MARINUS PHARMACEUTICALS INC
Form 10-K
March 12, 2019
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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

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 36576

Marinus Pharmaceuticals, Inc.

(Exact name of registrant as specified in its charter)

Delaware	20 0198082
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)

170 N Radnor Chester Rd, Suite 250

Radnor, PA 19087

(Address of principal executive offices including zip code)

(484) 801-4670

(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, par value $0.001 per share	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 Exchange 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 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 fi les). Yes No

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S K is not contained herein, and will not be contained, to the best of the 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 an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company" and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer	Accelerated filer	Non accelerated filer	Smaller reporting company

Emerging growth company

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

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

The aggregate market value of the Registrant's Common Stock (the only common equity of the registrant) held by non-affiliates for the last business day of the Registrant's most recent completed second fiscal quarter: $265,327,966

The number of shares of the issuer's Common Stock outstanding as of March 11, 2019, was 52,519,013.

Documents Incorporated by Reference

Certain portions, as expressly described in this report, of the registrant's proxy statement for the 2018 Annual Meeting of the Stockholders to be held May 7, 2019 are incorporated by reference into Part III, Items 10 14.

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Cautionary Note Regarding Forward-Looking Statements.

This Annual Report on Form 10-K contains forward-looking statements, within the meaning of the U.S. Private Securities Litigation Reform Act of 1995, that involve substantial risks and uncertainties. In some cases, you can identify forward-looking statements by the words “anticipate,” “believe,” “continue,” “could,” “estimate,” “expect,” “intend,” “might,” “objective,” “ongoing,” “plan,” “predict,” “project,” “potential,” “should,” “will,” or “would,” and or the negative of t or other comparable terminology intended to identify statements about the future. These statements involve known and unknown risks, uncertainties and other factors that may cause our actual results, levels of activity, performance or achievements to be materially different from the information expressed or implied by these forward-looking statements. Although we believe that we have a reasonable basis for each forward-looking statement contained in this Annual Report on Form 10-K, we caution you that these statements are based on a combination of facts and factors currently known by us and our expectations of the future, about which we cannot be certain.

The forward-looking statements in this Annual Report on Form 10-K include, among other things, statements about:

- our ability to develop and commercialize ganaxolone;
- status, timing and results of preclinical studies and clinical studies;
- enrollment in clinical studies, availability of data from ongoing clinical studies, expectations for regulatory approvals, or the attainment of clinical study results that will be supportive of regulatory approvals;
- the potential benefits of ganaxolone;
- the timing of seeking marketing approval of ganaxolone;
- our ability to obtain and maintain marketing approval;
- our estimates of expenses and future revenue and profitability;
- our estimates regarding our capital requirements and our needs for additional financing;
- our plans to develop and market ganaxolone and the timing of our development programs;
- our estimates of the size of the potential markets for ganaxolone;
- our selection and licensing of ganaxolone;
- our ability to attract collaborators with acceptable development, regulatory and commercial expertise;
- the benefits to be derived from corporate collaborations, license agreements, and other collaborative or acquisition efforts, including those relating to the development and commercialization of ganaxolone;
- sources of revenue, including contributions from corporate collaborations, license agreements, and other collaborative efforts for the development and commercialization of products;
- our ability to create an effective sales and marketing infrastructure if we elect to market and sell ganaxolone directly;
- the rate and degree of market acceptance of ganaxolone;

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- the timing and amount or reimbursement for ganaxolone;
- the success of other competing therapies that may become available;
- the manufacturing capacity for ganaxolone;
- our intellectual property position;
- our ability to maintain and protect our intellectual property rights;
- our results of operations, financial condition, liquidity, prospects, and growth strategies;
- the industry in which we operate; and
- the trends that may affect the industry or us.

You should refer to Part I, Item 1A "Risk Factors" of this Annual Report on this Form 10-K for a discussion of important factors that may cause our actual results to differ materially from those expressed or implied by our forward-looking statements. As a result of these factors, we cannot assure you that the forward-looking statements in this Annual Report on Form 10-K will prove to be accurate. Furthermore, if our forward-looking statements prove to be inaccurate, the inaccuracy may be material. In light of the significant uncertainties in these forward-looking statements, you should not regard these statements as a representation or warranty by us or any other person that we will achieve our objectives and plans in any specified time frame or at all. We undertake no obligation to publicly update any forward-looking statements, whether as a result of new information, future events or otherwise, except as required by law.

You should read this Annual Report on Form 10-K and the documents that we reference in this Annual Report on Form 10-K and have filed as exhibits to this Annual Report on Form 10-K completely and with the understanding that our actual future results may be materially different from what we expect. We qualify all of our forward-looking statements by these cautionary statements.

PART I

Item 1. Business.

Overview

We are a clinical stage pharmaceutical company focused on developing and commercializing innovative therapeutics to treat epilepsy and neuropsychiatric disorders. Our clinical stage product candidate, ganaxolone, is a positive allosteric modulator of $GABA_A$ being developed in three different dose forms: intravenous (IV), oral capsule and oral liquid. The multiple dose forms are intended to maximize the therapeutic range of ganaxolone for adult and pediatric patient populations, in acute and chronic care, and both in-patient and self-administered settings. Ganaxolone exhibits anti-seizure, anti-depression and anti-anxiety actions via its effects on synaptic and extrasynaptic $GABA_A$ receptors.

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Our Pipeline

We are developing ganaxolone in three different dose forms (IV, capsule, and liquid) intended to maximize therapeutic reach to adult and pediatric patient populations in both acute and chronic care settings where there is a mechanistic rationale for ganaxolone to provide a benefit, including the following indications:

CDKL5 deficiency disorder (CDD)

CDD is a serious and rare genetic disorder that is caused by a mutation of the cyclin dependent kinase like 5 (CDKL5) gene, located on the X chromosome. It predominantly affects girls and is characterized by early onset, difficult to control seizures and severe neuro developmental impairment. The CDKL5 gene encodes proteins essential for normal brain function. Most children affected by CDD cannot walk normally, talk, or care for themselves. Many also suffer from scoliosis, visual impairment, gastrointestinal difficulties and sleeping disorders. Currently, there are no approved therapies or treatments for CDD. We believe that no previous late stage clinical studies have been conducted in this patient population and estimate the CDD population to be approximately 5,000 to 7,000 patients worldwide.

We are currently enrolling patients into a pivotal Phase 3 clinical study (Marigold Study) evaluating the use of oral ganaxolone in children and young adults with CDD. The Marigold Study is a global, double blind, placebo controlled, study that will enroll approximately 70 patients between the ages of 2 and 21 with a confirmed disease related CDKL5 gene variant. Patients will undergo a six-week prospective baseline period to collect seizure data, followed by a 17-week double-blind treatment phase. Patients randomized to ganaxolone will titrate over four weeks to a dose of up to 600 mg of oral liquid suspension three times a day and maintain that dose for the following 13-weeks, in addition to their existing anti seizure treatment. Following the double blind treatment period, all patients that meet certain eligibility requirements will have the opportunity to receive ganaxolone in the open label phase of the study. The study’s primary efficacy endpoint is percent reduction in seizures. Secondary outcome measures will include non seizure related endpoints to capture certain changes in behavior and sleep. The Company plans to complete enrollment in this study by the end of 2019 with top-line data expected by mid-2020.

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The U.S. Food and Drug Administration (FDA) granted Orphan Drug Designation to ganaxolone for the treatment of CDKL5 gene related early onset infantile epileptic encephalopathy. Orphan Drug Designation is granted by the FDA Office of Orphan Products Development (OOPD) to novel drugs or biologics that treat a rare disease or condition affecting fewer than 200,000 patients in the U.S. The designation provides the drug developer with a seven year period of U.S. marketing exclusivity, as well as tax credits for clinical research costs, the ability to apply for annual grant funding, clinical research study design assistance and waiver of Prescription Drug User Fee Act (PDUFA) filing fees.

PCDH19-related epilepsy (PCDH19-RE)

PCDH19-RE is a rare and serious epileptic syndrome characterized by early-onset cluster seizures, cognitive and sensory impairment of varying degrees, and psychiatric and behavioral disturbances that mostly manifest in females. Currently, there are no approved therapies for PCDH19-RE.

