically-relevant resistance mechanisms and potentially treating highly-resistant gram-negative pathogens such as the Enterobacteriaceae family, Acinetobacter baumannii, and Pseudomonas aeruginosa.

On October 29, 2018, we borrowed $25.0 million (the "Term B Loan") under the SVB Loan Agreement. The Term B Loan has a maturity of four years and bears interest through maturity at a floating per annum rate equal to the greater of (a) 1.00% above the prime rate and (b) 5.50%. No borrowings remain available to us under the SVB Loan Agreement. In December 2018, SVB collateralized $25.0 million of the $50.0 million we had borrowed under the SVB Loan Agreement. Collateralization of this $25.0 million means that these funds are restricted and no longer available for our use until our cash on deposit at SVB exceeds the "Minimum Account Threshold" for thirty consecutive days, which is the greater of (a) $48.0 million and (b) the "Monthly Cash Burn," which is defined as the difference of (1)(i) net loss plus (ii) unfinanced capital expenditures minus (2)(i) depreciation and amortization expenses, (ii) non-cash stock compensation expense and (iii) other non-cash expenses as approved by SVB.

On February 15, 2019, the Company entered into an underwriting agreement with H.C. Wainwright & Co., LLC related to the public offering by the Company of (i) 15,000,000 shares of the Company's common stock , (ii) Series A warrants to purchase up to 15,000,000 shares of common stock and (iii) Series B warrants to purchase up to 15,000,000 shares of common Stock. The combined offering price per share of common Stock and the accompanying Series A and Series B warrants ("Warrants") was $1.00, representing an offering price of $0.99 per share of common Stock, with the accompanying Warrants offered at a purchase price of $0.01 per Warrant combination. The net

proceeds from the public offering of common Stock is approximately $13.6 million.

At December 31, 2018, we had unrestricted cash and cash equivalents of $31.0 million and restricted cash of approximately of $25.5 million, for a total cash and cash equivalents of $56.5 million as of December 31, 2018.

Plan of Operations and Future Funding Requirements

Based on our available cash resources, which excludes restricted cash (including the $25.0 million of restricted cash collateralized in connection with the SVB Loan Agreement), we believe we have sufficient cash to support current planned operations into June 2019. This condition results in the assessment that there is substantial doubt about our ability to continue as a going concern.

There can be no assurance that we will obtain additional debt or equity financing or generate product revenue or revenues from collaborative partners, on terms acceptable to us, on a timely basis or at all. If we raise additional funds by issuing equity, the issuance of additional shares will result in dilution to our current stockholders. If additional financing is accomplished by the issuance of additional debt, the service cost, or interest will reduce net income or increase net loss, and we may also be required to issue shares of common stock or warrants to purchase shares of common stock in connection with issuing such debt. If we are unable to raise additional funding, a further reduction in the scope of our operations may become necessary or we may need to file for protection under United States Bankruptcy laws. Our ability to obtain debt financing may be limited by covenants we have made under the SVB Loan Agreement (such as our covenant not to incur indebtedness other than certain specified forms of indebtedness) and our pledge to SVB of substantially all of our assets, other than our intellectual property, as collateral. The negative pledge in favor of SVB with respect to our intellectual property under the SVB Loan Agreement could further limit our ability to obtain additional debt financing. Our failure to raise capital as and when needed would adversely impact affect our business, results of operations, and financial condition.

The amount and timing of our future financing requirements will depend on many factors, including:

- the size and timing of revenues from ZEMDRI
- the size, timing and type of the nonclinical and clinical studies, including post-marketing commitments, that we decide to pursue in the development of C-Scape;
- our ability to identify and consummate a strategic transaction and the timing and nature of any strategic transactions that we undertake (if any);
- the timing of, and costs involved in, seeking and obtaining FDA and other regulatory approvals for C-Scape and other product candidates, and for seeking and obtaining regulatory approvals outside the United States for plazomicin;
- our ability to enter into additional collaboration, licensing or other arrangements and the terms and timing of such arrangements;
- the costs of preparing, filing, prosecuting, maintaining and enforcing any patent applications or claims and other intellectual property rights, including litigation costs and the results of such litigation;
- the emergence of competing technologies and other adverse market developments;
- the resources we devote to marketing and commercializing ZEMDRI;
- the resources we devote to marketing, and, if approved, commercializing our product candidates;
- the scope, progress, expansion, and costs of manufacturing our product or candidates;
- our ability to enter into additional government contracts, or other collaborative agreements, to support the development of our product candidates and development efforts, including potential collaborative arrangements relating to the commercialization of ZEMDRI outside the United States, if approved; and
- the costs associated with being a public company.

Future capital requirements will also depend on the extent to which we acquire or invest in additional businesses, products and technologies. We currently have no commitments or agreements relating to any of these types of transactions.

If we are unable to raise additional funds when needed, we may be required to delay, reduce or terminate the commercialization of ZEMDRI, our efforts to obtain regulatory approval for plazomicin from the EMA, the

development of C-Scape and other operations and could be forced to default under the SVB Loan Agreement or file for relief under the provisions of the U.S. Bankruptcy Code. We may also be required to sell or license to others technologies or clinical product candidates or programs that we would prefer to develop and commercialize ourselves or on terms that are less favorable that we might otherwise obtain.

Since July 2018, we have already implemented three restructurings, which has caused us to stop or reduce many activities in order to conserve capital resources.

On July 26, 2018, we announced a strategic update and corporate restructuring to focus our resources on the successful commercialization of ZEMDRI in the United States, the filing of a Marketing Authorization Application for plazomicin in the European Union and continued development of our C-Scape and novel aminoglycoside programs. The restructuring resulted in an elimination of approximately 28% of the Company's workforce.

On November 5, 2018, we announced a restructuring of our organization to preserve cash resources which is expected to reduce total operating expenses by approximately 35-40 percent, excluding one-time charges. The restructuring was largely completed by the end of 2018. The restructuring is designed to focus our cash resources on the continued successful launch of ZEMDRI and advancing C-Scape. We expect to incur substantial expenditures in the foreseeable future to support these priorities.

On February 28, 2019, we commenced a restructuring of our organization to conserve our cash resources. The majority of the roles eliminated in the restructuring were field-based sales and medical scientist positions.

Following the February restructuring, which we expect to be complete by the end of the second quarter of 2019, the Company expects to have approximately 40 full-time employees, of which approximately 25% are expected to be commercial and medical affairs personnel. We expect the restructuring to generate costs savings beginning in the second quarter of 2019 for both research and development expenses and selling, general and administrative expenses. We currently believe we have sufficient cash and cash equivalents to support current planned operations into June 2019.

Cash Flows

The following table sets forth the primary sources and uses of cash and cash equivalents for each of the periods presented below:

	Year Ended December 31,	
	2018	2017
	(in thousands)	
Net cash provided by (used in):		
Operating activities	$(165,000)	$(95,255)
Investing activities	11,491	468
Financing activities	55,030	130,411
Net increase (decrease) in cash, cash equivalents and restricted cash	$(98,479)	$35,624

Operating Activities

Net cash used in operating activities was $165.0 million and $95.3 million for the years ended December 31, 2018 and 2017, respectively. The primary use of cash was to fund our operations related to the research and development of our product candidates and to prepare for commercialization of ZEMDRI. Our net loss from operations in the year ended December 31, 2018 of $186.5 million was adjusted by non-cash gains of $9.1 million for the change of the warrant and derivative liabilities and $0.3 million for amortization of discount on short-term investments, and partially offset by non-cash charges of $2.6 million for depreciation and amortization, $0.8 million for non-cash interest expense, $14.4 million for stock-based compensation, $14.0 million for restructuring impairment, $5.2 million for loss on settlement of contingently redeemable stock and a change in net operating assets and liabilities of $7.2 million. The change in net operating assets and liabilities was primarily due to an increase in trade and contract receivables, decrease in prepaid expenses and other current assets and increase in other assets, as a result of commitments and deferred research and development costs related to our commercial validation and manufacturing for ZEMDRI, an increase in inventory, and increase in accounts payable and accrued liabilities partially offset by an decrease in deferred revenue, as a result of using the Advance Funds received under the grant agreement with the Gates Foundation.

Net cash used in operating activities for the year ended December 31, 2017 is primarily comprised of our net loss of $125.6 million, adjusted by non-cash charges of $1.9 million for the change of the warrant and derivative liabilities, $0.2 million for amortization of discount on short-term investments, and partially offset by non-cash charges of $1.3 million for depreciation and amortization, $0.8 million for non-cash interest expense, $14.2 million for stock-based compensation, and a change in net operating assets and liabilities of $16.1 million. The change in net operating assets and liabilities was primarily due to a decrease in contract receivable, partially offset by an increase in prepaid expenses and other assets, as a result of commitments in deferred research and development costs related to our commercial validation and manufacturing of ZEMDRI, an increase in accounts payable, accrued liabilities and deferred revenue, as a result of the Advance Funds received under the grant agreement with the Gates Foundation.

Investing Activities

Net cash provided by investing activities was $11.5 million for the year ended December 31, 2018 and consisted primarily of maturities of short-term investments of $78.0 million, partially offset by purchases of short-term securities of $58.1 million and purchases of property and equipment of $9.0 million.

Net cash provided by investing activities was $0.5 million for the year ended December 31, 2017 and consisted primarily of maturities of short-term investments of $129.4 million, partially offset by purchases of short-term securities of $121.8 million and purchases of property and equipment of $7.1 million.

Financing Activities

Net cash provided by financing activities was $55.0 million for the year ended December 31, 2018. The net cash provided by financing activities during the year ended December 31, 2018 includes $31.4 million of net proceeds, after deducting the issuance costs, from the sales of common stock, $49.2 million of net proceeds from the loan provided by SVB, and $3.0 million from issuance of common stock pursuant to our equity incentive plans, partially offset by a $22.8 million principal repayment on the loan provided by Solar Capital Ltd and $5.7 million from the repurchase of contingently redeemable common stock.

Net cash provided by financing activities was $130.4 million for the year ended December 31, 2017. The net cash provided by financing activities during the year ended December 31, 2017 includes $121.2 million of net proceeds, after deducting the underwriting discounts and commissions, from an underwritten public offering of our common stock in May 2017, approximately $10.0 million of gross proceeds from the sale of contingently redeemable common stock to the Gates Foundation in May 2017, $0.4 million of proceeds from the exercise of certain warrants issued from the Private Placement, and $3.0 million from issuance of common stock pursuant to our equity incentive plans, partially offset by a $4.2 million principal repayment on the former term loan provided by Solar Capital Ltd.

Contractual Obligations and Commitments

Solar Capital Ltd. Loan Agreement & Success Fee Agreement

On August 5, 2015, we entered into a loan and security agreement (the "Solar Loan Agreement") with Solar Capital Ltd. (the "Solar Capital") pursuant to which Solar Capital agreed to make available to the us term loans in an aggregate principal amount of up to $25.0 million with a maturity date of August 5, 2019. An initial $15.0 million term loan was funded at closing on August 5, 2015, and a second $10.0 million term loan was funded on June 20, 2016. Borrowings under the term loans bore interest per annum at 6.99% plus the greater of 1% or the one-month LIBOR. The obligation also included a final fee of $2.0 million, representing 8% of the term loan currently funded, which accreted over the life of the loan as interest expense. On February 26, 2018, we terminated the Solar Loan Agreement and repaid the outstanding principal and accrued interest expense of $20.9 million. For the year ended December 31, 2018, we recorded a loss from debt extinguishment of $0.8 million as the difference between the net carrying amount of the Solar Capital debt and the amount paid.

On August 5, 2015, pursuant to the Solar Loan Agreement, we entered into a Success Fee Agreement with Solar Capital under which the we agreed to pay Solar Capital $1.0 million if we obtain FDA approval to market ZEMDRI. If such approval is obtained, the Success Fee shall be due the later of (i) August 5, 2019 or (ii) the date such FDA approval is obtained. We obtained FDA approval for ZEMDRI on June 25, 2018; therefore, the Success Fee is due on August 5, 2019.

Silicon Valley Bank Loan Agreement

On February 26, 2018, we entered the SVB Loan Agreement. The SVB Loan Agreement provides for (i) a $25.0 million Term A loan facility with a maturity of five years (the "Term A Loan") and (ii) an up to $25.0 million Term B loan facility, which may be drawn, subject to certain conditions, by us during the first 12 months after February 26, 2018 (the "Term B Loans" and collectively, with the Term A Loan, the "Term Loans"). Each Term B Loan has a maturity of four years. As of December 31, 2018, we have received initial funding from the Term A Loan of $25.0 million, which was primarily used to repay our prior loan agreement with Solar Capital, and the remaining funding from the Term B Loan of $25.0 million. No borrowings remain available to us under the SVB Loan Agreement.

Borrowings under the Term A Loan bear interest at a floating per annum rate equal to the greater of (a) the prime rate minus 1.50% and (b) 3.00%, and the Term B Loans bear interest through maturity at a floating per annum rate equal to the greater of (a) 1.00% above the prime rate and (b) 5.50%. We are permitted to make interest-only payments on the Term A Loan through February 2020 and the Term B Loans for the first twenty-four (24) months following the funding date of each respective Term B Loan after which we will be required to repay the Term A Loan in 36 consecutive equal monthly installments of principal and repay any Term B Loans in 24 consecutive equal monthly installments of principal. We are obligated to pay a fee equal to 6.00% of the funded Term Loans upon the earliest to occur of the maturity date, the prepayment or repayment of such Term Loans or the termination of the SVB Loan Agreement. The final payment fee of $3.0 million, which represents 6% of the funded Term Loans is accreted under the effective interest method over the life of the loan as interest expense. We may voluntarily prepay all, but not less than all, of the outstanding Term Loans. The Term Loans are secured by substantially all of our assets, except for its intellectual property which is subject to a negative pledge and certain other customary exclusions. The SVB Loan Agreement contains customary representations, warranties and covenants.

In December 2018, SVB collateralized $25.0 million of the $50.0 million we previously borrowed under the SVB Loan Agreement. Collateralization of this $25.0 million means that these funds are restricted and no longer available for our use until our cash on deposit at SVB exceeds the "Minimum Account Threshold" for thirty consecutive days, which is the greater of (a) $48.0 million and (b) the "Monthly Cash Burn," which is defined as the difference of (1)(i)

net loss plus (ii) unfinanced capital expenditures minus (2)(i) depreciation and amortization expenses, (ii) non-cash stock compensation expense and (iii) other non-cash expenses as approved by SVB.

An event of default will occur under the SVB Loan Agreement if, among other things, we fail to make payments, we breach any of our covenants, subject to specified cure periods with respect to certain breaches, we or our assets become subject to certain legal proceedings, such as bankruptcy proceedings, we are unable to pay our debts as they become due, we default on contracts with third parties which would permit the holder of indebtedness to accelerate the maturity of such indebtedness or that could have a material adverse change on us or SVB

determines that a ‘material adverse change’ has occurred. The SVB Loan Agreement defines a ‘material adverse change’ as a material (a) impairment in the perfection or priority of SVB’s lien in its collateral or the value of its collateral, (b) adverse change in our business, operations, or condition (financial or otherwise) or (c) impairment of the prospect of our repayment to SVB of any portion of our obligations under the SVB Loan Agreement.

Upon the occurrence and for the duration of an event of default, including a determination by SVB that a ‘material adverse change’ has occurred, an additional default interest rate equal to 4.0% per annum will apply to all obligations owed under the SVB Loan Agreement. In addition, we may be required to repay the outstanding indebtedness if an event of default occurs under the SVB Loan Agreement. We may not have enough available cash or be able to raise additional funds through equity or debt financings to repay such indebtedness at the time any such event of default occurs. In this case, we may be required to delay, reduce or terminate the commercialization of ZEMDRI, our efforts to obtain regulatory approval for plazomicin from the EMA, the development of C-Scape and other operations and could be forced to file for relief under the U.S. Bankruptcy Code. SVB could also exercise its rights as collateral agent to take possession of and to dispose of the collateral securing the term loans, which collateral includes our cash held in our bank accounts with SVB and substantially all of our property (excluding intellectual property, which is subject to a negative pledge). Our business, financial condition and results of operations would be materially adversely affected as a result of any of these events.

Contract Manufacturing Obligations

In March 2017, we entered into a commercial validation and manufacturing agreement (the “Commercial Manufacturing Agreement”) with Hovione Limited (“Hovione”). Under the Commercial Manufacturing Agreement, Hovione has agreed to complete the validation program to validate and scale up our technology to manufacture the active pharmaceutical ingredient for plazomicin (the “Product”) and supply the Product to us. The Commercial Manufacturing Agreement has an initial term of seven years after the first delivery of the Product.

In connection with the Commercial Manufacturing Agreement, we executed certain work plans to carry out the validation and commercial manufacturing of plazomicin (the “Work Plans”). The Work Plans include certain terms that require us to compensate Hovione if it chooses to cancel the Work Plans (“Cancellation Clause”). As of December 31, 2018, $14.8 million is committed under the Cancellation Clause and the total aggregate amount of potential commitments, if all the services are rendered by Hovione, is approximately $26.4 million.

Upon the successful completion of the validation program and the Company’s launch of ZEMDRI, we agreed to purchase a minimum quantity of the Product from Hovione depending on the Company’s requirements and the period of time following approval by the FDA. For the first three years following approval of ZEMDRI by the FDA, the Company is required to purchase at least 80% of its required quantity from Hovione. Following the initial three years after FDA approval, the Company is required to purchase between 40% and 66% of its required quantity from Hovione, depending on the amounts required during any such fiscal year. Subsequent to FDA’s approval of ZEMDRI, the Company has minimum annual purchase commitments from Hovione of $53.0 million, beginning in 2020 through 2024.

Lease Obligations

In August 2016, we entered into a non-cancelable agreement (the "Lease") to lease 47,118 square feet of office, laboratory and research and development space (the “Original Space”) for our principal executive offices in South San

Francisco. In July 2017, we entered into an amendment (the "Lease Amendment") to lease an additional 51,866 square feet of space (the "Expansion Space") for a total of 98,984 square feet (the "Premises"). The Lease commenced in March 2017 and as of January 2018, we occupied the full Premises. The lease term for the Premises is through January 31, 2028 (the "Lease Term") and contains an option to extend the Lease Term for an additional 5 years. The Lease has rent escalation clauses for approximately 3.5% of the base rent in each subsequent year of the Lease Term and a rent abatement period in the first year of the Premises.

The Lease provides for a tenant improvement allowance of $5.7 million with the option to elect for up to $3.4 million in additional allowances. As of December 31, 2018, we have elected to use all additional allowances; therefore, we are not entitled to any additional improvement allowances. As a result of our receipt of tenant improvement allowances, the base rent increased in accordance with the Lease Amendment. Rent increases,

including the impact of tenant improvement allowances, are recognized as deferred rent and amortized on a straight-line basis over the term of the lease.

Pursuant to the Lease Amendment, we hold the option to pay the balance of the Original Additional Allowance and Expansion Additional Allowance in full any time within the first 36 months of the Lease Term. Further, the Company had deposits of $0.5 million in long-term restricted cash as of December 31, 2018 and 2017, respectively, restricted from withdrawal and held in an account with one of the Company's financial institutions in the form of collateral for a letter of credit held as security for the Lease and Lease Amendment.

Our facility lease obligations are offset by two sub-lease agreements. In November 2018, we entered into a sub-lease agreement with a third-party for 32,978 square feet of our principal executive offices in South San Francisco. The lease term will terminate on November 1, 2023. Under the terms of the lease, we will receive minimal annual rent payments ranging from $2.2 million in the first year to $2.5 million in the fifth year of the lease, for a total of $11.7 million over the term of the lease. In January 2019, we entered into another sub-lease agreement with a third-party for 32,909 square feet of our principal executive offices in South San Francisco. The lease term will terminate on March 1, 2022. Under the terms of the lease, we will receive minimum annual rent payments ranging from $2.2 million in the first year to $2.3 million in the third year of the lease, for a total of $6.7 million over the term of the lease.

Restructuring Commitments

In July 2018, we announced a corporate restructuring in which we incurred a one-time employee benefits and severance charge and an impairment charge of $8.1 million, of which 49% resulted in cash expenditures. As of December 31, 2018, we have a balance of an immaterial amount left to be paid.

In November 2018, we announced a corporate restructuring in which we incurred a one-time employee benefits and severance charge and an impairment charge of $15.5 million in the fourth quarter of 2018, of which 24% resulted in cash expenditures. As of December 31, 2018, we have a balance of $1.0 million left to be paid.

In February 2019, we announced a corporate restructuring in which we will incur a one-time employee benefits and severance charge and impairment charge of approximately $3.2 million in the first quarter of 2019, of which approximately 78% will result in cash expenditures.

Other Commitments

We have obligations to make future payments to third parties under license agreements, including sublicense fees, royalties, and payments that become due and payable on the achievement of certain development, regulatory and commercialization milestones. However, because the achievement of these milestones is not fixed and determinable, such commitments have not been included in our consolidated balance sheets or in the Contractual Obligations and Commitments above.

Indemnification

In the normal course of business, we enter into contracts and agreements that contain a variety of representations and warranties and provide for general indemnifications. Our exposure under these agreements is unknown because it involves claims that may be made against us in the future, but have not yet been made. To date, we have not paid any claims or been required to defend any action related to our indemnification obligations. However, we may record charges in the future as a result of these indemnification obligations.

In accordance with our amended and restated certificate of incorporation and our amended and restated bylaws, we have indemnification obligations to our officers and directors for specified events or occurrences, subject to some limits, while they are serving at our request in such capacities. We have also entered into indemnification agreements with our directors and executive officers. There have been no claims to date, and we have director and officer insurance that may enable us to recover a portion of any amounts paid for future potential claims.

Off-Balance Sheet Arrangements

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

Recent Accounting Pronouncements

In February 2016, the FASB issued ASU No. 2016-02, Leases, which, for operating leases, requires a lessee to recognize a right-of-use asset and a lease liability, initially measured at the present value of the lease payments, in its balance sheet. The standard also requires a lessee to recognize a single lease cost, calculated so that the cost of the lease is allocated over the lease term, on a generally straight-line basis. This ASU will be effective for us in fiscal year 2019. Early adoption is permitted. We have identified the relevant lease arrangements and are currently in the process of evaluating the impact of this new guidance on our consolidated financial statements. We believe the adoption of this standard will have an impact on our consolidated balance sheet as a result of the recognition of a right-to-use asset and corresponding liability for our facility operating lease and relevant new disclosures about our leasing activities.

In May 2017, the FASB issued ASU No. 2017-09, Compensation – Stock Compensation (Topic 718): Scope of Modification Accounting. This ASU provides guidance about which changes to the terms or conditions of a share-based payment award requires us to apply modification accounting. This ASU will be effective for us for annual reporting periods, including interim reporting periods, beginning after December 15, 2017. We adopted this standard on January 1, 2018 noting it did not have a material impact on our consolidated financial statements.

In January 2016, the FASB issued ASU No. 2016-01, Financial Instruments- Overall (Subtopic 825-10): Recognition and Measurement of Financial Assets and Financial Liabilities, which includes provisions to accounting for equity investments, financial liabilities under the fair value option, and presentation and disclosure requirements for financial instruments. The amended guidance requires equity securities, except for those accounted for under the equity method of accounting, with determinable fair values to be measured at fair with changes in fair value recognized in net income (loss). This ASU is effective for us for annual reporting periods, including interim reporting periods, beginning after December 15, 2017. We adopted this standard on January 1, 2018 noting it did not have a material impact on our consolidated financial statements.

In March 2018, the FASB issued ASU No. 2018-05, Income Taxes (Topic 740), Amendments to SEC Paragraphs Pursuant to SEC Staff Accounting Bulletin No. 118. The amendments add various Securities and Exchange Commission (“SEC) paragraphs pursuant to the issuance of SEC Accounting Bulletin No. 118, Income Tax Accounting Implications of the Tax Cuts and Jobs Act (“Act”) (“SAB 118”). The SEC issued SAB 118 to address concerns about reporting entities’ ability to timely comply with the accounting requirements to recognize all of the effects of the Act in the period of enactment. SAB 118 allows disclosure that timely determination of some or all of the income tax effects from the Act are incomplete by the due date of the financial statements and if possible to provide a reasonable estimate. As permitted by SAB 118, we recorded provisional estimates in 2017 and finalized our accounting for these provisional estimates based on guidance, interpretations and all of the available data in the year ended December 31, 2018. No adjustment to the previously recorded provisional amount was recorded in 2018.

In August 2018, the FASB issued ASU No. 2018-13, Fair Value Measurement (Topic 820): Disclosure Framework – Changes to the Disclosure Requirements for Fair Value Measurement, which eliminates certain disclosure requirements for fair value measurements for all entities, requires public entities to disclose certain new information and modifies some disclosure requirements. This standard is effective for fiscal years beginning after December 15, 2019, with early adoption permitted. We do not expect the adoption of this standard to have a material effect on our consolidated financial statements.

In August 2018, the SEC issued an amendment to Rule 3-04 of Regulation S-X, which extended the annual disclosure requirement of reporting changes in stockholders’ equity to interim periods. Such disclosures are to be provided in a note to the financial statements or in a separate financial statement and requires both the year-to-date information and subtotals for each interim period. In September 2018, the SEC issued guidance under a Compliance and Disclosure Interpretation (C&DI 105.09) to clarify the effective date of the requirement. Under the guidance in C&DI 105.09, we

plan to implement this updated disclosure requirement beginning with the first quarter 2019 Form 10-Q.

In November 2018, the FASB issued ASU No. 2018-18, Collaborative Arrangements (Topic 808), which discusses the interaction between Topic 808, Collaborative Arrangements and Topic 606, including clarification around certain transactions between collaborative arrangement participants and adding unit-of-account guidance to Topic 808. This standard is effective for annual periods beginning after December 15, 2019, and interim periods

within those periods and early adoption is permitted. The adoption of this guidance is not anticipated to have an impact on our consolidated financial statements.

Item 7A. Quantitative and Qualitative Disclosures about Market Risk.

We are exposed to limited market risk related to fluctuations in interest rates and market prices. Our primary exposure to market risk is interest rate sensitivity, which is affected by changes in the general level of U.S. interest rates. The primary objective of our investment activities is to preserve our capital to fund our operations.

We also seek to maximize income from our investments without assuming significant risk. To achieve our objectives, we maintain a portfolio of cash equivalents and investments in a variety of securities of high credit quality. As of December 31, 2018, we had unrestricted cash and cash equivalents of $31.0 million consisting of bank deposits, cash, commercial paper, cash repurchase agreement investments, money market funds deposited in highly rated financial institutions in the United States and corporate debt securities of institutions with investment grade credit ratings. A portion of our investments may be subject to interest rate risk and could fall in value if market interest rates increase. However, because our investments are primarily short-term in duration, we believe that our exposure to interest rate risk is not significant. We do not enter into investments for trading or speculative purposes and have not used any derivative financial instruments to manage our interest rate risk exposure. We have not been exposed nor do we anticipate being exposed to material risks due to changes in interest rates. Assuming a hypothetical increase in interest rates of one percentage point, the fair value of our total investment portfolio as of December 31, 2018, would have potentially declined by a negligible amount.

We contract for the conduct of certain clinical development and manufacturing activities with vendors outside the United States. We are subject to exposure due to fluctuations in foreign exchange rates in connection with these agreements. For the year ended December 31, 2018, a 1% movement in foreign exchange rates would not be material to us.

We do not believe that inflation or fluctuations in foreign exchange rates had a significant impact on our results of operations for any periods presented in our consolidated financial statements.

Item 8. Financial Statements and Supplementary Data.

Achaogen, Inc.

Index to Consolidated Financial Statements

Years Ended December 31, 2018 and 2017

Contents

Report of Independent Registered Public Accounting Firm	92
Consolidated Balance Sheets	93
Consolidated Statements of Operations	94
Consolidated Statements of Comprehensive Loss	95
Consolidated Statements of Contingently Redeemable Common Stock and Stockholders' Equity (Deficit)	96
Consolidated Statements of Cash Flows	97
Notes to Consolidated Financial Statements	98

Report of Independent Registered Public Accounting Firm

To the Shareholders and the Board of Directors of Achaogen, Inc.

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of Achaogen, Inc. (the Company) as of December 31, 2018 and 2017, the related consolidated statements of operations, comprehensive loss, contingently redeemable common stock and stockholders' equity (deficit) and cash flows for each of the two years in the period ended December 31, 2018, and the related notes (collectively referred to as the "consolidated financial statements"). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company at December 31, 2018 and 2017, and the results of its operations and its cash flows for each of the two years in the period ended December 31, 2018, in conformity with U.S. generally accepted accounting principles.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the Company's internal control over financial reporting as of December 31, 2018, based on criteria established in Internal Control - Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 Framework) and our report dated April 1, 2019 expressed an unqualified opinion thereon.

The Company's Ability to Continue as a Going Concern

The accompanying consolidated financial statements have been prepared assuming that the Company will continue as a going concern. As discussed in Note 1 to the financial statements, the Company has incurred recurring losses from operations and has stated that substantial doubt exists about the Company's ability to continue as a going concern. Management's evaluation of the events and conditions and management's plans regarding these matters are also described in Note 1. The consolidated financial statements do not include any adjustments that might result from the outcome of this uncertainty.

Basis for Opinion

These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on the Company's financial statements based on our audits. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

/s/ Ernst & Young LLP

We have served as the Company's auditor since 2011.

Redwood City, California

April 1, 2019

Achaogen, Inc.

Consolidated Balance Sheets

(in thousands except for share and per share amounts)

	December 31, 2018	December 31, 2017
Assets		
Current assets:		
Cash and cash equivalents	$ 30,956	$ 145,219
Short-term investments	—	19,572
Trade and contract receivables, net	1,861	1,357
Inventory	515	—
Assets held for sale	1,509	—
Prepaids and other current assets	1,412	6,367
Restricted cash	25,000	5,891
Total current assets	61,253	178,406
Property and equipment, net	2,471	14,810
Non-current restricted cash	530	3,855
Non-current inventory	8,846	—
Other long-term assets	9,190	—
Total assets	$ 82,290	$ 197,071
Liabilities, contingently redeemable common stock and stockholders’ equity (deficit)		
Current liabilities:		
Accounts payable	$ 12,472	$ 6,862
Accrued liabilities	15,232	15,441
Loan payable, current portion	49,784	12,500
Deferred revenue	—	2,100
Derivative liability	963	—
Total current liabilities	78,451	36,903
Loan payable, long-term	—	9,457
Warrant liability	444	9,774
Derivative liability, long-term	—	686
Deferred rent	9,682	8,289
Total liabilities	88,577	65,109
Commitments and contingencies (Note 7)		
Contingently redeemable common stock (Note 11)	—	10,000
Stockholders' equity (deficit)		
Common stock, $0.001 par value, 290,000,000 shares authorized at December 31, 2018 and December 31, 2017; 48,206,227 and 42,515,015 shares issued and outstanding at December 31, 2018 and December 31, 2017, respectively	48	42
Preferred stock, $0.001 par value, 10,000,000 shares authorized and zero shares issued and outstanding at December 31, 2018	—	—

and December 31, 2017		
Additional paid-in-capital	553,015	494,758
Accumulated deficit	(559,350)	(372,838)
Accumulated other comprehensive loss	—	—
Total stockholders' equity (deficit)	(6,287)	121,962
Total liabilities, contingently redeemable common stock and stockholders' equity (deficit)	$ 82,290	$ 197,071

See accompanying notes to consolidated financial statements.

Achaogen, Inc.

Consolidated Statements of Operations

(in thousands except for share and per share amounts)

	Year Ended December 31,	
	2018	2017
Revenues		
Product revenue, net	$783	$—
Contract revenue	7,945	11,175
Total revenues	8,728	11,175
Operating expenses		
Cost of sales	31	—
Research and development	102,959	95,598
Selling, general and administrative	71,385	41,903
Restructuring charges	23,518	—
Total operating expenses	197,893	137,501
Loss from operations	(189,165)	(126,326)
Interest expense	(2,112)	(2,855)
Change in warrant and derivative liabilities	9,053	1,928
Loss on debt extinguishment	(819)	—
Loss on settlement of contingently redeemable common stock	(5,179)	—
Other income, net	1,710	1,635
Net loss	$(186,512)	$(125,618)
Net loss per common share:		
Basic	$(4.11)	$(3.17)
Diluted	$(4.25)	$(3.17)
Weighted-average shares used to calculate net loss per common share		
Basic	45,384,380	39,645,635
Diluted	46,027,950	39,645,635

See accompanying notes to consolidated financial statements.

Achaogen, Inc.

Consolidated Statements of Comprehensive Loss

(in thousands)

	Year Ended December 31,	
	2018	2017
Net loss	$(186,512)	$(125,618)
Other comprehensive (loss) income:		
Net unrealized gain (loss) on available-for-sale securities	—	7
Total comprehensive loss	$(186,512)	$(125,611)

See accompanying notes to consolidated financial statements.

Achaogen, Inc.

Consolidated Statements of Contingently Redeemable Common Stock and Stockholders' Equity (Deficit)

(in thousands except for share amounts)

	Contingently Redeemable Common Stock		Common Stock		Additional Paid-In Capital	Accumulated Deficit	Accumulated Other Comprehensive Loss	Total Stockholders' Equity (Deficit)
	Shares	Amount	Shares	Amount				
Balance at December 31, 2016	—	$—	35,638,052	$ 35	$353,927	$(247,220)	$ (7)	$106,735
Issuance of contingently redeemable common stock under private placement	407,331	10,000	—	—	—	—	—	—
Issuance of common stock under stock plans	—	—	413,333	1	1,644	—	—	1,645
Issuance of common stock under ESPP	—	—	186,455	—	1,323	—	—	1,323
Issuance of common stock upon an underwritten public offering, net of issuance costs	—	—	5,750,000	6	121,186	—	—	121,192
Issuance of common stock upon exercise of warrants	—	—	119,844	—	2,506	—	—	2,506
Stock-based compensation expense	—	—	—	—	14,172	—	—	14,172
Unrealized gain on available-for-sale securities, net of taxes	—	—	—	—	—	—	7	7
Net loss	—	—	—	—	—	(125,618)		(125,618)
Balance at December 31, 2017	407,331	10,000	42,107,684	42	494,758	(372,838)	—	121,962
Issuance of common stock under stock plans	—	—	595,716	1	1,667	—	—	1,668
Issuance of common stock under ATM			5,233,812	5	31,411	—		31,416
Issuance of common stock under ESPP	—	—	269,015	—	1,327	—	—	1,327
Stock-based compensation expense	—	—	—	—	14,410	—	—	14,410
Repurchase of contingently redeemable common	(407,331)	(10,000)			9,442			9,442

stock								
Net loss	—	—	—	—	—	(186,512)	—	(186,512)
Balance at December 31, 2018	—	$—	48,206,227	$ 48	$553,015	$(559,350)	$ —	$(6,287)

See accompanying notes to consolidated financial statements.

Achaogen, Inc.

Consolidated Statements of Cash Flows

(in thousands)

	Year Ended December 31,	
	2018	2017
Cash flows from operating activities:		
Net loss	$(186,512)	$(125,618)
Adjustments to reconcile net loss to net cash used in operating activities:		
Depreciation and amortization	2,553	1,334
Amortization of (discount) premium on short-term investments	(341)	(227)
Stock-based compensation expense	14,410	14,172
Loss on fixed asset disposals	216	54
Impairment relating to restructuring	14,044	—
Change in warrant and derivative liabilities	(9,053)	(1,928)
Loss on debt extinguishment	819	—
Loss on settlement of contingently redeemable common stock	5,179	
Non-cash interest expense relating to notes payable	862	847
Change in operating assets and liabilities:		
Trade and contract receivable, net	(504)	10,794
Prepaids and other assets	4,955	(4,107)
Inventory	(4,861)	—
Other long-term assets	(9,190)	—
Accounts payable and accrued liabilities	691	5,736
Deferred revenue	(2,100)	2,100
Other liabilities	3,832	1,588
Net cash used in operating activities	(165,000)	(95,255)
Cash flows from investing activities:		
Purchase of property and equipment	(9,036)	(7,106)
Proceeds from sale of property and equipment	614	
Purchase of short-term investments	(58,101)	(121,796)
Maturities of short-term investments	78,014	129,370
Net cash provided by investing activities	11,491	468
Cash flows from financing activities:		
Proceeds from underwritten public offering, net of issuance costs	—	121,192
Proceeds from issuance of contingently redeemable common stock	—	10,000
Proceeds from sales of common stock, net of issuance costs	31,416	—
Proceeds from the issuance of common stock in connection with equity incentive plans	2,995	2,968
Proceeds from exercise of stock warrants	—	418
Proceeds from loan payable, net of issuance costs	49,189	—
Repurchase of contingently redeemable common stock	(5,737)	—
Repayment of loan payable	(22,833)	(4,167)
Net cash provided by financing activities	55,030	130,411
Net increase (decrease) in cash, cash equivalents, and restricted cash	(98,479)	35,624
Cash, cash equivalents, and restricted cash at beginning of year	154,965	119,341
Cash, cash equivalents, and restricted cash at end of year	$56,486	$154,965

Supplemental disclosures of cash flow information		
Interest paid	$1,219	$2,008
Supplemental disclosures of noncash investing and financing information		
Reclassification of warrant liability to additional paid-in capital	$—	$2,088
Purchases of property and equipment included in accounts payable and accrued liabilities	$—	$1,130
Purchases of property and equipment included in deferred rent	$1,485	$4,701
Transfers of assets held for sale	$1,509	$—

See accompanying notes to consolidated financial statements.

Achaogen, Inc.