The epileptic disorder is an X-linked condition caused by a missense mutation in the PCDH19 gene, which encodes for a calcium dependent cell-cell adhesion molecule that is expressed in the central nervous system. Genetic testing is available to determine if a child has the PCDH19 mutation. We estimate the PCDH19-RE population to be approximately 10,000 to 12,000 patients worldwide.

In December, the Company presented additional data at the American Epilepsy Society annual meeting from its Phase 2 study in patients with PCDH19-RE, which identified evidence of a plasma neurosteroid biomarker. The post-treatment review of baseline plasma neurosteroid levels in patients with PCDH19-RE revealed what we believe to be a significant association between these levels and response to ganaxolone treatment. Patients with a very low level of a specific neurosteroid showed a medically notable reduction in seizure frequency when treated with ganaxolone as compared to patients with a very high level of the specific neurosteroid. The difference in the levels of the specific neurosteroid between responders and non-responders was approximately 1.5 orders of magnitude.

In March 2019, Marinus announced the initiation of the Violet Study, a global, double-blind, randomized, placebo-controlled single pivotal Phase 3 study evaluating ganaxolone in children with PCDH19-RE. The study will enroll up to 70 patients between the ages of 1 and 17 with a confirmed PCDH19 mutation. Patients enrolled in the study will be stratified into one of two biomarker groups and randomized (ganaxolone or placebo) within each stratum. The study will consist of an 8-week prospective baseline period to collect seizure data, followed by a 17-week double-blind treatment phase. Patients randomized to ganaxolone will titrate over four weeks to a dose of up to 600 mg of oral liquid suspension three times a day and maintain that dose for the following 13-weeks. After the double-blind period, all patients who meet certain eligibility criteria will have the opportunity to receive ganaxolone in an open label phase of the study. The Company expects to begin screening patients for enrollment into the study in the second quarter of 2019 with top-line data from the study anticipated in 2021.

Postpartum Depression (PPD)

PPD is a mood disorder that affects about 15% of women within the first year following childbirth. Common symptoms include feelings of extreme sadness, hopelessness, suicidal ideation, anxiety and fatigue. PPD is thought to be linked to the rapid fluctuations in the levels of reproductive hormones and allopregnanolone after childbirth. Allopregnanolone has shown early clinical efficacy in treating patients with PPD. PPD can affect a mother’s ability to

care for her child and may negatively affect a child's cognitive development. There are no approved treatments for PPD but the most common treatments are psychotherapy and antidepressants. We believe that treatment with ganaxolone, a synthetic analog of allopregnanolone, may provide benefit to women suffering from PPD.

In December 2018, we announced positive top line results from Part 1 of our Magnolia Study. The primary endpoints of the study were safety and pharmacokinetics. In the study, 58 patients with PPD were randomized on a 1:1:1:1 basis to receive one of three ascending fixed IV 60 hour dose regimens of ganaxolone or placebo. No initial up titration was required, and patients were down titrated over the final 12 hours of the 60 hour infusion. A bolus injection of ganaxolone prior to the 60 hour infusion was also explored to test the safety and tolerability of a very short, high dose infusion. Patients with a Hamilton Rating Scale for Depression (HAM D17) score of ≥26 were considered for enrollment

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in the study. HAM D17 measurements were conducted by a centralized rater and taken at various timepoints spanning from baseline to day 34.

Ganaxolone was safe and well tolerated in all dose groups. Consistent with previous ganaxolone studies, the most common reported adverse events were sedation and dizziness. There were no serious adverse events reported, no discontinuations due to a treatment related adverse event and, consistent with prior studies, there were no reports of syncope or loss of consciousness. There was a dose response relationship seen for three groups of patients receiving ganaxolone IV at median doses of 60, 90 and 140 µg/kg/h. No dose group was powered to generate statistical significance in HAM-D17 scores as compared to baseline or placebo, however trends in the efficacy of ganaxolone to reduce HAM-D17 scores in PPD patients appeared to the Company to be very strong. The 140 µg/kg/h dose group (n=10) demonstrated the largest HAM D17 reduction, with a HAM D17 reduction of 15.1 (5.6 > placebo), 16.9 (4.2 > placebo) and 15.7 (4.1 > placebo) points from baseline at 48 hours, 60 hours and day 34, respectively. Patients in the 140 µg/kg/h dose group had a mean response rate, as defined as having a ≥50% reduction from baseline, of 67% and 75% at 60 hours and day 34, respectively. The mean remission rate, as determined by a HAM D17 ≤7, was 33% and 50% at 60 hours and day 34, respectively. The Clinical Global Impression of Improvement (CGI I) as well as the Edinburgh Postnatal Depression Survey (EPDS) and Spielberger State Trait Anxiety 6 (STAI 6) showed consistent trends as the HAM D17.

Based on these results, the Company is advancing to Part 2 of the Magnolia Study that will evaluate a short IV infusion followed by 28-days of oral ganaxolone administration. Patients randomized to ganaxolone in the current dose cohort receive 20 mg/hr of ganaxolone IV (> 140 µg/kg/h), for six hours followed by an evening 900 mg dose of oral ganaxolone on day one. A once daily 900 mg evening dose of oral ganaxolone will then be administered for the duration of treatment. Data from Part 2 are expected in the first half of 2019.

Marinus is also conducting a PPD study with oral ganaxolone alone, the Amaryllis Study. Patients with a HAM D17 score of ≥ 20 but < 26 are being considered for enrollment in the study. Cohorts of patients enrolled in the initial open label phase of the study receive ascending dose regimens with oral ganaxolone. The primary endpoints of the study are safety and pharmacokinetics. In December 2018, we provided an interim update from our Amaryllis study where a low dose and a moderate dose of ganaxolone was studied. Patients who received a once-daily 675 mg evening (moderate) dose who took oral ganaxolone for four weeks experienced a mean reduction in HAM D17 scores of 13.2 points at day 28 from a baseline of 24.7 and a mean reduction of 15.7 points at day 35. Oral ganaxolone was generally safe and well tolerated with no serious adverse events reported and no discontinuations due to treatment related adverse events.

Based on data to date from this study and Part 1 of the Magnolia Study, we plan to enroll additional patients into the open label phase of the Amaryllis Study with the goal of further optimizing the oral ganaxolone dose regimen. Patients enrolled in the current dose cohort receive 675 mg of oral ganaxolone at dinner and before bedtime for the first two days of treatment and then receive a once-daily 1125 mg evening dose of oral ganaxolone for the remainder of the 28-day regimen. Data from the Amaryllis Study are expected in the first half of 2019.

Refractory Status Epilepticus (RSE)

Status epilepticus (SE) is a life threatening occurrence of continuous or intermittent seizures lasting more than five minutes in duration without intermittent recovery during the five or more minutes duration. If SE is not treated immediately, permanent neuronal damage may occur, which contributes to high rates of morbidity and mortality. In RSE, patients who fail to respond to at least two antiepileptic drugs (AEDs) certain synaptic $GABA_A$ receptors are internalized, and thereby unavailable to drugs that target these receptors, such as benzodiazepines. RSE patients who

do not respond to additional AEDs are generally placed under IV anesthesia as a last resort to attempt to stop the seizures and prevent further damage to the brain and death. These patients are referred to as having super refractory status epilepticus (SRSE). According to LexisNexis, there are approximately 45,000 hospitalized RSE cases reported in the U.S. annually.

We are enrolling patients with refractory status epilepticus (RSE) in a Phase 2 study with ganaxolone IV. Initial data from this proof of concept study in approximately 10 patients are expected in the first half of 2019. The FDA

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granted Orphan Drug Designation to the IV formulation of ganaxolone for the treatment of SE.

Other Indications

We have also conducted proof-of-concept studies in Lennox Gastaut Syndrome (LGS) and Fragile X Syndrome (FXS). Data from these studies showed that ganaxolone was safe and well-tolerated and either reduced seizures or improved anxiety in some patients. Children with LGS and FXS often suffer from cognitive and developmental impairment, behavioral challenges, sleep disorders and seizures. We believe that ganaxolone could be helpful to these patients across a range of these co-morbidities. We may evaluate these and/or other rare genetic epilepsy diseases in future clinical studies.

Ganaxolone Mechanism of Action

Ganaxolone is a synthetic analog of a naturally occurring neurosteroid, allopregnanolone, which exhibits potent anxiolytic, antidepressant, antiepileptic and sedative activity by virtue of its $GABA_A$ receptor modulating properties. While allopregnanolone's $GABA_A$ modulatory activity is well documented, it has the potential to convert back to its metabolic precursor, dihydroxyprogesterone, which could lead to hormonal side effects. Ganaxolone has been designed with an added methyl group that prevents back conversion to an active steroid. This, along with our proprietary nanoparticulate technology, enables ganaxolone to be dosed chronically and orally. In preclinical and clinical studies, ganaxolone exhibited efficacy comparable to allopregnanolone.

GABA (gamma aminobutyric acid) is the chief inhibitory neurotransmitter in the brain. One of the subclasses of receptors that respond to GABA is the $GABA_A$ receptor. When activated, these receptors selectively conduct chloride ions through a pore that results in the inhibitory effect of hyperpolarization of the neuron. Synaptic $GABA_A$ receptors respond quickly to inhibit neurotransmission, while extrasynaptic $GABA_A$ receptors provide ambient tonic inhibition.

Both ganaxolone and allopregnanolone bind to $GABA_A$ receptors at the synaptic and extrasynaptic binding sites. Activity with extrasynaptic $GABA_A$ receptors may be of particular importance for treating patients who developed tolerance to benzodiazepines and barbiturates. Ganaxolone binds to the $GABA_A$ receptors, which opens the pore to allow chloride ions to move into the postsynaptic neuron, leading to the inhibition of neurotransmission.

Safety Overview

Oral Safety

More than 1,600 subjects have received oral treatment with ganaxolone ranging in duration from one day to more than two years using doses from 50 to 2,000 mg/day. Ganaxolone was administered in Phase 2 studies to pediatric subjects at doses up to 63 mg/kg and to adult subjects at doses up to 1,875 mg/day. No drug-related deaths occurred in any of these clinical studies, and the majority of adverse events were not medically serious and resolved upon discontinuation of therapy. The most common side effects are related to sedation. In the ganaxolone safety database there are no trends of medically important changes in blood chemistry, vital signs, liver function, renal function or cardiovascular parameters in the adult or pediatric populations. Acrossall placebo-controlled studies, therewere no events of loss of consciousness related to ganaxolone and no events of pre-syncope reported.

IV Safety

In 2016, we completed a Phase 1 dose-escalation study in ganaxolone IV. In this study, we achieved dose levels targeted for efficacy in patients with postpartum depression (PPD), status epilepticus (SE) and other indications. The Phase 1 clinical study enrolled 36 subjects and was designed to determine the pharmacokinetics (PK),

pharmacodynamics (PD), and safety of ganaxolone IV administered as an ascending bolus dose (Stage 1) or continuous infusion (Stage 2). Four cohorts of subjects were enrolled in Stage 1 and received escalating doses of ganaxolone, and one cohort of subjects was enrolled in Stage 2.

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In the study, every dose regimen of ganaxolone IV administered, either bolus or continuous infusion, was generally safe and well tolerated, and reached targeted dose levels in a short period of time. Following treatment, six treatment-emergent adverse events were reported, all of which were mild in severity and resolved without intervention. Only headache was considered possibly related to treatment with ganaxolone IV. No subject discontinued due to an adverse event and no serious adverse events were reported. Ganaxolone IV plasma concentrations were generally proportional to the administered dose. In addition, the continuous infusion of ganaxolone IV achieved the targeted exposure levels. Plasma exposures associated with anticonvulsant and anti-anxiety activity were reached in this study.

In 2018, we completed Part 1 of our Magnolia Phase 2 study evaluating ganaxolone IV in women with PPD. Ganaxolone was safe and well-tolerated in all dose groups. Consistent with previous ganaxolone studies, the most common reported adverse events were sedation and dizziness. There were no serious adverse events reported, no discontinuations due to a treatment related adverse event and, consistent with prior studies, there were no reports of syncope or loss of consciousness.

Preclinical Pharmacology and Toxicology

We have completed preclinical safety pharmacology and toxicology testing, including reproductive toxicology. Animal pharmacokinetic and in vitro studies show that ganaxolone is primarily metabolized by the CYP3A family of liver enzymes, a common route of drug metabolism. All in vitro studies have shown ganaxolone has low potential for interaction with other drugs at several multiples of observed human ganaxolone levels. Furthermore, neither ganaxolone nor its metabolites have a ketone ring at the 3-position, a requirement for hormonal activity. In binding studies, ganaxolone has no appreciable affinity for estrogen or progesterone receptors. We found no evidence of changes in blood, liver, kidney or the gastrointestinal systems indicating functional or anatomical adverse effects associated with either single- or multiple-dose treatment with ganaxolone in preclinical safety pharmacology studies, nor have we seen evidence of any end organ toxicity from human clinical studies. We have not detected potential for ganaxolone to cause cellular mutations or carcinogenicity in studies to date.

In reproductive toxicology studies, ganaxolone did not cause any malformations of the embryo or fetus in rats or mice and did not significantly affect the development of offspring. No changes in sperm parameters were found. We believe these findings are important as all currently marketed AEDs have shown developmental toxicities in animal studies such as fetal death or skeletal abnormalities that indicates a finding of developmental toxicities in animal studies. Valproate, carbamazepine, phenytoin and topiramate have been linked with birth defects in humans (e.g. head and facial malformations and lowered birth weight) at a rate higher than observed in women who did not take these drugs. This association has resulted in labeling for these drugs indicating positive evidence of human fetal risk based on scientific data. Based on ganaxolone’s mechanism and preclinical and clinical findings to date, we intend to seek differentiated labeling for ganaxolone, indicating that animal reproduction studies have failed to demonstrate a risk to the fetus, which we believe would be an important safety differentiator for women of childbearing age.

Our Strategy

Our mission is to maximize the value of ganaxolone as a best in class therapy for rare genetic and orphan epilepsy and targeted neuropsychiatric indications through development of multiple formulations for oral, liquid and infusion administration. The key elements of our strategy include the following:

· Pursuing orphan, genetic epilepsy indications for ganaxolone. Within epilepsy, there are several patient populations, such as CDD and PCDH19-RE, where we believe a genetic marker associated with the syndrome has been linked to deficits in GABAergic signaling. Based on our clinical data, we believe that increasing GABAergic tone with ganaxolone could provide benefits and that treatments for these small populations have the potential for more

efficient paths through clinical development, regulatory approval and commercialization. In addition to CDD, we are also developing ganaxolone in another rare refractory epilepsy indication, PCDH19-RE.

- Pursuing targeted depression and other neuropsychiatric disorder indications for ganaxolone. Due to its mechanism of action, we believe ganaxolone has potential for therapeutic benefit in a variety of targeted

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neuropsychiatric disorders. Evidence from preclinical and clinical studies demonstrates that treatment with ganaxolone could benefit patients with depression, anxiety, mood, sleep and other neuropsychiatric disorders. We believe our top line results from Phase 2 clinical studies in PPD, CDD, PCDH19-RE and FXS patients support this hypothesis. We may also explore development of ganaxolone in other targeted depression related, neuropsychiatric disorders.

- Pursuing hospital-based rare and underserved indications for ganaxolone. We believe that hospitalized SE patients who do not respond to available first and second line treatment options are significantly underserved with severely limited treatment options. Due to its activity at extrasynaptic $GABA_A$ receptors, ganaxolone may provide a therapeutic benefit to patients as second line therapy for patients refractive to benzodiazapines. To that end, we are conducting a Phase 2 proof of concept study in refractory SE patients and may in the future study similar hospital-based patient populations that could benefit from ganaxolone's mechanism.
- Building on our product pipeline. We intend to expand and diversify our product pipeline through development and/or acquisition of additional drug candidates that fit our business strategy. In addition, we may expand the targeted indication footprint for our ganaxolone franchise into other epilepsy, neuropsychiatric or other indications.

Intellectual Property

The proprietary nature of and protection for our product candidates, discovery programs and know-how are important to our business. We have sought patent protection in the United States and internationally for ganaxolone synthetic methods and ganaxolone nanoparticles, which are used in oral solid, oral liquid, and intravenous dose formulations, other injectable ganaxolone formulations, and methods of treatment using ganaxolone formulations. 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.