Notes to Consolidated Financial Statements

1. Organization and Basis of Presentation and Consolidation

Achaogen, Inc. (together with its consolidated subsidiaries, the “Company”) is a biopharmaceutical company that develops and commercializes innovative antibacterial agents for multi-drug resistant (MDR) gram-negative infections. On June 25, 2018, the U.S. Food and Drug Administration (FDA) approved the Company’s first commercial product ZEMDRI® (plazomicin) for adults with complicated urinary tract infections (cUTI), including pyelonephritis, caused by certain Enterobacteriaceae in adult patients with limited or no alternative treatment options. ZEMDRI is an intravenous (IV) infusion, administered once daily over a 30-minute IV. The approval of ZEMDRI was supported by data from the EPIC (Evaluating Plazomicin in cUTI) clinical trial, which evaluated the safety and efficacy of plazomicin in patients with serious infections caused by gram-negative pathogens. ZEMDRI became commercially available in July 2018. In December 2018, the Company also filed a Formal Dispute Resolution Request with the FDA regarding a bloodstream infection (BSI) indication for plazomicin, for which the FDA issued a Complete Response Letter (CRL) in June 2018. The FDA denied the Company's first-round FDRR and the Company is evaluating the current options, including requesting a further meeting with the reviewing division or further pursuing its appeal. The Company has global commercialization rights to ZEMDRI, which has patent protection in the United States estimated until 2031 or 2032. On October 17, 2018, the Company announced the submission of a Marketing Authorization Application (MAA) to the European Medicines Agency (EMA) for plazomicin. ZEMDRI was funded in part by a $124.4 million contract with the Biomedical Advanced Research and Development Authority (BARDA).

The Company is also currently developing C-Scape, which is in early-stage clinical development, as a product candidate, an orally administered antibiotic to address a serious unmet need for an effective oral treatment for patients with cUTI, including pyelonephritis, caused by extended spectrum beta-lactamases ESBL-producing Enterobacteriaceae. The C-Scape program is also supported from BARDA.

The Company was incorporated in Delaware in 2002 and commenced operations in 2004. Since commencing operations in 2004, the Company has devoted substantially all its resources to identifying, developing and commercializing its product candidates, including conducting preclinical studies and clinical trials and providing general and administrative support for these operations

Basis of Presentation and Consolidation

The consolidated financial statements are prepared in accordance with U.S. generally accepted accounting principles (“U.S. GAAP”) and include the consolidated accounts of the Company and its subsidiaries. Intercompany accounts and transactions have been eliminated in consolidation. During 2012, the Company established a wholly owned foreign subsidiary in the United Kingdom. During 2018, the Company established a wholly owned foreign subsidiary in Ireland. There have been no significant activities for these entities during the fiscal years ended December 31, 2018 and 2017.

Liquidity and Going Concern

In September 2017, the Company was awarded a C-Scape Contract valued at up to $18.0 million in grant funding from BARDA to support the development of C-Scape. The C-Scape Contract includes a base period with committed funding of $12.0 million and subsequent option periods that, if exercised, would bring the total value of the award to $18.0 million.

On February 26, 2018, the Company entered into a new Loan and Security Agreement ("SVB Loan Agreement") with Silicon Valley Bank ("SVB"), pursuant to which SVB agreed to make available to the Company term loans with an aggregate principal amount of up to $50.0 million, $20.9 million of which was used to repay its loan with Solar Capital Ltd., $4.1 million of which was provided to us on February 26, 2018 and $25.0 million of which the Company borrowed on October 29, 2018.

On February 27, 2018, the Company filed an amended Registration Statement on Form S-3 (the "2018 Shelf Registration Statement") covering the offering of up to $250.0 million of common stock, preferred stock, debt

securities, warrants and units. In addition, on February 27, 2018, the Company filed a prospectus supplement to the 2018 Shelf Registration Statement covering the offering, issuance and sale of up to $50.0 million shares of the Company's common stock in ATM offerings pursuant to a Common Stock Sales Agreement entered into with Cowen and Company, LLC (the "2018 Sales Agreement"). During the twelve months ended December 31, 2018, the Company sold 3,089,358 shares of common stock under the 2018 Sales Agreement, at a weighted-average price of approximately $2.46 per share for aggregate gross proceeds of $7.6 million and aggregate net proceeds of $7.4 million.

On April 24, 2018, the Company was awarded $2.4 million, with a possibility of up to $9.6 million in additional funding based on achievement of certain project milestones, from CARB-X. The funding was awarded to support the development of a next-generation broad-spectrum aminoglycoside antibiotic capable of overcoming clinically-relevant resistance mechanisms and potentially treating highly-resistant gram-negative pathogens such as the Enterobacteriaceae family, Acinetobacter baumannii, and Pseudomonas aeruginosa.

On October 29, 2018, the Company borrowed $25.0 million (the "Term B Loan") under the SVB Loan Agreement. The Term B Loan has a maturity of four years and bears interest through maturity at a floating per annum rate equal to the greater of (a) 1.00% above the prime rate and (b) 5.50%. No borrowings remain available to us under the SVB Loan Agreement. In December 2018, SVB collateralized $25.0 million of the $50.0 million the Company had borrowed under the SVB Loan Agreement. Collateralization of this $25.0 million means that these funds are restricted and no longer available for the Company's use until its cash on deposit at SVB exceeds the "Minimum Account Threshold" for thirty consecutive days, which is the greater of (a) $48.0 million and (b) the "Monthly Cash Burn," which is defined as the difference of (1)(i) net loss plus (ii) unfinanced capital expenditures minus (2)(i) depreciation and amortization expenses, (ii) non-cash stock compensation expense and (iii) other non-cash expenses as approved by SVB.

On February 15, 2019, the Company entered into an underwriting agreement with H.C. Wainwright & Co., LLC related to the public offering by the Company of (i) 15,000,000 shares of the Company's common stock , (ii) Series A warrants to purchase up to 15,000,000 shares of common stock and (iii) Series B warrants to purchase up to 15,000,000 shares of common Stock. The combined offering price per share of common Stock and the accompanying Series A and Series B warrants ("Warrants") was $1.00, representing an offering price of $0.99 per share of common Stock, with the accompanying Warrants offered at a purchase price of $0.01 per Warrant combination. The net proceeds from the public offering of common Stock is approximately $13.6 million.

At December 31, 2018, the Company had unrestricted cash and cash equivalents of $31.0 million and restricted cash of approximately of $25.5 million, for a total cash and cash equivalents of $56.5 million as of December 31, 2018.

The Company has incurred losses and negative cash flows from operations every year since its inception. As of December 31, 2018, the Company had unrestricted cash, cash equivalents and short-term investments of approximately $31.0 million and an accumulated deficit of approximately $559.4 million.

Based on the Company's available cash resources, which excludes restricted cash (including the $25.0 million of restricted cash collateralized in connection with the SVB Loan Agreement), the Company believes it has sufficient funds to support current planned operations into June 2019. This condition results in the assessment that there is substantial doubt about its ability to continue as a going concern. The Company's plans to address this condition include seeking additional funds through equity or debt financings, government contracts, third party collaborations, commercial sales of ZEMDRI or other sources to permit additional investments in the commercialization of ZEMDRI and the advancement of C-Scape. The Company may be unable to obtain equity or debt financings, government contracts, third party collaborations or other sources of additional investment and, if necessary, it will be required to implement further cost reduction strategies, including a reduction in the scope of the Company's programs and other operations.

The accompanying financial statements have been prepared assuming that the Company will continue as a going concern, which contemplates the realization of assets and the settlement of liabilities and commitments in the normal course of business. The financial statements do not reflect any adjustments relating to the recoverability and reclassification of assets and liabilities that might be necessary if the Company is unable to continue as a going concern. As of December 31, 2018, the Company has primarily financed its operations through public offerings and

private placements of its equity securities, debt financings and government contracts. There can be no assurance that the Company will be able to obtain additional debt or equity financing or continue to generate product revenue or revenues from collaborative partners, on terms acceptable to the Company, on a timely basis or at all. The failure of the Company to obtain sufficient funds on acceptable terms when needed would have a significant adverse effect on the Company's business, results of operations, and financial condition.

2. Summary of Significant Accounting Policies

Use of Estimates

The accompanying financial statements have been prepared in accordance with U.S. GAAP. The preparation of financial statements in conformity with U.S. GAAP requires management to make judgments, assumptions and estimates that affect the reported amounts of assets, liabilities, revenues and expenses and related disclosures of contingent liabilities. On an ongoing basis, management evaluates its estimates, including those related to net product revenue, clinical trial accruals, fair value of derivative and warrant liabilities, common stock and stock-based awards, impairment and income taxes. Management bases its estimates on historical experience and on various other assumptions that are believed to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ materially from those estimates.

Fair Value of Financial Instruments

The carrying amounts of the Company's financial instruments, including cash and cash equivalents, trade and contract receivables, prepaid and other current assets, assets held for sale, restricted cash, accounts payable, accrued liabilities, and deferred revenue approximate fair value due to their short-term maturities. Short-term investments consist of available-for-sale securities and are carried at fair value. Based upon the borrowing rates currently available to the Company for loans with similar terms, the Company believes the carrying amount of the loan payable approximates its fair value. The warrant and derivative liabilities are recorded at estimated fair value with changes in estimated fair value recorded in the Company's consolidated statements of operations.

Cash and Cash Equivalents

Cash equivalents include only securities having an original maturity of three months or less at the time of purchase. As of December 31, 2018 and 2017, cash and cash equivalents consisted of bank deposits, cash, commercial paper, money market funds, cash repurchase agreement investments and overnight cash sweep investments in government money market funds.

Short-term Investments

Short-term investments consist of debt securities with maturities greater than three months, but less than one year from the date of acquisition, and are classified as available for sale. Short-term investments are carried at fair value. Unrealized gains and losses on available-for-sale debt securities are excluded from earnings and reported as a component of net unrealized gain (loss) on available-for-sale securities in the Company's consolidated statements of comprehensive loss. The amortized cost of debt securities reflects amortization of purchase premiums and accretion of purchase discounts to date, which are included in other income, net.

The Company reviews all of its marketable debt securities on a regular basis to evaluate whether any security has experienced an other-than-temporary decline in fair value.

Trade and Contract Receivables, net

Trade accounts receivable consist of payments to be received from customers for sales of ZEMDRI recorded net of prompt-payment discounts, incentive fees, chargebacks, and doubtful accounts. Estimates for chargebacks, prompt-payment discounts and incentive fees are based on contractual terms, historical trends and expectations regarding the utilization rates for these programs.

Contract accounts receivable consist of payments to be received from U.S. government contracts and non-profit foundation grant.

Restricted Cash

As of December 31, 2018 and 2017, the Company had restricted cash of $25.5 million and $9.7 million, respectively. The following table provides a reconciliation of cash, cash equivalents, and restricted cash reported within the consolidated balance sheet that sum to the total of the same such amounts shown in the consolidated balance sheets (in thousands):

	Year Ended December 31,	
	2018	2017
Cash and cash equivalents	$30,956	$145,219
Restricted cash, current	25,000	5,891
Restricted cash, non-current	530	3,855
Total cash, cash equivalents, and restricted cash	$56,486	$154,965

In May 2017, the Company received $13.2 million of funding from the Bill & Melinda Gates Foundation (the “Gates Foundation”), of which the Company’s use is restricted to expenditures that are reasonably attributable to the activities required to support the research projects funded by the Gates Foundation, including an allocation of overhead and administrative expenses. As of December 31, 2018 and 2017 the Company had zero and $9.2 million, respectively, of restricted cash related to the unspent cash provided by the Gates Foundation. As of December 31, 2018, the Company utilized the $3.2 million of funds from the Grant Agreement (see Note 6) and $4.3 million of the Gates Investment (see Note 11) funds. The remaining Gates Investment funds of $5.7 million were used to pay for the redemption of the contingently redeemable common stock (see Note 11). As of December 31, 2018 and 2017, the Company had $0.5 million of restricted cash, which relates to the Company’s facility leases.

In December 2018, SVB collateralized $25.0 million of the $50.0 million that the Company borrowed under the SVB Loan Agreement. Collateralization of this $25.0 million means that these funds are restricted and no longer available for the Company’s use until its cash on deposit at SVB exceeds the “Minimum Account Threshold” for thirty consecutive days, which is the greater of (a) $48.0 million and (b) the “Monthly Cash Burn,” which is defined as the difference of (1)(i) net loss plus (ii) unfinanced capital expenditures minus (2)(i) depreciation and amortization expenses, (ii) non-cash stock compensation expense and (iii) other non-cash expenses as approved by SVB.

Other Long-Term Assets

Other long-term assets consist of deferred manufacturing costs related to clinical research or production of ZEMDRI. These costs are amortized over the life of the respective contracts.

Segment Reporting

Operating segments are identified as components of an enterprise about which separate discrete financial information is available for evaluation by the chief operating decision maker regarding resource allocation and assessing performance. The Company has one operating segment.

Customer Concentration

For the year ended December 31, 2018, the Company's revenue was generated from product revenues, funding pursuant to U.S. government contracts and a non-profit foundation grant. For the year ended December 31, 2017, the Company's revenue was generated from funding pursuant to U.S. government contracts and a non-profit organization grant. All trade and contract receivable relate to sales from product revenue and funding from U.S. government contracts.

Concentration of Credit Risk

Financial instruments that potentially subject the Company to a significant concentration of credit risk consist of cash, cash equivalents and short-term investments. Cash and cash equivalents are deposited in checking, overnight sweep and money market accounts at one financial institution with balances that generally exceed federally insured limits. Management believes that the financial institution is financially sound, and, accordingly, minimal credit risk exists with respect to this financial institution. The Company's investment policy limits

investments to certain types of debt securities issued by the U.S. government, its agencies and institutions with investment-grade credit ratings and places restrictions on maturities and concentration by type and issuer. The Company is exposed to credit risk in the event of default by the institutions holding its cash and cash equivalents or issuing the debt securities. As of December 31, 2018 and 2017, the Company has not experienced any credit losses in such accounts or investments.

Inventory

Inventory is stated at the lower of cost and net realizable value with costs determined under the first-in, first-out (FIFO) cost method and consists of raw materials, work-in-process and finished goods. Costs capitalized as inventory include third party manufacturing costs, associated compensation-related costs of personnel indirectly involved in the manufacturing process and other overhead costs. The Company uses a combination of standard and actual costs to determine its cost basis for inventory, which approximates actual costs. Standard costs are reviewed and updated annually or as needed.

The Company began to capitalize inventoriable costs of ZEMDRI upon FDA approval on June 25, 2018 when it was determined that the inventory had a probable future economic benefit and the related costs were expected to be realized through commercialization of ZEMDRI. Prior to regulatory approval of ZEMDRI, the Company incurred expenses related to the manufacturing of the product and recorded all such costs as research and development expenses. If information becomes available that suggests that inventories may not be realizable, the Company may be required to expense a portion or all of its previously capitalized inventory. The Company periodically analyzes its inventory levels, and evaluates for potential excess and obsolete inventory by analyzing current and future product demand relative to the remaining product shelf life. The Company builds demand forecasts by considering factors such as, but not limited to, overall market potential, market share, market acceptance and patient usage.

The Company sources certain raw material from a sole supplier. A disruption in the supply of materials could significantly impact the Company’s revenues in the future as alternative sources of raw materials may not be available at commercially reasonable rates or within a reasonable short period of time.

Property and Equipment, Net

Property and equipment consist of office equipment, laboratory equipment, and leasehold improvements and are stated at cost, less accumulated depreciation. Depreciation is computed using the straight-line method over the estimated useful lives of the respective assets, generally three to seven years. Leasehold improvements are amortized over their estimated useful lives or the remaining lease term, whichever is shorter. Maintenance and repair costs are recorded as a component of operating expenses in the Company’s consolidated statement of operations when incurred.

The following criteria is considered before concluding assets are classified as held-for-sale; (1) management’s commitment to a plan to sell, (2) availability for immediate sale in its present condition, (3) initiation of an active program to identify a buyer, (4) probability of a completed sale within one year, (5) actively marketed for sale at a reasonable price in relation to its current fair value, and (6) likelihood of significant changes to the plan will be made or that the plan will be withdrawn. If all of the criteria are met as of the balance sheet date, the assets and liabilities are presented separately in the balance sheet as held-for-sale at the lower of their carrying amount or fair value less costs to sell. The assets held for sale consist of laboratory equipment based on the above criteria. Losses are recognized for any initial or subsequent write-down to fair value less cost to sell, while gains are recognized for any subsequent increase in fair value less cost to sell, but not in excess of the cumulative loss previously recognized. Any gains or losses not previously recognized that result from the sale of the disposal group shall be recognized at the date of sale. The equipment is not depreciated while classified as held for sale.

Impairment of Long-Lived Assets

The Company reviews long-lived assets, including property and equipment, for impairment whenever events or changes in business circumstances indicate that the carrying amount of the assets may not be fully recoverable. If indicators of impairment exist, an impairment loss would be recognized when the estimated undiscounted future cash flows expected to result from the use of the asset and its eventual disposition are less than its carrying amount. The impairment charge is determined based upon the excess of the carrying value of the asset over its estimated fair

value, with estimated fair value determined based upon an estimate of discounted future cash flows or other appropriate measures of estimated fair value. For the year ended December 31, 2018, the Company recorded an impairment charge related to property and equipment in connection with the restructurings in July and November 2018 (see Note 4). There were no impairment charges for the year ended December 31, 2017.

Warrant Liability

On June 3, 2016, the Company issued warrants to purchase 1,999,999 shares of its common stock in connection a private placement financing transaction (“Private Placement.”) Each warrant has an exercise price of $3.66 per share and is exercisable for five years from the date of issuance. The Company accounts for these warrants as a liability instrument measured at estimated fair value. The initial fair value of the warrants was determined using a calibration model that involved the Black-Scholes Pricing Model ("Black-Scholes"), which requires inputs such as the risk-free interest rate, expected share price volatility, underlying price per share of the Company's common stock and remaining term of the warrants. The warrants are subject to remeasurement at each balance sheet date, using Black-Scholes, with any changes in the fair value of the outstanding warrants recognized in the consolidated statements of operations. As of December 31, 2018, warrants to purchase 1,178,782 shares of the Company’s common stock remain outstanding and unexercised.

Contingently Redeemable Common Stock

In May 2017, the Company agreed to sell 407,331 shares of its contingently redeemable common stock to the Gates Foundation in a private placement at a purchase price per share equal to $24.55. Common stock with embedded redemption features that are settled at the option of the holder, are considered redeemable common stock. Redeemable common stock is considered to be temporary equity and presented in a section between liabilities and equity on the Company’s consolidated balance sheets. Subsequent adjustment of the amount presented in temporary equity is required only if the Company determines that it is probable that the instrument will become redeemable. Upon termination of the redemption features, the redeemable common stock is reclassified into equity. As of December 31, 2018, zero shares of contingently redeemable common stock remain outstanding as the Company repurchased the shares (see Note 11).

Stock-Based Compensation

The Company measures and recognizes the compensation expense for all stock-based awards made to employees and directors, including employee stock options, stock grants and employee stock purchases related to the Employee Stock Purchase Plan (“ESPP”) based on estimated fair values. The Company uses the Black-Scholes option-pricing valuation model to estimate the grant-date fair value of stock options and ESPP awards with time-based vesting terms and milestone-bases stock options. The determination of fair value for stock-based awards on the date of grant using an option-pricing model requires management to make certain assumptions regarding a number of complex and subjective variables. The fair value of restricted stock unit (“RSU”) awards with time-based vesting terms is based on the grant date share price. The Company recognizes stock-based compensation cost over the award’s requisite service period on a straight-line basis for time-based awards and on a graded basis for awards that are contingent on the achievement of market-based conditions. The Company records stock-based compensation expense, net of the estimated impact of forfeited awards. As such, the Company recognizes stock-based compensation expense only for those stock-based awards that are expected to vest over their requisite service period, based on the vesting provisions of the individual underlying grants.

During 2017, the Company issued stock-based option awards with market-based conditions that vest upon achievement of certain market price thresholds of the Company’s common stock. The estimated fair value for market-based stock option awards is determined using a lattice valuation model with a Monte-Carlo simulation. The

model takes into consideration the historical volatility of the Company's stock and the risk-free interest rate at the date of grant. In addition, the model is used to estimate the derived service period for the awards. The derived service period is the estimated period of time that would be required to satisfy the market condition, assuming the market condition will be satisfied. Stock-based compensation expense is recognized over the implicit service period derived from the Monte-Carlo simulation model, as applicable, but is accelerated if the market condition is achieved earlier than estimated.

The Company has opted to use the "simplified method" for estimating the expected term of options, whereby the expected term equals the arithmetic average of the vesting term and the original contractual term of the option.

The Company includes the historical price volatility of its own stock, along with data for the group of similar companies, to estimate expected volatility. When selecting these public companies to use in estimating its expected stock price volatility, the Company selected companies with comparable characteristics to it, including enterprise value, stages of clinical development and commercialization, risk profiles, position within the industry and with historical share price information sufficient to meet the expected life of the stock-based awards. The risk-free rate assumption is based on the U.S. Treasury instruments with maturities similar to the expected term of the Company's stock options. The expected dividend assumption is based on the Company's history of not paying dividends and its expectation that it will not declare dividends for the foreseeable future.

Revenue Recognition

Product Revenue, Net

For revenue recognized as product revenue, the Company adopted the Accounting Standards Update ("ASU") No 2014-09, Revenue from Contracts with Customers ("Topic 606") at the time of its first commercial sale of ZEMDRI in the third quarter of 2018. Pursuant to ASC 606, the Company recognizes revenue when its customer obtains control of promised goods or services, in an amount that reflects the consideration that the Company expects to receive in exchange for those goods or services. To determine revenue recognition for arrangements that the Company determines are within the scope of ASC 606, the Company performs the following five steps: (i) identify the contract(s) with a customer; (ii) identify the performance obligations in the contract; (iii) determine the transaction price; (iv) allocate the transaction price to the performance obligations in the contract; and (v) recognize revenue when (or as) the Company satisfies a performance obligation. The Company only applies the five-step model to contracts when it is probable that it will collect the consideration it is entitled to in exchange for the goods or services it transfers to the customer. At contract inception, once the contract is determined to be within the scope of ASC 606, the Company assesses the goods or services promised within each contract, determines those that are performance obligations, and assesses whether each promised good or service is distinct. The Company then recognizes revenue in the amount of the transaction price that is allocated to the respective performance obligation when the performance obligation is satisfied.

The Company's product revenue consists of the sales of ZEMDRI, which the Company began shipping to customers in July 2018. Prior to July 2018, the Company had no product revenues. The Company sells ZEMDRI to specialty distributors and physician-owned infusion centers in the United States. These customers subsequently resell the Company's product to hospitals, medical centers, or patients. In addition to these distributions and purchasing agreements, the Company enters into arrangements with health care providers and payors that provide government mandated or negotiated rebates, chargebacks, and discounts with respect to the purchase of the Company's product.

Revenue is recognized on product sales when the customer obtains control of the Company's product, which occurs at a point in time (upon delivery). Product revenues are recorded net of applicable reserves for variable consideration, including discounts and allowances, chargebacks and government rebates. The Company expenses incremental costs of obtaining a contract when incurred, if the expected amortization period of the asset that the Company would have recognized is one year or less. To date, the Company has not incurred such costs.

Reserves for Variable Consideration

Revenues from product sales are recorded at the net sales price (transaction price), which includes estimates of variable consideration for which reserves are established based on discounts, returns, chargebacks, rebates, and other allowances that are offered within contracts between the Company and its customers, payors and other indirect customers relating to product sales. These reserves as detailed below are based on the amounts earned or to be claimed on the related sales and are classified as reductions of accounts receivable (if the amount is payable to the customer) or

a current liability (if the amount is payable to a party other than a customer). Where appropriate, these estimates take into consideration a range of possible outcomes that are probability-weighted in accordance with the expected value method under ASC 606 for relevant factors. These factors include current contractual and statutory requirements, specific known market events and trends, industry data, and/or forecasted customer buying and payment patterns. Overall, these reserves reflect the Company's best estimates of the amount of consideration to which the Company is entitled based on the terms of the respective underlying contracts.

The amount of variable consideration that is included in the transaction price may be constrained and is included in the net sales price only to the extent that it is probable that a significant reversal in the amount of the cumulative revenue recognized will not occur in a future period. Actual amounts of consideration ultimately received may differ from estimates. If actual results in the future vary from our estimates, the Company will adjust these estimates, which would affect net product revenue and earnings in the period such variances become known.

Trade Discounts and Allowances: The Company generally provides customers with discounts which include incentive fees and other considerations, including prompt-pay discounts, service fees, and other contract fees that are explicitly stated in contracts. These reserves are established in the same period that the related revenue is recognized, resulting in a reduction of product revenue and receivables or recording of accrued liabilities. In addition, the Company compensates its customers for sales order management, data, administrative, and distribution services. However, the Company has determined such services received to date are not distinct from the sale of products to the customer and therefore a fair market value for these services may not be reasonably determined. Therefore, these payments have been recorded as a reduction of revenue within the consolidated statement of operations for the year-ended December 31, 2018.

Product Returns: The Company's standard return policy offers customers a right of return for shipping errors or product damage. The Company estimates the amount of product sales that may be returned by customers and records this estimate as a reduction of revenue in the period the related product revenue is recognized. The Company currently estimates product return liabilities using available industry data, sales information and visibility into the inventory remaining in the distribution channel.

Chargebacks: Chargebacks are discounts that occur when qualified healthcare providers purchase directly from the Company's specialty distributors at a discounted price. The specialty distributors, in turn, charge the Company the difference between the price initially paid by the wholesaler and the discounted price paid to the wholesaler by the healthcare providers or government entities. These reserves are established in the same period that the related revenue is recognized, resulting in a reduction of product revenue and receivables. Chargeback amounts are generally determined at the time of resale to the qualified healthcare provider by customers, and the Company generally issues credits for such amounts shortly after the chargeback has been processed and approved. Reserves for chargebacks consist of amounts that the Company expects to issue for units that remain in the distribution channel at each reporting period end and chargebacks that customers have claimed but for which the Company have not yet issued a credit.

Government Rebates: Based on established reimbursement arrangements under the Medicaid and Medicare programs, the Company is obliged to make payment of rebates with respect to utilization of the Company's product by qualified customers. The Company estimates these rebates and records such estimates in the same period the related revenue is recognized, resulting in a reduction of product revenue and recording of accrued liabilities. The Company's liability for these rebates consists of invoices received for claims that have not been paid or for which an invoice has not yet been received, estimates of claims for the current quarter, and estimates of future claims that will be made for product that has been recognized as revenue, but which remains in the distribution channel at the end of each reporting period.

The Company will continue to assess its estimates of variable consideration as it accumulates additional historical data and will adjust these estimates accordingly.

Contract Revenue

For revenue recognized as contract revenue, the Company evaluated Accounting Standards Update ("ASU") No. 2014-09, Revenue from Contracts with Customers ("ASC 606") and determined that the government contracts and non-profit foundation grant are not in scope as the government entities and foundations are not customers under the agreements. For services performed under these contracts and grant agreements, the Company recognizes revenue

when: (i) evidence of an arrangement exists, (ii) fees are fixed or determinable, (iii) services have been delivered, and (iv) collectability is reasonably assured. Government contracts provide the Company with payments for certain types of expenditures in return for research and development activities over a contractually defined period. Revenue from government contracts and non-profit foundation grants are recognized in the period during which the related costs are incurred, and the related services are rendered, provided that the applicable conditions

under the contracts or grant arrangements have been met. Costs of contract revenue are recorded as a component of operating expenses in the Company's consolidated statements of operations.

Funds received from third parties under contract or grant arrangements are recorded as revenue if the Company is deemed to be the principal participant in the arrangements because the activities under the contracts or grants are part of the Company's development programs. If the Company is not the principal participant, the funds from contracts or grants are recorded as a reduction to research and development expense. Contract funds received are not refundable and are recognized when the related qualified research and development costs are incurred and there is reasonable assurance that the funds will be received. Funds received in advance are recorded as deferred revenue. Management has determined that the Company is the principal participant under the Company's government contract arrangements and non-profit grant agreement, and accordingly, the Company records amounts earned under these arrangements as revenue.

Cost of Sales

Cost of sales represents the costs associated with manufacturing ZEMDRI and ZEMDRI net sales-based royalties. The Company began capitalizing inventory costs after FDA approval of ZEMDRI as the related costs were expected to be recoverable through the commercialization for the product. Costs incurred prior to FDA approval have been recorded as research and development expenses in the consolidated statement of operations.

Research and Development Costs

Research and development costs are expensed as incurred. Research and development expenses include certain payroll and personnel expenses, laboratory supplies, consulting costs, external contract research and development expenses, and allocated overhead, including rent, equipment depreciation, and utilities and relate to both Company-sponsored programs as well as costs incurred pursuant to collaboration agreements, non-profit grants and government contracts. Nonrefundable advance payments for goods or services that will be used or rendered for future research and development activities are deferred and recognized as an expense as the goods are delivered or the related services are performed.

For certain research and development services where the Company has not yet been invoiced or otherwise notified of actual cost from the third-party contracted service providers, the Company is required to estimate the extent of the services that have been performed on the Company's behalf and the associated costs incurred at each reporting period. The majority of the service providers invoice the Company monthly in arrears for services performed. The Company makes estimates of the accrued expenses as of each balance sheet date in the consolidated financial statements based on facts and circumstances known to the Company at that time. The Company periodically confirms the accuracy of the estimates with the service providers and makes adjustments if necessary. Examples of estimated accrued research and development expenses include services from:

- contract research organizations ("CROs") and other service providers in connection with clinical studies;
- contract manufacturers in connection with the production of clinical trial materials; and
- vendors in connection with preclinical development activities.

The Company bases the expenses related to preclinical studies and clinical trials on estimates of the services received and efforts expended pursuant to contracts with multiple research institutions and CROs that conduct and manage such studies and trials on the Company's behalf. The financial terms of these agreements are subject to negotiation, vary from contract to contract, and may result in uneven payment flows and expense recognition. Payments under some of these contracts depend on factors such as the successful enrollment of patients and the completion of clinical trial milestones. In accruing service fees, the Company estimates the time period over which these services will be performed and the level of effort to be expended and costs to be incurred during each reporting period. If the actual

timing of the performance of services or the level of effort varies from the estimate, the Company adjusts the accrual accordingly. The Company's estimation of the status and timing of services performed relative to the actual status and timing of services performed may vary and may result in reporting changes in estimates in any particular period. To date, there have been no material adjustments from the Company's estimates to the amount actually incurred.

Leases

The Company has entered into lease agreements for its laboratory and office facilities. These leases qualify as and are accounted for as operating leases. Rent expense is recognized on a straight-line basis over the term of the lease and, accordingly, the Company records the difference between cash rent payments and the recognition of rent expense as a deferred rent liability. Incentives granted under the Company's facilities leases, including allowances to fund leasehold improvements and rent holidays, are capitalized and are recognized as reductions to rental expense on a straight-line basis over the term of the lease.

Income Taxes

The Company uses the liability method of accounting for income taxes. Under this method, deferred tax assets and liabilities are determined based on the differences between the financial reporting and the tax bases of assets and liabilities and are measured using the enacted tax rates and laws that will be in effect when the differences are expected to reverse. The Company must then assess the likelihood that the resulting deferred tax assets will be realized. A valuation allowance is provided when it is more likely than not that some portion or all of a deferred tax asset will not be realized. The Company assesses the need for a valuation allowance against the Company's deferred income tax assets by considering both positive and negative evidence related to whether it is more likely than not that the deferred income tax assets will be realized. In evaluating its ability to recover the deferred income tax assets within the jurisdiction from which they arise, the Company considered all available positive and negative evidence, including scheduled reversals of deferred income tax liabilities, projected future taxable income, tax-planning strategies, and results of recent operations. Due to the Company's considerations, the net deferred tax assets have been fully offset by a valuation allowance.

The Company recognizes benefits of uncertain tax positions if it is more likely than not that such positions will be sustained upon examination based solely on their technical merits. The tax benefit recognized in the financial statements for a particular tax position is the largest amount of benefit that is more likely than not to be realized upon the ultimate settlement. The Company's policy is to recognize interest and penalties accrued on any unrecognized tax benefits as a component of income tax expense.

Net Loss Per Share

Basic net loss per common share is computed by dividing the net loss by the weighted-average number of common shares outstanding during the period. Diluted net loss per common share is computed by dividing the net loss by the weighted-average number of common shares and dilutive common share equivalents outstanding during the period. The Company has reported a net loss for the years ended December 31, 2018 and 2017. For the purposes of this calculation, preferred stock, stock options, restricted stock units and warrants are considered to be common stock equivalents and are only included in the calculation of diluted net loss per share when their effect is dilutive.

The following table sets forth the computation of the basic and diluted net loss per share during the years ended December 31, 2018 and 2017 (in thousands, except share and per share amounts):

	Year Ended December 31,	
	2018	2017
Net loss	$(186,512)	$(125,618)
Less: Gain on private placement warrants	(9,330)	—
Net loss used to compute diluted net loss per share	$(195,842)	$(125,618)

Denominator:		
Weighted-average common shares outstanding used to calculate basic net loss per common share	45,384,380	39,645,635
Add: Private placement warrant shares	643,570	—
Weighted-average common shares outstanding used to calculate diluted net loss per common share	46,027,950	39,645,635
Net loss per share:		
Basic net loss per common share	$(4.11)	$(3.17)
Diluted net loss per common share	$(4.25)	$(3.17)

The following potentially dilutive securities outstanding have been excluded from diluted net loss per share, because their effect would be antidilutive, as of December 31, 2018 and 2017:

	December 31,	
	2018	2017
Options to purchase common stock	4,847,046	4,838,598
Restricted stock units	1,699,184	891,232
Warrants to purchase common stock	17,514	1,196,296

Recent Accounting Pronouncements

In February 2016, the FASB issued ASU No. 2016-02, Leases, which, for operating leases, requires a lessee to recognize a right-of-use asset and a lease liability, initially measured at the present value of the lease payments, in its balance sheet. The standard also requires a lessee to recognize a single lease cost, calculated so that the cost of the lease is allocated over the lease term, on a generally straight-line basis. This ASU will be effective for the Company in fiscal year 2019. Early adoption is permitted. The Company has identified the relevant lease arrangements and is currently in the process of evaluating the impact of this new guidance on its consolidated financial statements. The Company believes the adoption of this standard will have an impact on its consolidated balance sheet as a result of the recognition of a right-to-use asset and corresponding liability for its facility operating lease and relevant new disclosures about its leasing activities.

In May 2017, the FASB issued ASU No. 2017-09, Compensation – Stock Compensation (Topic 718): Scope of Modification Accounting. This ASU provides guidance about which changes to the terms or conditions of a share-based payment award requires the Company to apply modification accounting. This ASU will be effective for the Company for annual reporting periods, including interim reporting periods, beginning after December 15, 2017. The Company adopted this standard on January 1, 2018 noting it did not have a material impact on the Company's consolidated financial statements.

In January 2016, the FASB issued ASU No. 2016-01, Financial Instruments- Overall (Subtopic 825-10): Recognition and Measurement of Financial Assets and Financial Liabilities, which includes provisions to accounting for equity investments, financial liabilities under the fair value option, and presentation and disclosure requirements for financial instruments. The amended guidance requires equity securities, except for those accounted for under the equity method of accounting, with determinable fair values to be measured at fair with changes in fair value recognized in net income (loss). This ASU is effective for the Company for annual reporting periods, including interim reporting periods, beginning after December 15, 2017. The Company adopted this standard on January 1, 2018 noting it did not have a material impact on the Company's consolidated financial statements.

In March 2018, the FASB issued ASU No. 2018-05, Income Taxes (Topic 740), Amendments to SEC Paragraphs Pursuant to SEC Staff Accounting Bulletin No. 118. The amendments add various Securities and Exchange Commission ("SEC) paragraphs pursuant to the issuance of SEC Accounting Bulletin No. 118, Income Tax Accounting Implications of the Tax Cuts and Jobs Act ("Act") ("SAB 118"). The SEC issued SAB 118 to address concerns about reporting entities' ability to timely comply with the accounting requirements to recognize all of the effects of the Act in the period of enactment. SAB 118 allows disclosure that timely determination of some or all of the income tax effects from the Act are incomplete by the due date of the financial statements and if possible to provide a reasonable estimate. As permitted by SAB 118, the Company recorded provisional estimates in 2017 and finalized its accounting for these provisional estimates based on guidance, interpretations and all of the available data in the year ended

December 31, 2018. No adjustment to the previously recorded provisional amount was recorded in 2018.

In August 2018, the FASB issued ASU No. 2018-13, Fair Value Measurement (Topic 820): Disclosure Framework – Changes to the Disclosure Requirements for Fair Value Measurement, which eliminates certain disclosure requirements for fair value measurements for all entities, requires public entities to disclose certain new information and modifies some disclosure requirements. This standard is effective for fiscal years beginning after December 15, 2019, with early adoption permitted. The Company does not expect the adoption of this standard to have a material effect on its consolidated financial statements.

In August 2018, the SEC issued an amendment to Rule 3-04 of Regulation S-X, which extended the annual disclosure requirement of reporting changes in stockholders' equity to interim periods. Such disclosures are to be provided in a note to the financial statements or in a separate financial statement and requires both the year-to-date information and subtotals for each interim period. In September 2018, the SEC issued guidance under a Compliance and Disclosure Interpretation (C&DI 105.09) to clarify the effective date of the requirement. Under the guidance in C&DI 105.09, the Company plans to implement this updated disclosure requirement beginning with the first quarter 2019 Form 10-Q.

In November 2018, the FASB issued ASU No. 2018-18, Collaborative Arrangements (Topic 808), which discusses the interaction between Topic 808, Collaborative Arrangements and Topic 606, including clarification around certain transactions between collaborative arrangement participants and adding unit-of-account guidance to Topic 808. This standard is effective for annual periods beginning after December 15, 2019, and interim periods within those periods. Early adoption is permitted. The adoption of this guidance is not anticipated to have an impact on the Company's consolidated financial statements.

3. Fair Value Measurements

Financial assets and liabilities are recorded at fair value. The carrying amount of certain financial instruments, including cash and cash equivalents, restricted cash, trade and contract receivables, prepaid and other current assets, assets held for sale, accounts payable, accrued liabilities and deferred revenue approximate fair value due to their relatively short maturities. Assets and liabilities recorded at fair value on a recurring basis in the consolidated balance sheets are categorized based upon the level of judgment associated with the inputs used to measure their fair values. Fair value is defined as the exchange price that would be received for an asset or an exit price that would be paid to transfer a liability in the principal or most advantageous market for the asset or liability in an orderly transaction between market participants on the measurement date. The authoritative guidance on fair value measurements establishes a three-tier fair value hierarchy for disclosure of fair value measurements as follows:

Level 1: Quoted prices in active markets for identical assets or liabilities.

Level 2: Observable inputs other than Level 1 prices, such as quoted prices for similar assets or liabilities, quoted prices in markets that are not active, or other inputs that are observable or can be corroborated by observable market data for substantially the full term of the assets or liabilities.