The basis of our intellectual property for ganaxolone nanoparticle formulations was the discovery of a novel composition of ganaxolone nanoparticles and complexing agents that deliver consistent exposure and improved stability of ganaxolone. This discovery resulted in the issuance of our United States and foreign patents, which cover ganaxolone nanoparticle formulations and the use of these formulations for treating seizure disorders. Our patent portfolio for ganaxolone nanoparticle formulations contains eight United States patents, one pending United States patent application, and corresponding foreign patents and patent applications directed to solid and liquid ganaxolone formulations and methods for the making and use thereof. These patents expire in 2026, excluding accounting for possible patent term extension under the Drug Price Competition and Patent Term Restoration Act of 1984, or the Hatch-Waxman Act, or for possible pediatric exclusivity. Corresponding foreign patents have been granted in Australia, Canada, China, Eurasia, India, Israel, Japan, Mexico, South Africa, New Zealand, Singapore and South Korea. Corresponding foreign patent applications are pending in China, Europe and India. We have not licensed any rights to practice these patents in any of these territories. Pursuant to our agreement with Domain Russia Investments Limited, or DRI, we assigned DRI patent rights, which rights were subsequently assigned to NovaMedica LLC, along with the rights to develop and commercialize ganaxolone in Russia and certain other eastern European nations.

Our patent portfolio also contains patents issued in Australia, United States, Europe, Japan, Mexico, New Zealand, China, Hong Kong and Israel covering our novel and cost effective ganaxolone synthesis process, which expire in 2030, excluding accounting for possible patent term extension under the Hatch-Waxman Act, or for possible pediatric exclusivity. Corresponding foreign patent applications are pending in Brazil, Canada, India, and South Korea.

We filed two provisional applications in 2015 directed to intravenous ganaxolone formulations and methods of using these formulations to treat refractory epileptic seizures and other disorders. Both of these patents have been converted to US non-provisional applications with corresponding Patent Cooperation Treaty (PCT) applications. These PCT applications have entered the national stage in Australia, Canada, China, Europe, India, Israel, Japan, and South Africa. If granted, these patents will expire in 2036, excluding accounting for possible patent term extension under the

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Drug Price Competition and Patent Term Restoration Act of 1984 or the Hatch-Waxman Act or other similar provisions available outside the US that provide patent term extension for regulatory delays. We filed two provisional applications in 2016 directed to additional methods of treatment using our IV formulations. In 2017 we converted one of these applications to a US non-provisional application and converted the other to a PCT application. If subsequently granted, the patents from these applications will expire in 2037. We filed a provisional application directed to sustained release injectable ganaxolone formulations in 2017, which was converted to a PCT application in 2018. If subsequently filed as a national stage application, the patent from this application will expire in 2038. We filed a provisional application directed to ganaxolone use in prophylaxis and treatment of postpartum depression in 2018. If converted to a non-provisional application and subsequently granted, the patent from this application will expire in 2039.

We filed a provisional patent application in 2017 directed to the use of our formulations in the treatment of genetic epileptic disorders. This provisional patent application was converted to a US non-provisional application with a corresponding PCT application in 2018. We also filed a provisional patent application in 2017 directed to methods and compositions for the treatment of central nervous system (CNS) disorders. This application was converted to a US non-provisional application in 2018. If subsequently granted, the patents from these applications will expire in 2038.

In addition to patents, we rely upon unpatented trade secrets, know-how and continuing technological innovation to develop and maintain a competitive position. We seek to protect our proprietary information, in part, through confidentiality agreements with our employees, collaborators, contractors and consultants, and invention assignment agreements with our employees and some of our collaborators. The confidentiality agreements are designed to protect our proprietary information and, in the case of agreements or clauses requiring invention assignment, to grant us ownership of technologies that are developed through a relationship with a third party.

General considerations

As with other biotechnology and pharmaceutical companies, our ability to maintain and solidify a proprietary position for our ganaxolone synthesis and formulations will depend upon our success in obtaining effective patent claims and enforcing those claims once granted. Our commercial success will depend in part upon not infringing upon the proprietary rights of third parties. It is uncertain whether the issuance of any third-party patent could require us to alter our development or commercial strategies, obtain licenses, or cease certain activities. The biotechnology and pharmaceutical industries are characterized by extensive litigation regarding patents and other intellectual property rights.

The term of a patent that covers a FDA-approved drug may be eligible for patent term extension, which provides patent term restoration as compensation for the patent term lost during the FDA regulatory review process. The Hatch-Waxman Act permits a patent term extension of up to five years beyond the expiration of the patent. The length of the patent term extension is related to the length of time the drug is under regulatory review. Patent extension cannot extend the remaining term of a patent beyond a total of 14 years from the date of product approval and only one patent applicable to an approved drug may be extended. Similar provisions are available in Europe and other foreign jurisdictions to extend the term of a patent that covers an approved drug. In the future, if and when our pharmaceutical products receive FDA approval, we expect to apply for patent term extensions on patents covering those products.

Many pharmaceutical companies, biotechnology companies and academic institutions are competing with us in the field of neuropsychiatric disorders and filing patent applications potentially relevant to our business. Even if a particular third-party patent is identified as possibly being relevant to our product candidates or technology, we may conclude upon a thorough analysis, that we do not infringe upon the patent or that the patent is invalid. If the

third-party patent owner disagrees with our conclusion and we continue with the business activity in question, we may be subject to patent litigation. Alternatively, we might decide to initiate litigation in an attempt to have a court declare the third-party patent invalid or non-infringed by our activity. In either scenario, patent litigation typically is costly and time-consuming, and the outcome can be favorable or unfavorable.

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Collaborations

NovaMedica

In connection with our Series C convertible preferred stock financing, in December 2012 we entered into a Technology Transfer Agreement, or the Transfer Agreement, with DRI, a significant stockholder of our company. Pursuant to the Transfer Agreement, in exchange for a payment of $100,000, we assigned to DRI certain patents and patents applications in Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine and Uzbekistan, or the Covered Territory, and granted to DRI an exclusive, royalty-free, irrevocable and assignable license under our know-how to develop and commercialize ganaxolone and other products that would infringe our patent rights or use our know-how, or the Covered Products, in the Covered Territory, in the field of uses for any human or animal disease or condition excluding the treatment of unpleasant sensory or emotional experience associated with actual or potential tissue damage or described in terms of such damage, or the Field. Immediately thereafter, we, together with DRI, executed an Assignment and Assumption Agreement, pursuant to which all of DRI's rights and obligations under the Transfer Agreement were transferred to NovaMedica, LLC, or NovaMedica. We agreed to take all action required to register or record the patent transfers to DRI in each country in the Covered Territory and to ensure the assignment of DRI's rights under the Transfer Agreement to NovaMedica. NovaMedica is jointly owned by Rusnano Medinvest LLC, or Rusnano Medinvest, and DRI. RMI Investments, S.á.r.l, a stockholder of ours, is a wholly-owned subsidiary of Rusnano Medinvest.

Under the terms of the Transfer Agreement, NovaMedica, or its permitted transferees or assignees, has the exclusive right within the Covered Territory to manufacture the Covered Products solely for development and commercialization in the Covered Territory in the Field. Until the first commercial sale of a Covered Product within the Covered Territory, NovaMedica will have the right to purchase supplies of the Covered Product from us as are reasonably available to us and as are reasonable and necessary to conduct clinical studies of Covered Product in the Covered Territory, provided that any such purchase does not reasonably interfere with our having sufficient supplies of Covered Products on hand for use in development (including the conduct of clinical studies) or commercialization outside of the Covered Territory. Such purchases will be made on a cost-plus basis. The Transfer Agreement provides that the parties shall enter into the Supply Agreement to supply ganaxolone and/or Covered Product for development in the Covered Territory within 60 calendar days from NovaMedica's request, which we have not yet received.