Level 3: Unobservable inputs that are supported by little or no market activity and that are significant to the fair value of the assets or liabilities.

Assets and liabilities measured at fair value are classified in their entirety based on the lowest level of input that is significant to the fair value measurement. The Company's assessment of the significance of a particular input to the fair value measurement in its entirety requires management to make judgments and consider factors specific to the asset or liability.

Where quoted prices are available in an active market, securities are classified as Level 1 of the valuation hierarchy, including cash held at overnight sweep accounts. The Company's Level 2 valuations of marketable securities are generally derived from independent pricing services based upon quoted prices in active markets for similar securities, with prices adjusted for yield and number of days to maturity, or based on industry models using data inputs, such as interest rates and prices that can be directly observed or corroborated in active markets.

In certain cases, where there is limited activity or less transparency around inputs to valuation, securities are classified as Level 3 within the valuation hierarchy. Level 3 liabilities that are measured at estimated fair value on a recurring basis consist of a derivative liability in connection with the Solar Capital Ltd. Success Fee Agreement and a warrant liability in connection with the Private Placement.

As of December 31, 2018 and 2017, financial assets and liabilities measured and recognized at fair value on a recurring basis were as follows (in thousands):

As of December 31, 2018:

	December 31, 2018			
	Amortized Cost	Unrealized Gains	Unrealized Losses	Fair Value
Assets				
Level 1:				
Cash and restricted cash	$25,968	$ —	$ —	$ 25,968
Money market funds	10,518	—	—	10,518
Subtotal	36,486	—	—	36,486
Level 2:				
Other debt securities	20,000	—	—	20,000
Subtotal	20,000	—	—	20,000
Total	$56,486	$ —	$ —	$ 56,486
Reported as:				
Cash and cash equivalents				$ 30,956
Short-term investments				$ —
Restricted cash				$ 25,530
Liabilities, Level 3				
Warrant Liability				$ 444
Derivative Liability				$ 963
Total				$ 1,407

As of December 31, 2017:

	December 31, 2017			
	Amortized Cost	Unrealized Gains	Unrealized Losses	Fair Value
Assets				
Level 1:				
Restricted cash	$9,746	$ —	$ —	$ 9,746
Money market funds	58,769	—	—	58,769
U.S. Treasury bills	4,992	—	—	4,992
Subtotal	73,507	—	—	73,507
Level 2:				
Corporate debt securities	46,040	—	—	46,040
U.S. agency securities	4,990	—	—	4,990
Other debt securities	50,000	—	—	50,000
Subtotal	101,030	—	—	101,030
Total	$174,537	$ —	$ —	$ 174,537
Reported as:				

Cash and cash equivalents	$ 145,219
Short-term investments	$ 19,572
Restricted cash	$ 9,746
Liabilities, Level 3	
Warrant liability	$ 9,774
Derivative liability	$ 686
Total	$ 10,460

The amortized cost and estimated fair value of the debt securities by contractual maturity are summarized as follows:

	As of December 31, 2018		As of December 31, 2017	
	Amortized Cost	Estimated Fair Value	Amortized Cost	Estimated Fair Value
Due in one year or less	$30,518	$ 30,518	$174,007	$174,007
Due after one year through five years	—	—	—	—
Total debt securities	$30,518	$ 30,518	$174,007	$174,007

All available-for-sale securities held as of December 31, 2018 had maturities less than one year from the date of acquisition. There were no sales of available-for-sale securities in any of the periods presented. The Company held no debt securities that were in unrealized loss positions as of December 31, 2018 and 2017.

Pursuant to the loan and security agreement with Solar Capital Ltd. (see Note 8), the Company entered into a Success Fee Agreement under which the Company agreed to pay $1.0 million in cash (the “Success Fee”) if the Company obtains approval to market ZEMDRI from the FDA. If such approval is obtained, the Success Fee shall be due the later of (i) August 5, 2019 or (ii) the date such FDA approval is obtained. The Company obtained FDA approval for ZEMDRI on June 25, 2018; therefore, the Success Fee is due on August 5, 2019. The estimated fair value of the Success Fee is recorded as a derivative liability and included in current liabilities on the accompanying consolidated balance sheet. As of December 31, 2018 the derivative liability increased by $0.3 million to $1.0 million from December 31, 2017, primarily as a result of a change in the estimated cost of debt and the time value of money, which is presented as a component of change in warrant and derivative liabilities in the Company’s consolidated statements of operations for the year ended December 31, 2018.

The fair value of the derivative liability was determined using a discounted cash flow analysis, and is classified as a Level 3 measurement within the fair value hierarchy since the Company’s valuation utilized significant unobservable inputs. Specifically, the key assumptions included in the calculation of the estimated fair value of the derivative instrument include: i) the Company’s estimates of both the probability and timing of a potential $1.0 million payment to Solar Capital Ltd. as a result of FDA approval to market ZEMDRI, and ii) a discount rate of 6.3% which was derived from the Company's estimated cost of debt, based on the current loan and security agreement with SVB. The estimated fair value of the derivative liability is most sensitive to a change in the discount rate. If the discount rate decreased by 5%, the fair value of the derivative liability as of December 31, 2018 would not change. For the year ended December 31, 2018, the changes to the key assumptions used in the calculation of the estimated fair value included a decrease in the discount rate from 13% to 6.3% and the Company received FDA approval to market ZEMDRI. Any changes in the estimated fair values are presented as changes in warrant and derivative liabilities in the Company's consolidated statements of operations.

Pursuant to the Private Placement (see Note 9), the Company issued warrants to purchase 1,999,999 shares of common stock at an exercise price of $3.66 per share. The Company classified these warrants as a liability measured at fair value using Black-Scholes. Under certain entity conditions, the holder of a warrant may require the Company to settle the warrant in cash at its estimated fair value using Black-Scholes. As of December 31, 2018 and 2017, the estimated fair values of the outstanding warrants were approximately $0.4 million and $9.8 million, respectively. The change in the estimated fair value is primarily due to the change in the Company's stock price and is included in changes in warrant and derivative liabilities in the Company's consolidated statements of operations.

During the year ended December 31, 2017, certain holders of these warrants exercised warrants to purchase 113,948 shares of common stock. The Company received $0.4 million in proceeds from these warrant exercises. The Company is required to record the exercised warrants at its estimated fair value at the time of exercise, with any change included in changes in warrant and derivative liabilities in the Company's consolidated statements of operations.

The fair value of the warrant liability is classified as a Level 3 measurement within the fair value hierarchy since the Company's valuation utilized significant unobservable inputs, including the risk-free interest rate, expected share price volatility, underlying price per share of the Company's common stock and remaining term of the warrants.

The estimated fair values of the warrants were determined using Black-Scholes with the following assumptions, during the years ended December 31, 2018 and 2017:

	December 31, 2018	December 31, 2017
Expected volatility	95%	80%
Expected term	2.4	3.4
Risk-free interest rate	2.5%	2.0%
Dividend yield	—%	—%

The expected volatility is based on the Company's volatility. The expected term is based on the remaining life of the warrants. The risk-free interest rate is obtained from the yields on actively traded U.S. Treasury securities for a period equal to the expected term of the warrants. The dividend yield is zero because the Company has never paid cash dividends and has no present intention to pay cash dividends. Should the volatility change by 5%, the fair value of the warrant liability as of December 31, 2018 is negligible.

Changes in the estimated fair value of recurring measurements included in Level 3 of the fair value hierarchy are presented as changes in warrant and derivative liabilities in the Company’s consolidated statements operations and were as follows for the years ended December 31, 2018 and 2017 (in thousands):

	Estimated Fair Value of Derivative Liability	Estimated Fair Value of Warrant Liability
Balance of Level 3 Liabilities at December 31, 2016	$ 602	$ 13,874
Change in estimated fair value of warrant liability	—	(2,012)
Reclassification of warrant liability to additional paid-in-capital upon exercise of warrants	—	(2,088)
Change in estimated fair value of derivative liability	84	—
Balance of Level 3 Liabilities at December 31, 2017	686	9,774
Change in estimated fair value of warrant liability	—	(9,330)
Change in estimated fair value of derivative liability	277	—
Balance of Level 3 Liabilities at December 31, 2018	$ 963	$ 444

4. Balance Sheet Components

Inventory

The Company evaluates inventory levels based on the on-hand inventory, production plans, and sales forecasts. Inventories expected to be utilized within the next twelve months are classified as current and inventories expected to be utilized beyond that period are classified as non-current. Inventory consisted of the following (in thousands):

	December 31,	
Current assets	2018	2017
Work-in-process	$495	$ —
Finished goods	20	—
Current inventory	$515	$ —
Non-current assets		
Raw materials	$7,516	$ —
Work-in-process	1,330	—
Non-current inventory	$8,846	$ —

Prepaids, Other Current Assets and Other Long-Term Assets

Prepaids, other current assets and other long-term assets consisted of the following (in thousands):

	December 31,	
Current Assets	2018	2017
Deferred manufacturing and research and development costs	$—	$4,317
Prepaid expenses	1,351	1,755
Other current assets	61	295
Prepaids and other current assets	$1,412	$6,367
Non-current assets		
Deferred manufacturing and research and development costs	$9,190	$—
Other long-term assets	$9,190	$—

Property and Equipment, net

Property and equipment, net consisted of the following (in thousands):

	December 31,	
	2018	2017
Office equipment	$747	$863
Laboratory equipment	122	6,663
Leasehold improvements	2,110	9,355
Construction-in-progress	—	1,040
Property and equipment, gross	2,979	17,921
Less: accumulated depreciation	(508)	(3,111)
Property and equipment, net	$2,471	$14,810

Depreciation expense for the years ended December 31, 2018 and 2017 was $2.6 million and $1.3 million, respectively.

During the year-ended December 31, 2018, the Company conducted an impairment test of its property and equipment and determined there were impairment indicators related to the restructurings announced in July 2018 and November 2018. As a result of the reduction in workforce, the Company had excess and unoccupied office and lab space that corresponded to leasehold improvements, office equipment and construction-in-progress assets. The Company evaluated the recoverability and fair value of these assets in relation to executed and potential sub-leases and concluded the assets were impaired. In addition, the Company evaluated the recoverability and fair value of the laboratory equipment in relation to the remaining research and development priorities and determined a substantial portion of the assets were impaired. The Company recorded an impairment charge and net facility exit costs of $11.8 million in the restructuring charges line item of the consolidated statements of operations.

In connection with the restructuring announced in November 2018, the Company met the criteria to classify a portion of laboratory equipment to assets held for sale. The Company recorded an initial loss on remeasurement of assets held for sale of $2.2 million for the year ended December 31, 2018 in the restructuring charges line item of the consolidated statements of operations.

Accrued Liabilities

Accrued liabilities consisted of the following (in thousands):

	December 31,	
	2018	2017
Accrued manufacturing expenses	$1,931	$—
Accrued research and development expenses	3,220	6,480
Payroll and related bonus expenses	7,252	6,281
Other	2,829	2,680
	$15,232	$15,441

5. License and Collaboration Agreements

Thermo Fisher Scientific, Inc.

In April 2016, the Company entered into an agreement with its collaboration partner, Microgenics Corporation ("Thermo Fisher"), a wholly owned subsidiary of Thermo Fisher Scientific, Inc., to co-develop and commercialize an assay to support plazomicin, which would enable healthcare professionals to make decisions on safe and efficacious doses of plazomicin for certain patients. In December 2018, Thermo Fisher received FDA clearance for its do novo submission of the Thermo Scientific QMS Plazomicin Immunoassay. The assay developed under the agreements provides TDM to certain patients receiving plazomicin. In accordance with the terms of the agreement, the Company is required to make milestone payments with respect to research, development, regulatory and commercialization milestones (if any). All such milestone payments may total, in aggregate, up to but no more than $7.0 million. In further consideration of this agreement, in the event of a successful commercialization of the assay, the Company is required to pay a minimum threshold annual revenue to Thermo Fisher.

As of December 31, 2018, the Company has incurred $4.3 million in milestone payments and these costs were fully recorded as research and development expense. The Company recorded $0.6 million and $2.5 million for the years ended December 31, 2018 and December 31, 2017, respectively.

Crystal Biosciences, Inc.

In May 2016, the Company entered into a collaboration and license agreement with Crystal Biosciences, Inc. ("Crystal"). Pursuant to the terms of this agreement, the Company and Crystal agreed to collaborate on the discovery of monoclonal antibodies against multiple targets. Crystal agreed to conduct the initial discovery work with its antibody platform and the Company has the right to develop and commercialize the antibodies discovered through this collaboration. The Company is required to provide signing and milestone payments with respect to research, development, regulatory and commercialization milestones (if any). All such milestone payments may total, in aggregate, up to but no more than approximately $20.6 million. The upfront signing fee, technology access fees and research funding were recorded as research and development expense during the years ended December 31, 2018 and December 31, 2017. This collaboration and license agreement also provides that the Company shall pay royalties equal to a low single-digit percentage of annual worldwide net sales of the commercialized product. In 2017, Ligand Pharmaceuticals Incorporated ("Ligand") acquired Crystal and the platform became a part of the OmniAb platform. This acquisition does not materially impact the Company's ongoing collaboration.

Ionis Pharmaceuticals

In January 2006, the Company entered into a license agreement with Ionis Pharmaceuticals, Inc. (“Ionis”). Ionis granted the Company an exclusive, worldwide license with the right to grant and authorize sublicenses related to the research and development of aminoglycoside products. In consideration of this license, and in accordance with the terms of the agreement, the Company is required to make milestone payments with respect to development, regulatory and commercialization milestones, and to pay a percentage of revenue received from sublicensees (if any). All such milestone and sublicense revenue payments may total, in the aggregate, up to but no more than $19.5 million for the first product and $9.8 million following the second product commercialized under the agreement with Ionis. The Company is also required to pay additional milestone payments of up to $20.0 million in the aggregate upon the first achievement of specified threshold levels of annual net sales of all aminoglycoside products in a

calendar year. The license agreement also provides that the Company shall pay royalties equal to a low single-digit percentage of annual worldwide net sales of all licensed products, including, if applicable, ZEMDRI.

As of December 31, 2018, the Company has incurred $14.5 million in milestone payments and these costs were recorded as research and development expense in the consolidated statement of operations. In connection with the FDA approval of ZEMDRI, the Company recorded $7.5 million of research and development expense during the year ended December 31, 2018. For the year ended December 31, 2017 there was no milestone payment.

6. Revenue Agreements

Product Revenue, Net

To date, the Company’s source of product revenue has been from the U.S. sales of ZEMDRI, which the Company began shipping to customers in July 2018. Revenues from product sales are recorded at the net sales price, which includes estimates of variable considerations. No costs to obtain or fulfill the contracts have been capitalized.

Contract Revenue

Certain of the Company’s drug discovery and development activities are performed under contracts with the Gates Foundation and U.S. government agencies. Management has determined that the Company is the principal participant in the following contract arrangements, and, accordingly, the Company records amounts earned under the arrangements as revenue. Costs incurred under the Revenue Contracts are recorded as operating expenses in the Company's consolidated statements of operations.

Biomedical Advanced Research and Development Authority (BARDA)

In August 2010, the Company was awarded a contract with BARDA for the development, manufacturing, nonclinical and clinical evaluation of, and regulatory filings for, ZEMDRI as a countermeasure for diseases caused by antibiotic-resistant pathogens and biothreats. The original contract included committed funding of $27.6 million for the first two years of the contract and subsequent options exercisable by BARDA to provide additional funding. As of December 31, 2018, the original contract and the three-exercised options and modifications total $124.4 million of obligated funding, of which a total of $124.4 million has been recorded as revenue. The contract was terminated as of June 30, 2018.

In September 2017, the Company was awarded the C-Scape Contract (“C-Scape Contract”) valued at up to $18.0 million from BARDA to support the development of C-Scape. The C-Scape Contract includes a base period with committed funding of $12.0 million and subsequent option periods that, if exercised, would bring the total value of the award to $18.0 million. As of December 31, 2018, the Company recorded revenue of $5.2 million with $6.8 million remaining available from the committed funding under the C-Scape Contract

For the years ended December 31, 2018 and 2017, the Company recorded revenue related to the C-Scape Contract of $4.2 million and $1.0 million, respectively. As of December 31, 2018 and 2017, $0.4 million and $1.0 million was included in trade and contract receivables, net.

CARB-X

On April 26, 2018, the Company entered into an agreement with CARB-X, under which the Company was awarded $2.4 million, with a possibility of up to $9.6 million in additional funding based on achievement of certain project milestones. The funding was awarded to support the development of a next-generation broad-spectrum

aminoglycoside antibiotic capable of overcoming clinically-relevant resistance mechanisms and potentially treating highly-resistant gram-negative pathogens such as the Enterobacteriaceae family, Acinetobacter baumannii, and Pseudomonas aeruginosa.

The Company recorded contract revenue of $1.3 million and under this agreement for the year ended December 31, 2018. As of December 31, 2018, $1.0 million was included in trade and contract receivables, net.

Bill & Melinda Gates Foundation

In May 2017, the Company entered into an agreement with the Gates Foundation to discover drug candidates against gram-negative bacterial pathogens intended to prevent neonatal sepsis (the "Grant Agreement"). The Gates Foundation awarded the Company up to approximately $10.5 million in grant funding ("Grant Funds") over a three-year research term, of which approximately $3.2 million of funding was received in May 2017 (the "Advance Funds") of which the Company earned and recognized the full amount as revenue as of December 31, 2018. The Advance Funds are replenished by the Gates Foundation each calendar year, or sooner, following the Company's submission of a progress report, including expenses incurred for the research activities. Under certain conditions, as described in the Grant Agreement, the Gates Foundation may terminate the Grant Agreement and the Company is obligated to return to the Gates Foundation any unused portion of the Advance Funds. In December 2018, the Grant Agreement was amended to reduce the total grant amount by $7.1 million. As of December 31, 2018, the Company has recorded revenue of $3.3 million under this agreement, with $0.1 million of remaining funding available.

In connection with the Grant Agreement and the Gates Investment, the Company entered into a strategic relationship with the Gates Foundation (the "Letter Agreement"). Under the terms of the Letter Agreement, the Gates Investment and Grant Funds may only be used to conduct mutually agreed upon work, including the scale up of the Company's antibody platform technology to launch a product intended to prevent neonatal sepsis (the "NSP"). Pursuant to the Letter Agreement, the Company agreed to make the NSP available and accessible in certain developing countries and to grant the Gates Foundation a non-exclusive license to commercialize selected drug candidates in certain developing countries, which may only be exercised in the event of certain defaults as described in the Letter Agreement (the "Global Access Commitments"). The Global Access Commitments will continue in effect until the earlier of 25 years from the closing of the Gates Investment or 7 years following the termination of all funding provided by the Gates Foundation; provided, that the Global Access Commitments will continue for any products or services developed with funding provided by the Gates Foundation which continue to be developed or available in certain developing countries.

The Company recorded contract revenue of $2.2 million and $1.1 million under this agreement for the years ended December 31, 2018 and 2017, respectively.

National Institute of Allergy and Infectious Diseases (NIAID)

In July 2015, the Company was awarded a contract by NIAID to support the discovery and development of LpxC inhibitors for the treatment of bacterial infections for $1.5 million committed through June 30, 2016. In January 2016, an additional committed funding of $0.5 million was added. In April 2016, NIAID modified the contract to exercise the first option to increase the total contract committed funding to $4.4 million. In April 2017, NIAID modified the contract to add committed funding of $0.3 million to the first option, bringing the total committed funding to $4.7 million. In June 2017, NIAID modified the contract to exercise the second option of $0.6 million and extended performance through August 2018, bringing the total committed funding to $5.3 million, of which $0.4 million remains available as of December 31, 2018. During 2017, the Company decided to discontinue all research and development efforts on its preclinical LpxC inhibitor programs for gram-negative pathogens. The Company does not expect to recognize additional revenues under this contract in future periods.

During the years ended December 31, 2018 and 2017, the Company recognized revenue of zero and $1.3 million, respectively, under these agreements, of which zero and $0.2 million were included in trade and contract receivable, net at December 31, 2018 and 2017, respectively.

7. Commitments

Facility Lease Agreement

In August 2016, the Company entered into a non-cancelable agreement (the "Lease") to lease 47,118 square feet of office, laboratory and research and development space (the “Original Space”) for the Company's principal executive offices in South San Francisco. In July 2017, the Company entered into an amendment (the “Lease Amendment”) to lease an additional 51,866 square feet of space (the “Expansion Space”) for a total of 98,984 square feet (the “Premises”). The Lease commenced in March 2017 and as of January 2018, the Company occupied the full Premises. The lease term for the Premises is through January 31, 2028 (the “Lease Term”) and contains an option to extend the Lease Term for an additional 5 years. The Lease has rent escalation clauses for approximately

3.5% of the base rent in each subsequent year of the Lease Term and a rent abatement period in the first year of the Premises.

The Lease provides for a tenant improvement allowance of $5.7 million with the option to elect for up to $3.4 million in additional allowances. As of December 31, 2018, the Company has elected to use all additional allowances; therefore, the Company is not entitled to any additional improvement allowances. As a result of the tenant improvement allowances, the base rent increased as calculated in the Lease Amendment. Rent increases, including the impact of leasehold improvement allowances, are recognized as deferred rent and amortized on a straight-line basis over the term of the lease.

Future minimum lease payments, net of future sublease income of $11.3 million, under the operating leases as of December 31, 2018 are as follows (in thousands):

Year Ending December 31,	Amounts
2019	$ 4,247
2020	4,396
2021	4,551
2022	4,708
2023	5,306
Thereafter	32,866
Total minimum lease payments	$ 56,074

The Company recognizes rent expense on a straight-line basis over the non-cancelable lease period. Rent expense was $5.6 million and $3.0 million, net of sublease income of $0.3 million and zero, for the years ended December 31, 2018 and 2017, respectively.

Commercial Validation and Manufacturing Agreement

In March 2017, the Company entered into a commercial validation and manufacturing agreement (the “Commercial Manufacturing Agreement”) with Hovione Limited (“Hovione”). Under the Commercial Manufacturing Agreement, Hovione has agreed to complete the validation program to validate and scale up the Company’s technology to manufacture the active pharmaceutical ingredient for plazomicin (the “Product”) and supply the Product to the Company. The Commercial Manufacturing Agreement has an initial term of seven years after the first delivery of the Product.

Pursuant to the Commercial Manufacturing Agreement, if plazomicin is approved by the FDA, we have minimum quantity and minimum annual purchase commitments from Hovione depending on our requirements and the period of time following approval by the FDA. For the first three years following approval of plazomicin by the FDA, the Company is required to purchase at least 80% of its required quantity from Hovione. Following the initial three years after FDA approval, the Company is required to purchase between 40% and 66% of its required quantity from Hovione, depending on the amounts required during any such fiscal year. Contingent upon FDA’s approval of plazomicin, the Company has minimum annual purchase commitments from Hovione, beginning in 2020 through 2024.

Future minimum purchase commitments under the Manufacturing Agreement as of December 31, 2018 are as follows (in thousands):

Year Ending December 31,	Amounts
2019	$ —
2020	9,000

2021	8,000
2022	12,000
2023	12,000
Thereafter	12,000
Total minimum purchase commitments	$ 53,000

In connection with the Commercial Manufacturing Agreement, the Company executed certain work plans to carry out the validation and commercial manufacturing of plazomicin (the "Work Plans"). The Work Plans obligated the Company to make an aggregate amount of approximately $6.2 million in nonrefundable advance payments, of which $1.5 million was for the reservation of facilities and resources, plus procurement of long lead raw materials, paid in full under a separate agreement executed in July 2015. Such advance payments are initially capitalized as prepaid and other current assets and will be recognized as research and development expenses as goods are delivered and/or services are performed. The Company assesses such prepaid and other current assets for impairment if events or changes in circumstances indicate that the carrying amount may not be recoverable or may not provide future economic benefits. Further, the Work Plans include certain terms that require the Company to compensate Hovione if it chooses to cancel the Work Plans ("Cancellation Clause"). As of December 31, 2018, $14.8 million is committed under the Cancellation Clause and the total aggregate amount of potential commitments, if all the services are rendered by Hovione, is approximately $26.4 million. As of December 31, 2018 and 2017, the Company has recorded approximately $7.4 million and $4.3 million, respectively as other long-term assets and prepaid and other current assets. For the years ended December 31, 2018 and 2017, the Company recognized $7.3 million and $3.3 million, respectively, as research and development expenses, related to the Work Plans.

Pfizer CentreOne Development and Supply Agreement

In August 2015, the Company entered into a development and supply agreement with Hospira, which was amended in September 2015 to include the Pfizer CentreOne Group ("Pfizer CentreOne"). Under the development and supply agreement, Pfizer CentreOne has agreed to produce the drug product, ZEMDRI, through December 2022. Subsequent to FDA's approval of ZEMDRI, which occurred in June 2018, the Company agreed to certain minimum purchase requirements of approximately $7.1 million through 2022 based on a percentage of the Company's annual forecast.

Guarantees and Indemnifications

As permitted under Delaware law and in accordance with the Company's bylaws, the Company is required to indemnify its officers and directors for certain events or occurrences while the officer or director is or was serving in such capacity. The Company is also party to indemnification agreements with its directors and officers. The Company believes the fair value of the indemnification rights and agreements is minimal. Accordingly, the Company has not recorded any liabilities for these indemnification rights and agreements as of December 31, 2018 and 2017.

8. Borrowings

Solar Capital Ltd. Loan Agreement

On August 5, 2015, the Company entered into a loan and security agreement (the "Solar Loan Agreement") with Solar Capital Ltd. (the "Solar Capital") pursuant to which Solar Capital agreed to make available to the Company term loans in an aggregate principal amount of up to $25.0 million with a maturity date of August 5, 2019. An initial $15.0 million term loan was funded at closing on August 5, 2015, and a second $10.0 million term loan was funded on June 20, 2016. Borrowings under the term loans bore interest per annum at 6.99% plus the greater of 1% or the one-month LIBOR. The obligation also included a final fee of $2.0 million, representing 8% of the term loan currently funded, which accreted over the life of the loan as interest expense. On February 26, 2018, the Company terminated the Solar Loan Agreement and repaid the outstanding principal and accrued interest expense of $20.9 million. For the year ended December 31, 2018, the difference between the net carrying amount of the Solar Capital debt and the amount paid by the Company was recorded as a loss from debt extinguishment of $0.8 million in the Company's consolidated statements of operations.

On August 5, 2015, pursuant to the Solar Loan Agreement, the Company entered into a Success Fee Agreement with Solar Capital under which the Company agreed to pay Solar Capital $1.0 million if the Company obtains FDA approval to market ZEMDRI. If such approval is obtained, the Success Fee shall be due the later of (i) August 5, 2019 or (ii) the date such FDA approval is obtained. The Company obtained FDA approval for ZEMDRI on June 25, 2018; therefore, the Success Fee is due on August 5, 2019. The estimated fair value of the Success Fee is recorded as a derivative liability in the accompanying consolidated balance sheets as of December 31, 2018 and 2017.

Silicon Valley Bank Loan Agreement

On February 26, 2018, the Company entered into a loan agreement with SVB. The SVB Loan Agreement provides for (i) a $25.0 million Term A loan facility with a maturity of five years (the “Term A Loan”) and (ii) an up to $25.0 million Term B loan facility, which may be drawn, subject to certain conditions, by the Company during the first 12 months after February 26, 2018 (the “Term B Loans” and collectively, with the Term A Loan, the “Term Loans”). Each Term B Loan has a maturity of four years. In February 2018, the Company received initial funding from the Term A Loan of $25.0 million, which was primarily used to repay the Company’s prior loan agreement with Solar Capital. In addition, on October 29, 2018, the Company borrowed the remaining $25.0 million under the Term B Loans.

Borrowings under the Term A Loan bear interest at a floating per annum rate equal to the greater of (a) the prime rate minus 1.50% and (b) 3.00%, and the Term B Loans bear interest through maturity at a floating per annum rate equal to the greater of (a) 1.00% above the prime rate and (b) 5.50%.

The Company is permitted to make interest-only payments on the Term A Loan through February 2020 and the Term B Loans for the first twenty-four (24) months following the borrowing date after which the Company will be required to repay the Term A Loan in 36 consecutive equal monthly installments of principal and repay any Term B Loans in 24 consecutive equal monthly installments of principal. The Company is obligated to pay a fee equal to 6.00% of the funded Term Loans upon the earliest to occur of the maturity date, the prepayment or repayment of such Term Loans or the termination of the Loan Agreement. The final payment fee of $3.0 million, which represents 6.00% of the funded Term Loans is accreted under the effective interest method over the life of the loan as interest expense. The Company may voluntarily prepay all, but not less than all, of the outstanding Term Loans. The Term Loans are secured by substantially all of the Company’s assets, except for its intellectual property which is subject to a negative pledge and certain other customary exclusions.

The SVB Loan Agreement contains customary representations, warranties and covenants. The Company is required to have cash on deposit at SVB equal to the greater of (a) $48.0 million (the “Minimum Account Threshold”) and (b) the “Monthly Cash Burn,” which is defined as the difference of (1)(i) net loss plus (ii) unfinanced capital expenditures minus (2)(i) depreciation and amortization expenses, (ii) non-cash stock compensation expense and (iii) other non-cash expenses as approved by SVB. In December 2018, SVB collateralized $25.0 million of the $50.0 million loans that the Company drew down under the SVB Loan Agreement. Collateralization of this $25.0 million means that these funds are restricted and no longer available for the Company’s use until the Company’s cash on deposit at SVB exceeds the Minimum Account Threshold.

As of December 31, 2018, the Company was in compliance with all covenants under the loan. The loan agreement contains customary affirmative and negative covenants, indemnification provisions and events of default. The affirmative covenants include, among others, covenants requiring us to maintain our legal existence and governmental approvals, deliver certain financial reports and maintain certain intellectual property rights. The negative covenants include, among others, restrictions on transferring or licensing our assets, changing our business, incurring additional indebtedness, engaging in mergers or acquisitions, paying dividends or making other distributions, and creating other liens on our assets, in each case subject to customary exceptions. If the Company defaults under the loan, SVB may accelerate all of our repayment obligations and take control of our pledged assets. SVB could declare a default under the loan upon the occurrence of any event that SVB interprets as a material adverse change as defined under the loan agreement, thereby requiring the Company to repay the loan immediately. The outstanding loan balance due under the SVB Loan Agreement has been classified as a current liability at December 31, 2018 based on the Company’s ability to continue as a going concern (see Note 1) and the assessment that the material adverse change clause under the SVB Loan Agreement is not within the Company's control. The Company has not been notified of an event of default by SVB as of the date of the filing of this Form 10-K.

Pursuant to the SVB Loan Agreement, the Company incurred $1.2 million of debt issuance costs related to external legal and transaction fees. The Company recorded the debt issuance costs as a direct deduction from the carrying value of the Term Loans which are amortized as interest expense using the effective-interest method over the term of the Term Loans.

Future principal debt payments on the loan payable are as follows (in thousands):

	December 31, 2018
2019	$ —
2020	9,028
2021	20,833
2022	20,250
2023 (1)	2,889
Thereafter	—
Total principal and final fee payments	53,000
Unamortized discount and debt issuance costs	(3,216)
Loan payable, current portion	$ 49,784

(1) Includes $3.0 million final fee payment

The obligation includes a final fee of $3.0 million, representing 6% of the term loan funded, which accretes over the life of the loan as interest expense. The Company recorded interest expense related to the loan of $2.1 million and $2.9 million for the years ended December 31, 2018 and 2017, respectively.

9. Warrants

During 2012 and 2011, the Company issued warrants to Oxford Finance LLC and Silicon Valley Bank (“SVB”) to purchase 20,016 and 10,008 shares, respectively, of its Series C convertible preferred stock at an exercise price of $11.99 per share. The warrants were issued in connection with a loan and security agreement, which was repaid in full in June 2014. Immediately prior to the closing of the IPO, these warrants automatically converted into warrants exercisable for shares of common stock, resulting in the reclassification of the related preferred stock warrant liabilities to additional paid-in capital. During the year ended December 31, 2017, SVB elected a net exercise of 12,510 warrants to purchase 5,896 shares of common stock.

On June 3, 2016, the Company sold 7,999,996 shares of its common stock and warrants to purchase 1,999,999 shares of its common stock in the Private Placement. The warrants have an exercise price of $3.66 per share and are exercisable up to five years from the date of issuance. The Company's Chief Executive Officer, a related party, participated in the Private Placement by purchasing 141,453 shares of common stock and a warrant to purchase 35,363 shares of common stock for an aggregate purchase price of $0.5 million. The warrants issued in connection with the Private Placement are subject to remeasurement at each balance sheet date, using Black-Scholes, with any changes in the fair value of the outstanding warrants recognized in the consolidated statements of operations.

As of December 31, 2018, the following warrants to purchase shares of common stock were outstanding and exercisable:

Warrant Holder	Issue Date	In Connection With	Warrant to Purchase	Shares	Exercise Price	Expiration Date
Oxford Finance LLC	4/30/2012	Loan agreement	Common stock	11,676	$ 11.99	11/1/2021
Oxford Finance LLC	11/1/2011	Loan agreement	Common stock	5,838	$ 11.99	11/1/2021
Growth Equity Opportunities Fund IV, LLC	6/3/2016	Private Placement	Common stock	1,178,782	$ 3.66	6/3/2021
				1,196,296		

10. Equity Incentive Plans

2014 Plan

In February 2014, the Company's stockholders approved the 2014 Equity Incentive Award Plan (the "2014 Plan"), which became effective as of March 11, 2014. Under the 2014 Plan, the Company may grant incentive stock options ("ISOs"), nonstatutory stock options, stock appreciation rights, restricted stock awards, restricted stock unit awards ("RSUs") and other stock-based awards for the purchase of common stock. In 2018 and 2017, the compensation committee of the board of directors approved an evergreen increase of 1,700,600 and 1,425,522

shares of common stock, respectively, that may be granted in accordance with the terms of the 2014 Plan. As of December 31, 2018, 788,235 shares were available for future issuance under the 2014 Plan.

Under the 2014 Plan, the terms of stock award agreements, including vesting requirements, are determined by the board of directors, subject to the provisions of the 2014 Plan. Options granted by the Company typically vest over a four year period and the exercise price may not be less than fair market value on the date of grant. Certain of the options are subject to acceleration of vesting in the event of certain change of control transactions. Options granted under the 2014 Plan expire no later than 10 years from the date of grant.

2014 Employment Commencement Incentive Plan

In December 2014, the Company adopted a 2014 Employment Commencement Incentive Plan (the "Inducement Plan"). The Inducement Plan is designed to comply with the inducement exemption contained in Nasdaq's Rule 5635(c)(4), which provides for the grant of non-qualified stock options, restricted stock units, restricted stock awards, performance awards, dividend equivalents, deferred stock awards, deferred stock units, stock payment and stock appreciation rights to a person not previously an employee or director of the Company, or following a bona fide period of non-employment, as an inducement material to the individual's entering into employment with the Company. As of December 31, 2018, a total of 2,050,000 shares of common stock have been authorized under the Inducement Plan, including the additional 450,000 shares that became available resulting from an amendment adopted by the board of directors as of September 13, 2017. As of December 31, 2018, 467,327 shares were available for issuance under the Inducement Plan.

2014 Employee Stock Purchase Plan

In February 2014, the Company's stockholders approved the 2014 Employee Stock Purchase Plan (the "ESPP Plan"), which became effective as of March 11, 2014. In 2018 and 2017, the compensation committee of the board of directors approved an evergreen increase of 318,863 and 178,190 shares, respectively, that may be granted in accordance with the terms of the ESPP Plan. As of December 31, 2018, 680,731 shares of common stock have been issued to employees participating in the ESPP Plan, and 324,799 shares were available for issuance under the ESPP.

Amended and Restated 2003 Stock Plan

The Company's Amended and Restated 2003 Stock Plan, referred to herein as the 2003 Plan, provided for the granting of incentive and non-statutory stock options to employees, directors and consultants at the discretion of the board of directors. The Company granted options under its 2003 Plan until January 2014 when it was terminated as to future awards in March 2014, although it continues to govern the terms of options that remain outstanding under the 2003 Plan. Options granted under the 2003 Plan expire no later than 10 years from the date of grant. Options granted under the 2003 Plan vest over periods determined by the board of directors, generally over four years. In connection with the Board of Directors and stockholders' approval of the 2014 Plan, all remaining shares available for future awards under the 2003 Plan were transferred to the 2014 Plan, and the 2003 Plan was terminated as to future awards. As of December 31, 2018, a total of 444,317 shares of common stock are subject to options outstanding under the 2003 plan, which shares will become available under the 2014 Plan to the extent the options are forfeited or lapse unexercised.

Total stock-based compensation recognized in the Company's consolidated statements of operations for the years ended December 31, 2018 and 2017, was classified as follows (in thousands):

	Year Ended December 31,	
	2018	2017
Research and development	$5,501	$6,340
General and administrative	6,939	7,312
Restructuring charges	1,970	—
Total	$14,410	$13,652

Stock-based compensation expense for the year ended December 31, 2018 includes $2.0 million associated with the stock modifications as a result of the restructurings in July 2018 and November 2018. The restructuring charges include the stock modification for three executives' stock options and restricted stock units as a result of the July 2018 restructuring and the accelerated vesting of all impacted employee's restricted stock units as a result of the

November 2018 restructuring. Stock-based compensation expense for the year ended December 31, 2017 includes $0.7 million of expense that relates to the stock options and restricted stock units held by the former Chief Medical Officer, which were modified upon his resignation in March 2017.