In accordance with the terms of the Transfer Agreement, on June 25, 2013 we entered into a Clinical Development and Collaboration Agreement, or the Collaboration Agreement, with NovaMedica, pursuant to which we agreed to assist NovaMedica in the development and commercialization of Covered Products in the Covered Territory in the Field. The Collaboration Agreement requires the formation of committees consisting of our representatives and NovaMedica representatives to oversee the general development, day-to-day development work and commercialization of Covered Products in the Field in the Covered Territory. All decisions of these committees must be made by unanimous vote, subject to a dispute resolution process. Under the terms of the Collaboration Agreement, the joint committees will determine a development plan for ganaxolone in clinical studies and a plan for commercialization of ganaxolone. NovaMedica will have sole responsibility for the costs and expenses of obtaining regulatory approval for Covered Products and for commercializing any approved products in the Covered Territory, and NovaMedica will have the right to conduct its own clinical studies in the Covered Territory at its sole expense. NovaMedica also has the right to file applications for approval of Covered Products in the Covered Territory, subject to committee oversight. We have agreed, among other things, to provide NovaMedica with data and regulatory files necessary for it to obtain necessary approvals in the Covered Territory, information relating to applications for regulatory approval of Covered Products, certain commercialization information and to assist NovaMedica in conducting any clinical studies necessary for regulatory approval of Covered Products in the Covered Territory. We also have agreed to provide NovaMedica with certain development know-how and support, including making our clinical development personnel available to provide scientific and technical explanations, consultation and support

that may be reasonably requested by NovaMedica.

NovaMedica is required to reimburse us for any out-of-pocket expenses incurred by us in providing this assistance, except for expenses incurred in our participation on the joint committees. Pursuant to the Collaboration Agreement and the Transfer Agreement, we have agreed to use commercially reasonable efforts to include sites in the Russian Federation in our clinical study programs for the first indications of the Covered Products at our sole expense.

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Under the Transfer Agreement, at least 36 months prior to the first commercial sale of a product candidate in the Covered Territory, the parties have agreed to negotiate in good faith a supply agreement pursuant to which we or a third party contract manufacturer authorized by us to manufacture and supply the Covered Products, will supply needed quantities of Covered Product to NovaMedica solely for commercialization of Covered Products in the Covered Territory, on commercially fair and reasonable terms. Such purchases will be made on a cost-plus basis. In the event the parties are unable to agree on pricing under the supply agreement, they have agreed to engage an internationally recognized consulting firm reasonably acceptable to both parties to perform an analysis to determine final pricing under the supply agreement, which decision will be binding upon the parties. In the event that the parties are unable to reach a reasonably acceptable supply agreement or we are unable to supply Covered Products to NovaMedica under such supply agreement for a period of at least 60 calendar days after the specified delivery date and we thereafter fail to cure such failure within 60 days after written notice from NovaMedica, we have agreed to cooperate with NovaMedica to identify a mutually acceptable alternative source of supply and will provide the necessary consents to allow such alternative source of supply to provide the needed quantities of the Covered Products to NovaMedica. The terms of the alternative source of supply would be negotiated directly by NovaMedica with the supplier.

The Collaboration Agreement expires on the earlier of three years following the first commercial sale of a product candidate in the Covered Territory or the termination of the Transfer Agreement. NovaMedica also has the right to terminate the Collaboration Agreement at any time at its convenience upon 90 days' prior written notice.

Purdue Neuroscience Company (Purdue)

In September 2004, we entered into a license agreement with Purdue, which was most recently amended and restated in May 2008, that granted us exclusive rights to certain know-how and technology relating to ganaxolone, excluding the field of treatment of unpleasant sensory or emotional experience associated with actual or potential tissue damage or described in terms of such damage. The agreement contains a right by us to sublicense subject to prior written approval by Purdue and we have sublicensed our licensed rights to NovaMedica for the Covered Territory. We are obligated to pay royalties as a percentage in the range of high single digits up to 10% of net product sales for direct licensed products, such as ganaxolone. The obligation to pay royalties expires, on a country-by-country basis, ten years from the first commercial sale of a licensed product in each country. Upon commercialization, we estimate the in licensed technology would result in our paying royalties to Purdue in the low single digits as a percentage of sales. Other payment obligations may be triggered if we successfully partner our product candidates with third parties. In addition, the agreement also requires that we pay Purdue a percentage in the mid-single digits of the non-royalty consideration that we receive from a sublicensee and a percentage in the twenties of milestone payments received from sublicensees for indications other than seizure disorders and vascular migraine headaches not associated with mood disorders. Under the license agreement, we are committed to use commercially reasonable efforts to develop and commercialize at least one licensed product.

Competition

The pharmaceutical industry is highly competitive and subject to rapid and significant technological change. While we believe that our development experience and scientific knowledge provide us with competitive advantages, we face competition from both large and small pharmaceutical and biotechnology companies, specifically from companies that treat epilepsy and neuropsychiatric disorders.

There are a variety of available therapies marketed for epilepsy and neuropsychiatric disorders. In many cases, these products are administered in combination to enhance efficacy or to reduce side effects. Some of these drugs are branded and subject to patent protection, some are in clinical development and not yet approved, and others are available on a generic basis. Many of these approved drugs are well established therapies or products and are widely

accepted by physicians, patients and third-party payers. Insurers and other third-party payers may also encourage the use of generic products. More established companies have a competitive advantage over us due to their greater size, cash flows and institutional experience. Compared to us, many of our competitors have significantly greater financial, technical and human resources.

Our competitors may also develop drugs that are safer, more effective, more widely used and less costly than

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ours, and may also be more successful than us in manufacturing and marketing their products. These appreciable advantages could render ganaxolone obsolete or non-competitive before we can recover the expenses of ganaxolone's development and commercialization.

Mergers and acquisitions in the pharmaceutical and biotechnology industries may result in even more resources being concentrated among a smaller number of our competitors. Smaller and other early-stage companies may also prove to be significant competitors, particularly through collaborative arrangements with large and established companies. These third parties compete with us in recruiting and retaining qualified scientific, management and commercial personnel, establishing clinical study sites and subject registration for clinical studies, as well as in acquiring technologies complementary to, or necessary for, our programs.

Competitive Landscape

We primarily compete with pharmaceutical and biotechnology companies that are developing therapies or marketing drugs to treat indications that we are targeting.

CDD and PCDH19-RE

There are no drugs approved for the treatment of CDD and PCDH19-RE. CDD and PCDH19-RE patients are typically prescribed drugs approved for epileptic seizures, which often fail to control seizures in this patient population. To our knowledge, there are three other companies currently conducting a Phase 2 clinical study in CDD patients and no other ongoing clinical studies in PCDH19-RE.

PPD

Approximately 500,000-750,000 mothers suffer from postpartum depression annually in the US. The majority of women suffering from depression do not seek treatment. There are no approved treatments for PPD, however the most common treatments are psychotherapy and prescription antidepressants. Many women who take antidepressants discontinue them prior to and after parturition due to concern for the child. Sage Therapeutics is developing an intravenous formulation of allopregnanolone, which is expected to be approved for marketing in 2019, and a new orally-administered chemical entity for PPD.

RSE

SE patients generally are treated with benzodiazepine as first-line treatment. When benzodiazepines are not effective, several second line AEDs are used. When second-line AEDs are not effective, the RSE patient is generally placed under IV anesthesia as a last resort to attempt to stop the seizures and prevent further damage to the brain and death. Morbidity and mortality rates increase for patients that progress to SRSE. To our knowledge, there are no other companies currently conducting clinical studies in SE patients.

Manufacturing

Manufacturing of drugs and product candidates, including ganaxolone, must comply with FDA current good manufacturing practice, or cGMP, regulations. Ganaxolone is a synthetic small molecule made through a series of organic chemistry steps starting with commercially available organic chemical raw materials. We conduct manufacturing activities under individual purchase orders with independent contract manufacturing organizations, or CMOs, to supply our clinical studies. We have an internal quality program and have qualified and signed quality agreements with our major CMOs. We conduct periodic quality audits of their facilities. We believe that our existing suppliers of ganaxolone's active pharmaceutical ingredient and finished product will be capable of providing sufficient

quantities of each to meet our clinical study supply needs. Other CMOs may be used in the future for clinical supplies and, subject to approval, commercial manufacturing.

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Ganaxolone Formulations

The therapeutic possibilities of ganaxolone have been understood for some time, however, because ganaxolone is a high-dose water insoluble compound, developing a formulation that could provide consistent drug exposure and could be manufactured at a commercially feasible cost had proven challenging. We believe our patented nanoparticulate formulation and novel manufacturing process for ganaxolone can successfully address the cost of manufacturing and pharmacokinetic challenges that previously encumbered the clinical and commercial feasibility of ganaxolone.

Ganaxolone is currently formulated as an IV, liquid suspension and as a capsule.