A summary of stock option and RSU activity is as follows:

		Outstanding Options			
	Shares Available for grant	Number of Shares	Weighted-Average Exercise Price	Weighted-Average Remaining Contractual Life (in years)	Aggregate Intrinsic Value (in thousands)
Balance, December 31, 2016	639,374	3,540,293	$ 6.31	7.98	$ 23,837
Additional shares reserved	2,325,522	—			
Options granted	(1,806,157)	1,806,157	$ 21.12		
Options exercised	—	(227,444)	$ 7.23		$ 2,879
Options forfeited	280,408	(280,408)	$ 9.14		
RSUs granted	(544,185)	—			
RSUs cancelled	72,116	—			
Balance, December 31, 2017	967,078	4,838,598	$ 11.63	7.69	$ 14,174
Additional shares reserved	1,700,600	—			
Options granted	(2,254,107)	2,254,107	$ 9.49		
Options exercised	—	(295,519)	$ 5.64		$ 993
Options forfeited	1,950,140	(1,950,140)	$ 12.09		
RSUs granted	(1,672,708)	—			
RSUs cancelled	564,559	—			
Balance, December 31, 2018	1,255,562	4,847,046	$ 10.82	6.09	$ —
At December 31, 2018					
Vested and exercisable		2,488,996	$ 10.59	5.15	$ —
Vested and expected to vest		4,778,573	$ 10.79	6.08	$ —

The following table summarizes information about stock options outstanding as of December 31, 2018:

	Options Outstanding		Vested and Exercisable	
Exercise Price	Number of Options	Weighted-Average Remaining Contractual Life (in Years)	Number of Options	Weighted-Average Exercise Price
$3.65 - $4.34	593,906	3.97	371,983	$ 3.97
$4.44 - $4.73	156,133	3.53	131,883	$ 4.61
$4.79 - $4.79	500,000	9.61	—	$ —
$4.84 - $6.93	545,704	5.89	432,454	$ 5.80

$6.99 - $10.44	589,787	4.26	558,579	$	8.53
$10.64 - $10.64	708,785	6.87	231,131	$	10.64
$10.74 - $12.40	604,099	6.2	208,355	$	11.77
$12.45 - $22.41	501,988	6.59	217,196	$	19.03
$22.64 - $23.62	506,525	6.09	283,211	$	23.56
$23.68 - $24.71	140,119	7.76	54,204	$	23.80
	4,847,046	6.09	2,488,996	$	10.59

Stock Options Granted to Employees and Non-Employee Directors

During the years ended December 31, 2018 and 2017, the Company granted stock options to employees and directors to purchase 2,254,107 and 1,806,157, respectively, of common stock under the stock plans with a weighted-average estimated grant-date fair value of $9.49 and $21.12 per share, respectively. As of December 31, 2018, there were unrecognized compensation costs of $12.1 million related to outstanding employee and non-employee director stock options, which are expected to be recognized over a weighted-average period of 1.37 years.

The Company estimated the fair value of stock options using the Black-Scholes option valuation model for options with time-based vesting terms. The Black-Scholes model requires the input of subjective assumptions, including (a) the expected term of the award, (b) the expected stock price volatility, (c) the risk-free interest rate and (d) expected dividends. The estimated fair value of these employee stock options is being amortized on a straight-line basis over the requisite service period of the awards. The estimated grant date fair value of employee stock options with time-based vesting terms was calculated using the Black-Scholes valuation model, based on the following assumptions:

	Year Ended December 31,	
	2018	2017
Expected term	5.3 – 6.1 years	5.0 – 6.0 years
Expected volatility	77 – 78%	78 – 81%
Risk-free interest rate	2.3 – 3.1%	1.7 – 2.3%
Expected dividend yield	—%	—%

Restricted Stock Units Granted to Employees

During the years ended December 31, 2018 and 2017, the Company granted restricted stock units (“RSUs”) to employees to purchase 1,672,708 and 544,185 shares of common stock, respectively, under the stock plans with a weighted-average estimated grant-date fair value of $6.44 and $20.61 per share, respectively. RSUs generally vest annually over a 4-year service period and vesting is contingent on continued service. As of December 31, 2018, there were unrecognized compensation costs of $8.2 million related to outstanding RSUs, which are expected to be recognized over a weighted-average period of 2.33 years.

A summary of RSU activity is as follows:

	RSU Awards Outstanding		
	Number of Shares	Weighted-Average Grant Date Fair Market Value	Aggregate Intrinsic Value (in thousands)
Balance, December 31, 2016	605,052	$ 5.60	$ 7,878

RSUs granted	544,185	$	20.61	
RSUs released	(185,889)	$	6.24	
RSUs cancelled	(72,116)	$	9.22	
Balance, December 31, 2017	891,232	$	14.34	$ 9,572
RSUs granted	1,672,708	$	6.44	
RSUs released	(300,197)	$	12.93	
RSUs cancelled	(564,559)	$	12.55	
Balance, December 31, 2018	1,699,184	$	7.41	$ 2,090

Stock Options and Restricted Stock Units Granted to Employees that Contain Performance Conditions

During the year ended December 31, 2018 the Company granted options to purchase an aggregate of 158,370 shares of stock that vest upon the achievement of company-based milestone targets and during the year ended December 31, 2017, the Company granted options to purchase an aggregate of 184,200 shares of common stock that vest upon the achievement of market-based common stock targets. During the years ended December 31, 2018, the Company granted 33,424 RSUs that vest upon the achievement of company-based milestone targets and during the year ended December 31, 2017, the Company granted 35,050 RSUs, respectively, that vest upon the achievement of market-based common stock price targets.

The fair value of the milestone-based awards is estimated based on the Black-Scholes option valuation model, similar to time-based awards. In 2017, the fair value for market-based awards was estimated at the grant date using a Monte-Carlo simulation model ("Monte-Carlo"), which requires the use of a range of assumptions. The expected life assumption is not used in the Monte-Carlo simulation model, but the output of the model indicates an expected term. The associated stock-based compensation expense is being recognized on a straight-line basis over the implicit service period (expected time to vest) derived from that simulation model. The fair value of market-based awards granted to was estimated using Monte-Carlo with the following assumptions:

	Year Ended December 31, 2017
Expected term	0.5–3.5 years
Expected volatility	75-80%
Risk-free interest rate	2.1–2.4%
Expected dividend yield	—%

11. Contingently Redeemable Common Stock

In May 2017, the Company entered into a Common Stock Purchase Agreement with the Gates Foundation, pursuant to which the Company agreed to sell 407,331 shares of its contingently redeemable common stock (the "Gates Shares") to the Gates Foundation in a private placement at a purchase price per share equal to $24.55, for gross proceeds to the Company of $10.0 million (the "Gates Investment").

In connection with the Gates Investment, the Company entered into the Letter Agreement, which includes terms of Global Access Commitments (see Note 6). Under the Letter Agreement, if the Company defaults in its obligation to conduct certain mutually-agreed upon work, use the proceeds from the Gates Investment as described in the Letter Agreement, or otherwise triggers certain other events of default as described in the Letter Agreement ("Charitable Default"), subject to a cure period, the Gates Foundation will have the right to request that (a) the Company redeem, or facilitate the purchase by a third party of, the Gates Shares then held by the Gates Foundation at a price per share equal to the greater of (i) the fair market value of the common stock (if the Gates Shares are freely tradable, the closing price of the Company's common stock on the trading day prior to the redemption or purchase, as applicable), or (ii) an amount equal to $24.55 plus a compounded annual return of 5% from the date of issuance of the Gates Shares, or (b) if the Gates Shares then held by the Gates Foundation are not freely tradeable, the Company register the resale of the Gates Shares held by the Gates Foundation on an effective registration statement, subject to certain conditions and qualifications.

The Company concluded that certain potential events of the Charitable Default are not solely within the control of the Company and, accordingly, has classified the Shares outside of permanent equity, as temporary equity ("Mezzanine Equity"). The 407,331 shares classified as Mezzanine Equity were recorded as contingently redeemable common stock at an initial carrying value equal to the gross proceeds of approximately $10.0 million, which approximated their fair value at the date of issuance. As of December 31, 2017, the Company determined that the 407,331 shares of contingently redeemable common stock were not redeemable and that a Charitable Default was not currently probable. If, and at the time when, a Charitable Default becomes probable, then the Company will record a change in the carrying value to adjust it to the redemption value of the contingently redeemable common stock. At the time of such an occurrence, the contingently redeemable common stock will be adjusted to equal the redemption value at the end of each reporting period.

On December 27, 2018, the Company entered into a License Confirmation Agreement and a Redemption Agreement with the Gates Foundation (together, the "2018 Gates Agreements") in connection with the amendment of certain provisions of the Grant Agreement and the Letter Agreement. The 2018 Gates Agreements were entered into following the de-prioritization of antibody work by the Company, which was the focus of the Company's collaboration with the Gates Foundation. Among other things, the 2018 Gates Agreements (a) terminated the Company's obligations to conduct mutually agreed upon work, including work related to the Company's platform technology to develop and launch a product intended to prevent neonatal sepsis, (b) terminated the obligations of the Company to discover drug candidates intended to prevent neonatal sepsis and the obligation of the Gates Foundation to fund approximately $7.1 million in grants not yet received by the Company and (c) granted the Gates Foundation a non-exclusive license to intellectual property developed by the Company pursuant to the Grant Agreement and

Letter Agreement in specified developing countries. The Redemption Agreement also provided for the redemption by the Company of the 407,331 Gates Shares purchased by the Gates Foundation pursuant to the Gates Purchase Agreement for an aggregate redemption price of $5.7 million. The Company paid for the redemption of the Gates Shares with the unused portion of the restricted cash received by the Company pursuant to the original purchase of the Gates Shares under the Purchase Agreement. The Company recorded a loss on redeemable common stock settlement of $5.2 million as a result of the repurchase of the Gates Shares, which represents the difference between the redemption purchase price and the fair value of the stock on the day of the settlement.

12. Income Taxes

A reconciliation of the statutory tax rates and the effective tax rates for the years ended December 31, 2018 and 2017 is as follows:

	Year Ended December 31,	
	2018	2017
Statutory tax rate	21.00%	34.00%
State taxes, net of federal benefits	6.36%	1.38%
Stock-based compensation	(1.67)%	(0.16)%
Credits	(9.01)%	1.99%
Other	1.25%	(0.64)%
Valuation allowance	(17.93)%	(4.03)%
Tax rate change	0.00%	(32.54)%
Effective tax rate	0.00%	0.00%

The tax effects of temporary differences and carryforwards that give rise to the Company’s deferred tax assets are as follows (in thousands):

	December 31,	
	2018	2017
Deferred tax assets:		
Net operating loss carry forwards	$114,251	$68,807
Research and development credit	—	17,365
Intangible assets	673	824
Depreciation	3,628	—
Temporary differences	9,898	8,017
Gross Deferred tax assets	128,450	95,013
Less: valuation allowance	(128,450)	(95,013)
Net deferred tax assets	$—	$—

The deferred tax asset on research and development tax credit decreased due to a remeasurement of the uncertain tax position. Accordingly, such amount was offset against the deferred tax asset on research and development tax credit as of December 31, 2018. Realization of the deferred tax assets is dependent upon future taxable income, if any, the

amount and timing of which are uncertain. Accordingly, the net deferred tax assets have been fully offset by a valuation allowance. The net valuation allowance increased by $33.4 million and $5.7 million during the years ended December 31, 2018 and 2017, respectively.

The Company had federal and state net operating loss carryforwards of approximately $465.7 million and $109.4 million, respectively, at December 31, 2018. The federal and state net operating loss carryforwards are available to reduce future taxable income, if any. If not utilized, the federal and state operating loss carryforwards will begin to expire in various amounts beginning 2023 and 2029, respectively. The Company also had federal and state research and development credit carryforwards of approximately $18.2 million and $9.1 million, respectively, at December 31, 2018. The federal research and development credits will begin to expire in 2025. The state research and development credits can be carried forward indefinitely.

Utilization of the net operating loss and research and development credits carryforwards may be subject to an annual limitation due to the ownership change limitations provided by the Internal Revenue Code of 1986 and

similar state provisions. The annual limitation may result in the expiration of the net operating loss and research and development credits before utilization.

The Company files income tax returns in the U.S. federal jurisdiction and various state jurisdictions. The Company is subject to U.S. federal and state income tax examinations by tax authorities for tax years from 2003 due to net operating losses and tax credits that are being carried forward for tax purposes.

The Company recognizes the financial statements effects of a tax position when it is more likely than not, based on technical merits, that the position will be sustained upon examination. A reconciliation of the Company's unrecognized tax benefits is as follows (in thousands):

	December 31,	
	2018	2017
Balance at beginning of year	$1,857	$1,197
Increase related to current year tax provision	5,369	516
Increase related to tax rate change	—	144
Increase related to prior year tax provision	16,687	—
Balance at end of year	$23,913	$1,857

For the year ended December 31, 2018, the increase in uncertain tax position of prior year and current year provision related to federal and state research and development tax credits. Given the Company's valuation allowance, the uncertain tax positions would not impact the effective tax rates. The unrecognized tax benefits, if recognized and in absence of full valuation allowance, would impact the income tax provision by $22.0 million and $1.7 million as of December 31, 2018 and 2017, respectively.

The Company has elected to include interest and penalties as a component of tax expense. There was no interest or penalties accrued related to uncertain tax positions as of December 31, 2018.

On December 22, 2017, the Tax Cuts and Jobs Act (the "Act") was enacted into law in the United States. The Act reduces the U.S. federal corporate tax rate from 35% to 21%, requires companies to pay a one-time transition tax on earnings of certain foreign subsidiaries that were previously tax deferred and creates new taxes on certain foreign sourced earnings. As of December 31, 2018, the Company had completed the accounting for the tax effects as a result of the Act and made a reasonable estimate of the effects on its existing deferred tax balances and recognized an amount of $40.9 million in 2017.

Pursuant to SEC Staff Accounting Bulletin (SAB) 118 (regarding the application of ASC 740 associated with the enactment of the Act), the Company remeasured certain tax assets and liabilities based on the rates the Company expects them to reverse in the future, which is generally 21%. For the year ended December 31, 2017, the amount recorded related to the remeasurement of the deferred tax balance was $40.9 million, which was fully offset by a valuation allowance.

During 2018, the Company finalized its analysis of the provisional impact associated with the remeasurement of deferred tax assets. There was no material change in the provisional remeasurement amount previously recorded in 2017.

13. Employee Benefit Plan

In 2003, the Company adopted a 401(k) plan for its employees whereby eligible employees may contribute up to 100% of their compensation, on a pretax basis, subject to the maximum amount permitted by the Internal Revenue Code. In December 2015, the Company changed the plan to increase its 401(k) match to 50% of employees' contributions, up to 8% of annual earnings, starting in January 2016. The Company's contributions were $0.6 million and $0.9 million for the years ended December 31, 2018 and 2017, respectively.

14. Related-Party Transactions

In August 2017, the Company’s Chief Executive Officer, a related party, exercised these warrants to purchase 35,363 shares of common stock issued as part of the Private Placement (see Note 9). The Company received $129,429 in proceeds from these warrant exercises.

15. Restructuring Charges

July 2018 Corporate Restructuring

On July 26, 2018, the Company announced a strategic update and corporate restructuring to focus its resources on the successful commercialization of ZEMDRI in the United States, the filing of a Marketing Authorization Application for plazomicin in the European Union and continued development of its C-Scape and novel aminoglycoside programs. During the twelve months ended December 31, 2018, the Company incurred $8.1 million in restructuring charges. The restructuring charges primarily consist of net facility exit costs, fixed asset impairment and severance and payroll related costs. The restructuring was largely completed by the end of 2018. The Company accounted for the restructuring costs in accordance with ASC 420, Exit or Disposal Cost Obligations.

	Amounts
Balance at December 31, 2017	$—
Expenses incurred	8,068
Amounts paid	(3,927)
Non-cash expense	(4,125)
Balance at December 31, 2018	$16

November 2018 Corporate Restructuring

On November 5, 2018, the Company announced another restructuring of its organization to preserve cash resources and focus its resources towards the continued successful launch of ZEMDRI and advancing C-Scape. During the twelve months ended December 31, 2018, the Company incurred $15.5 million in restructuring charges. The restructuring charges primarily consist of one-time employee benefits, employee severance, stock-based compensation and fixed asset impairments. Non-cash expenditures consist of fixed asset impairment and stock-based compensation. The restructuring was largely completed by the end of 2018. The Company accounted for the restructuring costs in accordance with ASC 420, Exit or Disposal Cost Obligations.

	Amounts
Balance at December 31, 2017	$—
Expenses incurred	15,450
Amounts paid	(2,726)
Non-cash expense	(11,689)
Balance at December 31, 2018	$1,035

16. Subsequent Events

Sub-Lease Agreement

On January 25, 2019, the Company entered into a sub-lease agreement with a third-party for 32,909 square feet of the Company’s office space at 1 Tower Place, South San Francisco, CA. The lease term will terminate on March 1, 2022. Under the terms of the lease, the Company will receive minimum annual rent payments ranging from $2.2 million in

the first year to $2.3 million in the third year of the lease, for a total of $6.7 million over the term of the lease.

Underwritten Public Offering

On February 15, 2019, the Company entered into an underwriting agreement with H.C. Wainwright & Co., LLC related to the public offering by the Company of (i) 15,000,000 shares of the Company's common stock , (ii) Series A warrants to purchase up to 15,000,000 shares of common stock and (iii) Series B warrants to purchase up to 15,000,000 shares of common stock. The combined offering price per share of common Stock and the accompanying Series A and Series B warrants ("Warrants") was $1.00, representing an offering price of $0.99 per share of common stock, with the accompanying Warrants offered at a purchase price of $0.01 per Warrant combination. The net proceeds from the public offering of common Stock is approximately $13.6 million.

Corporate Restructuring

On February 28, 2019, the Company commenced a restructuring of its organization to conserve its cash resources. The majority of the roles eliminated in the restructuring are field-based sales and medical scientist positions. The Company estimates it will incur restructuring charges of approximately $3.2 million in the first quarter of 2019, consisting of one-time employee benefits, employee severance and stock-based compensation and fixed asset impairment, of which approximately 78% is expected to result in cash expenditures. Non-cash expenditures consist of stock-based compensation and fixed asset impairments. The Company may incur additional costs not currently contemplated due to events that may occur as result of or are associated with the restructuring.

17. Selected Unaudited Quarterly Financial Data

The following tables show a summary of the Company's unaudited quarterly financial data for each of the four quarters of 2018 and 2017 (in thousands, except per share amounts):

	Three Months Ended			
	December 31, 2018	September 30, 2018	June 30, 2018	March 31, 2018
Revenues	$2,025	$1,998	$2,562	$2,143
Operating expenses	45,881	48,624	57,408	45,980
Other income (expense), net	1,512	4,835	4,877	(3,392)
Loss on settlement of contingently redeemable common stock	(5,179)	—	—	—
Net loss	$(47,523)	$(41,791)	$(49,969)	$(47,229)
Net loss per common share[1] :				
Basic	$(1.01)	$(0.92)	$(1.11)	$(1.06)
Diluted	$(1.01)	$(1.92)	$(1.20)	$(1.06)
Weighted-average shares used to calculate net loss per common share:				
Basic	46,957,396	45,329,711	44,865,861	44,356,570
Diluted	46,957,396	45,794,686	45,691,646	44,356,570

	Three Months Ended			
	December 31, 2017	September 30, 2017	June 30, 2017	March 31, 2017
Revenues	$1,869	$577	$1,266	$7,463
Operating expenses	43,973	37,121	31,059	25,348
Other income (expense), net	5,722	6,637	3,723	(15,374)
Net loss	$(36,382)	$(29,907)	$(26,070)	$(33,259)
Net loss per common share[1] :				
Basic	$(0.86)	$(0.71)	$(0.68)	$(0.93)
Diluted	$(0.98)	$(0.85)	$(0.78)	$(0.93)

Weighted-average shares used to calculate net loss per common share:				
Basic	42,422,592	42,259,001	38,072,763	35,725,876
Diluted	43,257,602	43,211,059	39,092,279	35,725,876

(1) Basic and diluted net loss per common share are computed independently for each of the quarters presented. Therefore, the sum of quarterly basic and diluted per share information may not equal annual basic and diluted net loss per common share.