Commercial Operations

If we obtain FDA approval for ganaxolone, we intend to build a sales and marketing infrastructure to reach high prescribing neurologist, critical care, epilepsy specialists and other target physician populations in the United States. We believe a focused sales and marketing organization could be leveraged to market ganaxolone across multiple epilepsy, neurology or psychiatry indications if we are able to obtain regulatory approval for those other indications. We may seek co-promotion partners for our sales efforts to reach other United States physician groups, such as primary care physicians. We believe that there could also be significant market opportunities for ganaxolone in epilepsy and other neurological and psychiatric conditions outside of the United States. In order to capitalize on such opportunities, we plan to seek collaborations with pharmaceutical companies that have greater reach and resources by virtue of their size and experience in the field.

Government Regulation

As a clinical stage pharmaceutical company that operates in the United States, we are subject to extensive regulation by the FDA, and other federal, state, and local regulatory agencies. The Federal Food, Drug, and Cosmetic Act, or the FDC Act, and its implementing regulations set forth, among other things, requirements for the research, testing, development, manufacture, quality control, safety, effectiveness, approval, packaging, labeling, storage, record keeping, reporting, distribution, import, export, advertising and promotion of our products. Although the discussion below focuses on regulation in the United States, we anticipate seeking approval for, and marketing of, our product candidates in other countries. Generally, our activities in other countries will be subject to regulation that is similar in nature and scope as that imposed in the United States, although there can be important differences. In addition, some significant aspects of regulation in Europe are addressed in a centralized way through the EMA, but country-specific regulation also remains in many essential respects. The process of obtaining regulatory marketing approvals and the subsequent compliance with appropriate federal, state, local and foreign statutes and regulations will require the expenditure of substantial time and financial resources and may not be successful.

United States Government Regulation

The FDA is the main regulatory body that controls pharmaceuticals in the United States, and its regulatory authority is based in the FDC Act. Pharmaceutical products are also subject to other federal, state and local statutes. A failure to comply explicitly with any requirements during the product development, approval, or post-approval periods, may lead to administrative or judicial sanctions. These sanctions could include the imposition by the FDA or an institutional review board, or IRB, of a hold on clinical studies, refusal to approve pending marketing applications or supplements, withdrawal of approval, warning letters, product recalls, product seizures, total or partial suspension of production or distribution, injunctions, fines, civil penalties or criminal prosecution.

The steps required before a new drug may be marketed in the United States generally include:

- completion of non-clinical, or preclinical, studies, animal studies, clinical and non-clinical pharmacology and formulation studies in compliance with the FDA's good laboratory practice (GLP) and good clinical practice (GCP) regulations;
- submission to the FDA of an IND to support human clinical testing;

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- approval by an IRB at each clinical site before each study may be initiated;
- performance of adequate and well-controlled clinical studies in accordance with federal regulations, including requirements for good clinical practices, or GCPs, to establish the safety and efficacy of the investigational product candidate for each targeted indication;
- submission of a new drug application, or NDA, to the FDA;
- satisfactory completion of an FDA Advisory Committee review, if applicable;
- satisfactory completion of an FDA inspection of clinical study sites and sponsor to ensure compliance with GCPs, if applicable;
- satisfactory completion of an FDA inspection of the manufacturing facilities at which the investigational product candidate is produced to assess compliance with cGMP, and to assure that the facilities, methods and controls are adequate; and
- FDA review and approval of the NDA.

Clinical Studies

An IND is a request for authorization from the FDA to transport investigational product across state lines, thereby enabling the sponsor to administer an investigational product candidate to humans. This authorization is required before interstate shipping and administration of any new drug product to humans that is not the subject of an approved NDA. A 30-day waiting period after the submission of each IND is required prior to the commencement of clinical testing in humans. If the FDA has neither commented on nor questioned the IND within this 30-day period, the clinical study proposed in the IND may begin. The FDA may submit questions after the 30-day period and after the study was allowed to begin. Clinical studies involve the administration of the investigational product candidate to subjects under the supervision of qualified investigators following GCPs, requirements meant to protect the rights and health of subjects and to define the roles of clinical study sponsors, administrators and monitors. Clinical studies are conducted under protocols that detail the subject inclusion and exclusion criteria, the dosing regimen, the parameters to be used in monitoring safety, and the efficacy criteria to be evaluated. Each protocol involving testing on United States subjects and subsequent protocol amendments must be submitted to the FDA as part of the IND. The informed written consent of each participating subject is required. The clinical investigation of an investigational product candidate is generally divided into three phases. Although the phases are usually conducted sequentially, they may overlap or be combined. The three phases of an investigation are as follows:

- Phase 1. Phase 1 includes the initial introduction of an investigational product candidate into humans. Phase 1 studies may be conducted in subjects with the target disease or condition or healthy volunteers. These studies are designed to evaluate the safety, metabolism, pharmacokinetic properties, or PKs, and pharmacologic actions of the investigational product candidate in humans, the side effects associated with increasing doses, and if possible, to gain early evidence on effectiveness. During Phase 1 studies, sufficient information about the investigational product candidate's PKs and pharmacological effects may be obtained to permit the design of Phase 2 studies. The total number of participants included in Phase 1 studies varies, but is generally in the range of 20 to 80.
- Phase 2. Phase 2 includes the controlled clinical studies conducted to evaluate the effectiveness of the investigational product candidate for a particular indication(s) in subjects with the disease or condition under study, to determine dosage tolerance and optimal dosage, and to identify possible adverse side effects and safety risks associated with the product candidate. Phase 2 studies are typically well-controlled, closely monitored, and conducted in a limited subject population, usually involving no more than several hundred participants.

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- Phase 3. Phase 3 studies are controlled clinical studies conducted in an expanded subject population at geographically dispersed clinical study sites. They are performed after preliminary evidence suggesting effectiveness of the investigational product candidate has been obtained, and are intended to further evaluate dosage, clinical effectiveness and safety, to establish the overall benefit-risk relationship of the product candidate, and to provide an adequate basis for drug approval. Phase 3 studies usually involve several hundred to several thousand participants. In most cases, the FDA requires two adequate and well controlled Phase 3 studies to demonstrate the efficacy of the drug. A single Phase 3 study with other confirmatory evidence, such as a surrogate marker, may be sufficient in rare instances where the study is a multicenter study demonstrating internal consistency and a statistically very persuasive finding of a clinically meaningful effect on mortality, irreversible morbidity or prevention of a disease with a potentially serious outcome and confirmation of the result in a second study would be practically or ethically impossible.

The decision to terminate development of an investigational product candidate may be made by either a health authority body, such as the FDA or IRB/ethics committees, or by a company for various reasons. The FDA may order the temporary, or permanent, discontinuation of a clinical study, which is referred to as a clinical hold, at any time, or impose other sanctions, if it believes that the clinical study either is not being conducted in accordance with FDA requirements or presents an unacceptable risk to the clinical study subjects. In some cases, clinical studies are overseen by an independent group of qualified experts organized by the study sponsor, or the clinical monitoring board or data safety monitoring board. This group provides authorization for whether or not a study may move forward at designated check points. These decisions are based on the limited access to data from the ongoing study. The suspension or termination of development can occur during any phase of clinical studies if it is determined that the participants or subjects are being exposed to an unacceptable health risk. In addition, there are requirements for the registration of ongoing clinical studies of product candidates on public registries and the disclosure of certain information pertaining to the studies as well as clinical study results after completion.

A sponsor may be able to request a special protocol assessment, or SPA, the purpose of which is to reach agreement with the FDA on the Phase 3 study protocol design and analysis that will form the primary basis of an efficacy claim. A sponsor meeting the regulatory criteria may make a specific request for an SPA and provide information regarding the design and size of the proposed clinical study. An SPA request must be made before the proposed study begins, and all open issues must be resolved before the study begins. If a written agreement is reached, it will be documented and made part of the record. The agreement will be binding on the FDA and may not be changed by the sponsor or the FDA after the study begins except with the written agreement of the sponsor and the FDA or if the FDA determines that a substantial scientific issue essential to determining the safety or efficacy of the product candidate was identified after the testing began. An SPA is not binding if new circumstances arise, and there is no guarantee that a study will ultimately be adequate to support an approval even if the study is subject to an SPA.

Although the goal of an SPA is to reach concurrence on the adequacy of protocol elements intended to support a statutory finding of safety and efficacy, an SPA agreement with FDA does not imply that FDA has reviewed or concurs with each detail of the protocol. Absence of an FDA comment on a particular aspect of the study does not necessarily indicate agreement on that aspect if the sponsor did not specifically ask about it, especially if the context of a certain protocol element has not been highlighted or explained.

Assuming successful completion of all required testing in accordance with all applicable regulatory requirements, detailed investigational product candidate information is submitted to the FDA in the form of an NDA to request market approval for the product in specified indications.

New Drug Applications

In order to obtain approval to market a drug in the United States, a marketing application must be submitted to the FDA that provides data establishing the safety and effectiveness of the product candidate for the proposed indication.

The application includes all relevant data available from pertinent preclinical studies and clinical studies, including negative or ambiguous results as well as positive findings, together with detailed information relating to the product's chemistry, manufacturing, controls and proposed labeling, among other things. Data can come from company-sponsored

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clinical studies intended to test the safety and effectiveness of a product, or from a number of alternative sources, including studies initiated by investigators. To support marketing approval, the data submitted must be sufficient in quality and quantity to establish the safety and effectiveness of the investigational product candidate to the satisfaction of the FDA.

In most cases, the NDA must be accompanied by a substantial user fee; there may be some instances in which the user fee is waived. The FDA will initially review the NDA for completeness before it accepts the NDA for filing. The FDA has 60 days from its receipt of an NDA to determine whether the application will be accepted for filing based on the agency's threshold determination that it is sufficiently complete to permit substantive review. After the NDA submission is accepted for filing, the FDA begins an in-depth review. The FDA has agreed to certain performance goals in the review of NDAs. Applications for standard review product candidates are reviewed within twelve months of FDA's acceptance for filing. An accelerated six-month review can be given to applications that meet certain criteria. The FDA can extend this review by three months to consider certain late-submitted information or information intended to clarify information already provided in the submission. The FDA reviews the NDA to determine, among other things, whether the proposed product is safe and effective for its intended use, and whether the product is being manufactured in accordance with cGMP. FDA Advisory Committee meetings are typically held for New Chemical Entities (NCEs), novel indications, or for applications in which there is a specific safety/efficacy risk that the FDA is looking for advice on. However, the FDA can decide to hold advisory committee meeting for any application. An advisory committee meeting includes a panel of FDA members and clinicians and other experts who review, evaluate and make 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 will inspect the facilities at which the product is manufactured. The FDA will not approve the product unless it determines that the manufacturing processes and facilities are in compliance with cGMP requirements and adequate to assure consistent production of the product within required specifications. In addition, before approving an NDA, the FDA will typically inspect one or more clinical sites to assure compliance with GCP. After the FDA evaluates the NDA and the manufacturing facilities, it issues either an approval letter or a complete response letter. A complete response letter generally outlines the deficiencies in the submission and may require substantial additional testing or information in order for the FDA to reconsider the application. If, or when, those deficiencies have been addressed to the FDA's satisfaction in a resubmission of the NDA, the FDA will issue an approval letter. The FDA has committed to reviewing such resubmissions in two or six months depending on the type of information included. Notwithstanding the submission of any requested additional information, the FDA ultimately may decide that the application does not satisfy the regulatory criteria for approval.

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

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

supplements as it does in reviewing NDAs.

Breakthrough designation

In the United States, Breakthrough therapy designation allows the FDA to grant priority review to drug

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candidates if preliminary clinical studies indicate that the therapy may offer substantial treatment advantages over existing options for patients with serious or life-threatening diseases. Breakthrough designation provides increased communication with FDA during drug development and review, FDA guidance to ensure that the design of clinical studies are as efficient as practicable, and cross-disciplinary project lead assigned to the FDA review team and increased involvement of senior managers and experienced review staff. Breakthrough designation can be requested with the IND or ideally any time prior to the end-of-phase 2 meeting.

Fast Track designation

Fast Track is a designation by the FDA of an investigational drug for expedited review to facilitate development of drugs which treat a serious or life-threatening condition and fill an unmet medical need. The request can be initiated at any time during the drug development process but prior to the pre-NDA/BLA meeting. Fast track designation provides more frequent meetings and interactions with FDA to discuss the drug's development plan and ensure collection of appropriate data needed to support drug approval, potential for accelerated approval or priority review if the requisite criteria are met, and a rolling review of the NDA/BLA.

Advertising and Promotion

The FDA and other federal regulatory agencies closely regulate the marketing and promotion of drugs through, among other things, standards and regulations for direct-to-consumer advertising, communications regarding unapproved uses, industry-sponsored scientific and educational activities, and promotional activities involving the Internet. A product cannot be commercially promoted before it is approved. After approval, product promotion can include only those claims relating to safety and effectiveness that are consistent with the labeling approved by the FDA. Healthcare providers are permitted to prescribe drugs for "off-label" uses—that is, uses not approved by the FDA and therefore not described in the drug's labeling—because the FDA does not regulate the practice of medicine. However, FDA regulations impose stringent restrictions on manufacturers' communications regarding off-label uses. Broadly speaking, a manufacturer may not promote a drug for off-label use, but may engage in non-promotional, balanced communication regarding off-label use under specified conditions. Failure to comply with applicable FDA requirements and restrictions in this area may subject a company to adverse publicity and enforcement action by the FDA, the United States Department of Justice, or DOJ, or the Office of the Inspector General of the United States Department of Health and Human Services, or HHS, as well as state authorities. This could subject a company to a range of penalties that could have a significant commercial impact, including civil and criminal fines and agreements that materially restrict the manner in which a company promotes or distributes drug products.

Post-Approval Regulations

After regulatory approval of a drug is obtained, a company is required to comply with a number of post-approval requirements. For example, as a condition of approval of an NDA, the FDA may require post-marketing testing, including Phase 4 clinical studies, and surveillance to further assess and monitor the product's safety and effectiveness after commercialization. In addition, as a holder of an approved NDA, a company would be required to report adverse reactions and production problems to the FDA, to provide updated safety and efficacy information, and to comply with requirements concerning advertising and promotional labeling for any of its products. Also, quality control and manufacturing procedures must continue to conform to cGMP after approval to assure and preserve the long term stability of the drug product. The FDA periodically inspects manufacturing facilities to assess compliance with cGMP, which imposes extensive procedural and substantive record keeping requirements. In addition, changes to the manufacturing process are strictly regulated, and, depending on the significance of the change, may require prior FDA approval before being implemented. FDA regulations also require investigation and correction of any deviations from cGMP and impose documentation requirements upon a company and any third-party manufacturers that a company may decide to use. Accordingly, manufacturers must continue to expend time, money and effort in the area of

production and quality control to maintain compliance with cGMP and other aspects of regulatory compliance.

We rely, and expect to continue to rely, on third parties for the production of clinical and commercial quantities of ganaxolone. Future FDA and state inspections may identify compliance issues at our facilities or at the facilities of our contract manufacturers that may disrupt production or distribution, or require substantial resources to correct. In

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addition, discovery of previously unknown problems with a product or the failure to comply with applicable requirements may result in restrictions on a product, manufacturer or holder of an approved NDA, including withdrawal or recall of the product from the market or other voluntary, FDA-initiated or judicial action that could delay or prohibit further marketing.

Newly discovered or developed safety or effectiveness data may require changes to a product's approved labeling, including the addition of new warnings and contraindications, and also may require the implementation of other risk management measures. Also, new government requirements, including those resulting from new legislation, may be established, or the FDA's policies may change, which could delay or prevent regulatory approval of our products under development.

The Hatch-Waxman Amendments to the FDC Act

Orange Book Listing

In seeking approval for a drug through an NDA, applicants are required to list with the FDA each patent whose claims cover the applicant's product or a method of using the product. Upon approval of a drug, each of the patents listed in the application for the drug is then published in the FDA's Approved Drug Products with Therapeutic Equivalence Evaluations, commonly known as the Orange Book. Drugs listed in the Orange Book can, in turn, be cited by potential generic competitors in support of approval of an abbreviated new drug application, or ANDA, or 505(b)(2) application. An ANDA provides for marketing of a drug product that has the same active ingredients, generally in the same strengths and dosage form, as the listed drug and has been shown through PK testing to be bioequivalent to the listed drug. Other than the requirement for bioequivalence testing, ANDA applicants are generally not required to conduct, or submit results of, preclinical studies or clinical tests to prove the safety or effectiveness of their drug product. 505(b)(2) applications provide for marketing of a drug product that may have the same active ingredients as the listed drug and contains full safety and effectiveness data as an NDA, but at least some of this information comes from studies not conducted by or for the applicant. Drugs approved in this way are commonly referred to as "generic equivalents" to the listed drug, and can often be substituted by pharmacists under prescriptions written for the original listed drug.