Item 9. Changes in and Disagreements with Accountants on Accounting and Financial Disclosure.

None.

Item 9A. Controls and Procedures.

Evaluation of Disclosure Controls and Procedures

We maintain disclosure controls and procedures that are designed to ensure that information required to be disclosed in our reports under the Securities Exchange Act of 1934, as amended, or the Exchange Act, and the rules and regulations thereunder, is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms and that such information is accumulated and communicated to our management, including our principal executive officer and principal financial officer, as appropriate, to allow for timely decisions regarding required disclosure. In designing and evaluating the disclosure controls and procedures, management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving the desired control objectives, and management is required to apply its judgment in evaluating the cost-benefit relationship of possible controls and procedures.

As required by Rule 13a-15(b) under the Exchange Act, our management, under the supervision and with the participation of our principal executive officer and principal financial officer, has evaluated the effectiveness of the design and operation of our disclosure controls and procedures (as such term is defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act) as of December 31, 2018. Based on such evaluation, our principal executive officer and principal financial officer have concluded that, as of December 31, 2018, our disclosure controls and procedures were effective at the reasonable assurance level.

Management's Annual Report on Internal Control Over Financial Reporting

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

Under the supervision and with the participation of our management, including our Principal Executive Officer and Principal Financial Officer, we conducted an evaluation of the effectiveness of our internal control over financial reporting based on criteria established in "Internal Control-Integrated Framework (2013)" issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). Our management concluded that our internal control over financial reporting was effective as of December 31, 2018.

Our independent registered public accounting firm, Ernst & Young LLP, has audited the effectiveness of our internal control over financial reporting as of December 31, 2018 as stated in its report which is included herein.

Changes in Internal Control over Financial Reporting

There were no changes in our internal controls over financial reporting identified in connection with the evaluation required by Rule 13a-15(d) and 15d-15(d) of the Exchange Act that occurred during the year ended December 31, 2018 that have materially affected, or are reasonably likely to materially affect, our internal control over financial

reporting.

Report of Independent Registered Public Accounting Firm

To the Shareholders and the Board of Directors of Achaogen, Inc.

Opinion on Internal Control over Financial Reporting

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

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the consolidated balance sheets of the Company as of December 31, 2018 and 2017, and the related consolidated statements of operations, comprehensive loss, contingently redeemable common stock and stockholders’ equity (deficit) and cash flows for each of the two years in the period ended December 31, 2018, and the related notes and our report dated April 1, 2019 expressed an unqualified opinion thereon.

Basis for Opinion

The Company's management is responsible for maintaining effective internal control over financial reporting and for its assessment of the effectiveness of internal control over financial reporting included in the accompanying Management’s Annual Report on Internal Control over Financial Reporting. Our responsibility is to express an opinion on the Company’s internal control over financial reporting based on our audit. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects.

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

Definition and Limitations of Internal Control Over Financial Reporting

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

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

/s/ Ernst & Young LLP

Redwood City, California

April 1, 2019

Changes in Internal Control Over Financial Reporting

There were no changes in our internal controls over financial reporting identified in connection with the evaluation required by Rule 13a-15(d) and 15d-15(d) of the Exchange Act that occurred during the year ended December 31, 2018 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. Other Information

None.

PART III

Item 10. Directors, Executive Officers and Corporate Governance.

The information required by this item will be contained in our definitive Proxy Statement for our 2019 Annual Meeting of Stockholders to be filed with the Securities and Exchange Commission on Schedule 14A in connection with our 2019 Annual Meeting of Stockholders (the "Proxy Statement"), which will be filed not later than 120 days after the end of our fiscal year ended December 31, 2018, under the headings "Executive Officers," "Election of Directors," "Corporate Governance," and " Section 16(a) Beneficial Ownership Reporting Compliance," and is incorporated herein by reference.

We have adopted a Code of Business Conduct and Ethics that applies to our officers, directors and employees which is available on our website at www.achaogen.com. The Code of Business Conduct and Ethics is intended to qualify as a "code of ethics" within the meaning of Section 406 of the Sarbanes-Oxley Act of 2002 and Item 406 of Regulation S-K. In addition, we intend to promptly disclose (1) the nature of any amendment to our Code of Business Conduct and Ethics that applies to our principal executive officer, principal financial officer, principal accounting officer or controller or persons performing similar functions and (2) the nature of any waiver, including an implicit waiver, from a provision of our code of ethics that is granted to one of these specified officers, the name of such person who is granted the waiver and the date of the waiver on our website in the future.

Item 11. Executive Compensation.

The information required by this item will be contained in our definitive Proxy Statement for our 2019 Annual Meeting of Stockholders under the headings "Executive Compensation," "Director Compensation," "Compensation Committee Interlocks and Insider Participation" and "Report of the Compensation Committee," and is incorporated herein by reference.

Item 12. Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters.

The information required by this item will be contained in our definitive Proxy Statement for our 2019 Annual Meeting of Stockholders under the headings "Security Ownership of Certain Beneficial Owners and Management" and "Equity Compensation Plan Information," and is incorporated herein by reference.

Item 13. Certain Relationships and Related Transactions, and Director Independence.

The information required by this item will be contained in our definitive Proxy Statement for our 2019 Annual Meeting of Stockholders under the headings "Certain Relationships and Related Party Transactions" and "Corporate Governance," and is incorporated herein by reference.

Item 14. Principal Accounting Fees and Services.

The information required by this item will be contained in our definitive Proxy Statement for our 2019 Annual Meeting of Stockholders under the heading "Principal Accounting Fees and Services," and is incorporated herein by reference.

PART IV

Item 15. Exhibits and Financial Statement Schedules.

(a) The following documents are filed as part of this report:

1. Financial Statements

See Index to Financial Statements at Item 8 herein.

2. Financial Statement Schedules

All schedules are omitted because they are not applicable or the required information is shown in the financial statements or notes thereto.

3. Exhibits

See the Exhibit Index immediately preceding the signature page of this Annual Report on Form 10-K.

(b) See the Exhibit Index immediately preceding the signature page of this Annual Report on Form 10-K.

(c) All schedules are omitted because they are not applicable or the required information is shown in the financial statements or notes thereto.

EXHIBIT INDEX

Exhibit Number	Description of Document	Incorporated by Reference from				Provided Herewith
		Registrant's Form	File No.	Date Filed with the SEC	Exhibit Number	
3.1	Amended and Restated Certificate of Incorporation of Achaogen, Inc.	8-K	001-36323	3/17/2014	3.1	
3.2	Amended and Restated Bylaws of Achaogen, Inc.	8-K	001-36323	3/17/2014	3.2	
4.1	Form of Common Stock Certificate.	S-1/A	333-193559	2/25/2014	4.1	
4.2	Warrant issued to Oxford Finance LLC on November 1, 2011.	S-1	333-193559	1/24/2014	4.4	
4.3	Warrant issued to Oxford Finance LLC on April 30, 2012 (Term A Loan (2)).	S-1	333-193559	1/24/2014	4.6	
4.4	Warrant issued to Oxford Finance LLC on April 30, 2012 (Term B Loan).	S-1	333-193559	1/24/2014	4.7	
4.5	Form of Warrant, issued pursuant to the Securities Purchase Agreement, dated June 1, 2016, by and among Achaogen, Inc. and the purchasers named therein	S-3	333-212253	6/24/2016	4.3	
4.6	Form of Series A Warrant	8-K	001-36323	2/20/2019	4.1	
4.7	Form of Series B Warrant	8-K	001-36323	2/20/2019	4.2	
10.1(A)†	License Agreement, dated January 25, 2006, by and between the registrant and Ionis Pharmaceuticals, Inc.	S-1/A	333-193559	2/27/2014	10.5(A)	
10.1(B)†	Letter Agreement, dated January 25, 2006, by and between the registrant and Ionis Pharmaceuticals, Inc.	S-1	333-193559	1/24/2014	10.5(B)	
10.4(A)	Amended and Restated Lease Agreement, dated December 29, 2010, by and between the registrant and ARE-San Francisco No. 17, LLC.	S-1	333-193559	1/24/2014	10.9(A)	
10.4(B)	Letter Agreement, dated January 4, 2011, by and between the registrant and ARE-San Francisco No. 17, LLC.	S-1	333-193559	1/24/2014	10.9(B)	
10.4(C)	Letter Agreement, dated June 15, 2011, by and between the registrant and ARE-San Francisco No. 17, LLC.	S-1	333-193559	1/24/2014	10.9(C)	
10.4(D)	First Amendment, dated April 1, 2013, to that certain Amended and Restated Lease Agreement, dated December 29, 2010, by and between the registrant and ARE-San Francisco No. 17, LLC.	S-1	333-193559	1/24/2014	10.9(D)	
10.4(E)	Second Amendment, dated June 28, 2013, to that certain Amended and Restated Lease	S-1	333-193559	1/24/2014	10.9(E)	

	Agreement, dated as of December 29, 2010, by and between the registrant and ARE-San Francisco No. 17, LLC.	

Exhibit Number	Description of Document	Incorporated by Reference from Registrant's Form	File No.	Date Filed with the SEC	Exhibit Number	Provided Herewith
10.5(A)	Lease dated August 12, 2016, by and between AP3-SF2 CT South, LLC and Achaogen, Inc.	10-Q	001-36323	11/7/2016	10.2	
10.5(B)	First Amendment to Lease, dated April 7, 2017, by and between AP3-SF2 CT South, LLC and Achaogen, Inc.	10-Q	001-36323	8/8/2017	10.3	
10.5(C)	Second Amendment to Lease, effective as of July 20, 2017, by and between AP3-SF2 CT South, LLC and Achaogen, Inc.	10-Q	001-36323	11/8/2017	10.2	
10.5(D)	Third Amendment to Lease, effective August 17, 2017, by and between AP3-SF2 CT South, LLC and Achaogen, Inc.	10-Q	001-36323	11/8/2017	10.3	
10.5(E)	Fourth Amendment to Lease, effective November 29, 2018, by and between AP3-SF2 CT South, LLC and Achaogen, Inc.	10-Q	001-36323	4/1/2019	10.5	X
10.6(A)#	Achaogen, Inc. Amended and Restated 2003 Stock Plan, as amended.	S-8	333-195348	4/17/2014	99.1	
10.6(B)#	Amendment to Amended and Restated 2003 Stock Plan, as amended.	10-K	001-36323	3/16/2015	10.8(B)	
10.6(C)#	Form of Stock Option Agreement under Achaogen, Inc. Amended and Restated 2003 Stock Plan.	S-1	333-193559	1/24/2014	10.1(B)	
10.7(A)#	Achaogen, Inc. 2014 Equity Incentive Award Plan.	S-8	333-195348	4/17/2014	99.3	
10.7(B)#	Form of Stock Option Agreement under Achaogen, Inc. 2014 Equity Incentive Award Plan.	S-1/A	333-193559	2/12/2014	10.2(B)	
10.7(C)#	Form of Restricted Stock Agreement under Achaogen, Inc. 2014 Equity Incentive Award Plan.	S-1/A	333-193559	2/12/2014	10.2(C)	
10.7(D)#	Form of Restricted Stock Unit Award Grant Notice and Restricted Stock Unit Award Agreement under Achaogen, Inc. 2014 Equity Incentive Award Plan.	10-K	001-36323	3/15/2016	10.18(D)	
10.8#	Achaogen, Inc. 2014 Employee Stock Purchase Plan.	S-8	333-195348	4/17/2014	99.7	
10.9(A)#	Achaogen, Inc. 2014 Employment Commencement Incentive Plan.	10-Q	001-36323	11/8/2017	10.1	
10.9(B)#	Form of Stock Option Grant Notice and Stock Option Agreement under the Achaogen, Inc. 2014 Employment Commencement Incentive Plan.	10-K	001-36323	3/16/2015	10.11(B)	

10.9(C)#	Form of Restricted Stock Unit Award Grant Notice and Restricted Stock Unit Award Agreement under the Achaogen, Inc. 2014 Employment Commencement Incentive Plan.	10-K	001-36323	3/15/2016	10.10(C)
10.10#	Change in Control Plan.	S-1	333-193559	1/24/2014	10.14

Exhibit Number	Description of Document	Incorporated by Reference from Registrant's Form	File No.	Date Filed with the SEC	Exhibit Number	Provided Herewith
10.11#	Form of Indemnification Agreement between the registrant and its directors and officers.	S-1/A	333-193559	2/12/2014	10.3	
10.12#	Offer Letter, dated January 24, 2011, by and between the registrant and Kenneth J. Hillan M.B., Ch.B.	S-1	333-193559	1/24/2014	10.10	
10.14#	Offer Letter, dated August 12, 2015, between Achaogen, Inc. and Blake Wise.	10-Q	001-36323	11/5/2015	10.5	
10.15#	Offer Letter, dated May 13, 2014, between Achaogen, Inc. and Zeryn Sarpangal.	10-K	001-36323	3/15/2016	10.16	
10.17#	Offer Letter, dated October 19, 2016, between Achaogen, Inc. and Gary Loeb.	10-K	001-36323	3/14/2017	10.18	
10.18#	Form of Change in Control Severance Agreement	10-K	001-36323	3/14/2017	10.20	
10.23	Registration Rights Agreement, dated June 1, 2016, by and among Achaogen, Inc. and the investors signatory thereto.	S-3	333-212253	6/24/2016	99.1	
10.24	Securities Purchase Agreement, dated June 1, 2016, by and among Achaogen, Inc. and the purchasers named therein.	10-Q	001-36323	8/11/2016	10.3	
10.25†	Letter Agreement by and between the Bill & Melinda Gates Foundation and the Company, dated May 4, 2017.	10-Q	001-36323	8/8/2017	10.1	
10.26†	Validation and Manufacturing Agreement, dated March 5, 2017, by and between the Company and Hovione Limited.	10-Q	001-36323	5/8/2017	10.3	
10.27(A)†	Collaborative Development and Commercialization Agreement, dated April 26, 2016, by and between the Company and Microgenics Corporation.	10-Q	001-36323	5/8/2017	10.5	
10.27(B) †	Amendment #1, dated November 29 2017, to the Collaborative Development and Commercialization Agreement, dated April 26, 2016, by and between the Company and Microgenics Corporation.	10-K	001-36323	2/27/2018	10.27	
10.27(C) †	Amendment #2 to the Collaborative Development and Commercialization Agreement dated July 22, 2018 by and between Achaogen, Inc. and Microgenics Corporation.	10-Q	001-36323	11/8/2018	10.1	
10.28†	Loan and Security Agreement, dated February 26, 2018, by and between the Company and Silicon Valley Bank	10-K	001-36323	2/27/2018	10.28	
10.29#	Offer Letter, dated August 22, 2017 between Achaogen, Inc. and Elizabeth Bhatt.	10-K	001-36323	4/1/2019	10.29	X

136

Exhibit Number	Description of Document	Incorporated by Reference from Registrant's Form	File No.	Date Filed with the SEC	Exhibit Number	Provided Herewith
10.30#	Offer Letter, dated February 11, 2017 between Achaogen, Inc. and Janet Dorling.	10-K	001-36323	4/1/2019	10.30	X
23.1	Consent of Ernst & Young LLP, Independent Registered Public Accounting Firm.	10-K	001-36323	2/27/2018	23.1	
24.1	Power of Attorney (included on signature page hereto).					X
31.1	Certification of Principal Executive Officer Required Under Rule 13a-14(a) and 15d-14(a) of the Securities Exchange Act of 1934, as amended.					X
31.2	Certification of Principal Financial Officer Required Under Rule 13a-14(a) and 15d-14(a) of the Securities Exchange Act of 1934, as amended.					X
32.1*	Certification of Principal Executive Officer and Principal Financial Officer Required Under Rule 13a-14(b) of the Securities Exchange Act of 1934, as amended, and 18 U.S.C. §1350.					X
101.INS	XBRL Instance Document.					X
101.SCH	XBRL Taxonomy Extension Schema Document.					X
101.CAL	XBRL Taxonomy Extension Calculation Linkbase Document.					X
101.DEF	XBRL Taxonomy Extension Definition Linkbase Document.					X
101.LAB	XBRL Taxonomy Extension Label Linkbase Document.					X
101.PRE	XBRL Taxonomy Extension Presentation Linkbase Document.					X

† Confidential treatment has been granted for certain information contained in this exhibit. Such information has been omitted and filed separately with the SEC.

# Indicates management contract or compensatory plan.

* The certification attached as Exhibit 32.1 that accompanies this Annual Report on Form 10-K is not deemed filed with the SEC and is not to be incorporated by reference into any filing of Achaogen, Inc. under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended, whether made before or after the date of this Form 10-K, irrespective of any general incorporation language contained in such filing.

Item 16. Form 10-K Summary.

None.

137

SIGNATURES

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

Date: April 1, 2019 ACHAOGEN, INC.

By: /s/ Blake Wise
Blake Wise
Chief Executive Officer

(principal executive officer)

Date: April 1, 2019 ACHAOGEN, INC.

By: /s/ Zeryn Sarpangal
Zeryn Sarpangal
Chief Financial Officer

(principal financial and accounting officer)

POWER OF ATTORNEY

KNOW ALL PERSONS BY THESE PRESENTS, that each person whose signature appears below constitutes and appoints each of Blake Wise, Zeryn Sarpangal, and Gary Loeb his or her true and lawful attorney-in-fact and agent, with full power of substitution, for him or her and in his or her name, place and stead, in any and all capacities, to sign any and all amendments to this annual report on Form 10-K, and to file the same, with all exhibits thereto, and other documents in connection therewith, with the Securities and Exchange Commission, granting unto said attorney-in-fact and agent, full power and authority to do and perform each and every act and thing requisite and necessary to be done in connection therewith, as fully to all intents and purposes as he might or could do in person, hereby ratifying and confirming all that said attorney-in-fact and agent, or his substitutes or substitute, may lawfully do or cause to be done by virtue hereof.

IN WITNESS WHEREOF, each of the undersigned has executed this Power of Attorney as of the date indicated opposite his/her name.

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

Signature	Title	Date
/s/ Blake Wise Blake Wise	Chief Executive Officer and Director (Principal Executive Officer)	April 1, 2019
/s/ Zeryn Sarpangal Zeryn Sarpangal	Chief Financial Officer (Principal Financial and Accounting Officer)	April 1, 2019
/s/ Bryan E. Roberts Bryan E. Roberts, Ph.D.	Chairman of the Board of Directors	April 1, 2019
/s/ Karen Bernstein Karen Bernstein, Ph.D.	Director	April 1, 2019
/s/ John C. Doyle John C. Doyle	Director	April 1, 2019
/s/ Michael Fischbach Michael Fischbach, Ph.D.	Director	April 1, 2019
/s/ Kenneth J. Hillan Kenneth J. Hillan, M.B., Ch.B.	Director	April 1, 2019
/s/ Kent E. Lieginger Kent E. Lieginger, Pharm.D.	Director	April 1, 2019
/s/ John W. Smither John W. Smither	Director	April 1, 2019

/s/ Gregory Stea Gregory Stea	Director	April 1, 2019
/s/ Halley Gilbert Halley Gilbert	Director	April 1, 2019