The ANDA or 505(b)(2) applicant is required to certify to the FDA concerning any patents listed for the approved product in the FDA's Orange Book. Specifically, the applicant must certify that: (i) the required patent information has not been filed; (ii) the listed patent has expired; (iii) the listed patent has not expired, but will expire on a particular date and approval is sought after patent expiration; or (iv) the listed patent is invalid or will not be infringed by the new product. The ANDA or 505(b)(2) applicant may also elect to submit a statement certifying that its proposed ANDA label does not contain (or carves out) any language regarding a patented method of use rather than certify to such listed method of use patent. If the applicant does not challenge the listed patents by filing a certification that the listed patent is invalid or will not be infringed by the new product, the ANDA or 505(b)(2) application will not be approved until all the listed patents claiming the referenced product have expired.

A certification that the new product will not infringe the already approved product's listed patents, or that such patents are invalid, is called a Paragraph IV certification. If the ANDA or 505(b)(2) applicant has provided a Paragraph IV certification to the FDA, the applicant must also send notice of the Paragraph IV certification to the NDA and patent holders once the ANDA or 505(b)(2) application has been accepted for filing by the FDA. The NDA and patent holders may then initiate a patent infringement lawsuit in response to the notice of the Paragraph IV certification. The filing of a patent infringement lawsuit within 45 days of the receipt of a Paragraph IV certification automatically prevents the FDA from approving the ANDA or 505(b)(2) application until the earliest of 30 months, expiration of the patent, settlement of the lawsuit, and a decision in the infringement case that is favorable to the ANDA or 505(b)(2) applicant.

The ANDA or 505(b)(2) application also will not be approved until any applicable non-patent exclusivity listed in the Orange Book for the referenced product has expired.

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Marketing Exclusivity

Upon NDA approval of a new chemical entity, which is a drug that contains no active moiety that has been approved by the FDA in any other NDA, that drug receives five years of marketing exclusivity during which the FDA cannot approve any ANDA seeking approval of a generic version of that drug. Certain changes to a drug, such as the addition of a new indication to the package insert, are associated with a three-year period of exclusivity during which the FDA cannot approve an ANDA for a generic drug that includes the change.

An ANDA may be submitted one year before marketing exclusivity expires if a Paragraph IV certification is filed. In this case, the 30 months stay, if applicable, runs from the end of the five years marketing exclusivity period. If there is no listed patent in the Orange Book, there may not be a Paragraph IV certification, and, thus, no ANDA may be filed before the expiration of the exclusivity period.

Patent Term Extension

After NDA approval, owners of relevant drug patents may apply for up to a five year patent extension. The allowable patent term extension is calculated as half of the drug's testing phase—the time between an effective IND and NDA submission—and all of the review phase—the time between NDA submission and approval up to a maximum of five years. The time can be shortened if the FDA determines that the applicant did not pursue approval with due diligence. The total patent term after the extension may not exceed 14 years.

Many other countries also provide for patent term extensions or similar extensions of patent protection for pharmaceutical products. For example, in Japan, it may be possible to extend the patent term for up to five years and in Europe, it may be possible to obtain a supplementary patent certificate that would effectively extend patent protection for up to five years.

The Foreign Corrupt Practices Act

The Foreign Corrupt Practices Act, or FCPA, prohibits any United States individual or business from paying, offering, or authorizing payment or offering of anything of value, directly or indirectly, to any foreign official, political party or candidate for the purpose of influencing any act or decision of the foreign entity in order to assist the individual or business in obtaining or retaining business. The FCPA also obligates companies whose securities are listed in the United States to comply with accounting provisions requiring such companies to maintain books and records that accurately and fairly reflect all transactions of the corporation, including international subsidiaries, and to devise and maintain an adequate system of internal accounting controls for international operations.

European and Other International Government Regulation

In addition to regulations in the United States, we will be subject to a variety of regulations in other jurisdictions governing, among other things, clinical studies and any commercial sales and distribution of our products. Whether or not we obtain FDA approval for a product, we must obtain the requisite approvals from regulatory authorities in foreign countries prior to the commencement of clinical studies or marketing of the product in those countries. Some countries outside of the United States have a similar process that requires the submission of a request for a clinical study authorization, or CTA, much like the IND prior to the commencement of human clinical studies. In Europe, for example, a request for a CTA must be submitted to each country's national health authority and an independent ethics committee, much like the FDA and IRB, respectively. Once the CTA request is approved in accordance with a country's requirements, clinical study development may proceed.

To obtain regulatory approval to commercialize a new drug under European Union (EU) regulatory systems, we must submit a marketing authorization application, or MAA. The MAA is similar to the NDA, with the exception of, among other things, country-specific document requirements.

For other countries outside of the European Union, such as countries in Eastern Europe, Russia, Latin America or Asia, the requirements governing the conduct of clinical studies, product licensing, pricing and reimbursement vary

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from country to country. Internationally, clinical studies are generally required to be conducted in accordance with GCP, applicable regulatory requirements of each jurisdiction and the medical ethics principles that have their origin in the Declaration of Helsinki.

Small Medium Enterprise (SME) designation

In the EU, small medium enterprise designation (SME) can be granted to non-subsidiary, independent firms which employ fewer than 250 employees to promote innovation and the development of new medicinal products by smaller companies. The criteria for designation is dependent on staff headcount, either turnover or balance sheet total and the ownership structure, including any partnership or linkage. Benefits of SME designation include direct assistance on regulatory aspects of the pharmaceutical legislation, help navigating the array of services available, fee exemptions and reductions for pre- and post-authorization regulatory procedures, assistance with translations of product information into all official EU languages, guidance on clinical data publication and a free redaction tool license, liaison with academic investigators in pediatric-medicine research through the European Network of Pediatric Research at the European Medicines Agency and workshops and training sessions. In October 2017, we received SME designation in the EU.

Compliance

During all phases of development (pre- and post-marketing), failure to comply with applicable regulatory requirements may result in administrative or judicial sanctions. These sanctions could include the FDA's imposition of a clinical hold on studies, refusal to approve pending applications, withdrawal of an approval, warning letters, product recalls, product seizures, total or partial suspension of production or distribution, product detention or refusal to permit the import or export of products, injunctions, fines, civil penalties or criminal prosecution. Any agency or judicial enforcement action could have a material adverse effect on us.

Other Special Regulatory Procedures

Orphan Drug Designation

The FDA may grant Orphan Drug Designation to drugs intended to treat a rare disease or condition that affects fewer than 200,000 individuals in the United States, or, if the disease or condition affects more than 200,000 individuals in the United States, there is no reasonable expectation that the cost of developing and making the drug would be recovered from sales in the United States. In the European Union, the EMA's Committee for Orphan Medicinal Products grants Orphan Drug Designation to promote the development of products that are intended for the diagnosis, prevention or treatment of life-threatening or chronically debilitating conditions affecting not more than five in 10,000 persons in the European Union community. In addition, designation is granted for products intended for the diagnosis, prevention or treatment of a life- threatening, seriously debilitating or serious and chronic condition and when, without incentives, it is unlikely that sales of the drug in the European Union would be sufficient to justify the necessary investment in developing the drug.

In the United States, Orphan Drug Designation entitles a party to financial incentives, such as opportunities for grant funding towards clinical study costs, tax credits for certain research and user fee waivers under certain circumstances. In addition, if a product receives the first FDA approval for the indication for which it has orphan designation, the product is entitled to seven years of market exclusivity, which means the FDA may not approve any other application for the same drug for the same indication for a period of seven years, except in limited circumstances, such as a showing of clinical superiority over the product with orphan exclusivity. Orphan drug exclusivity does not prevent the FDA from approving a different drug for the same disease or condition, or the same drug for a different disease or condition.

In the European Union, Orphan Drug Designation also entitles a party to financial incentives such as reduction of fees or fee waivers, protocol assistance, a type of scientific advice specific for designated orphan medicine and ten years of market exclusivity is granted following drug approval. This period may be reduced to six years if the Orphan

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Drug Designation criteria are no longer met, including where it is shown that the product is sufficiently profitable not to justify maintenance of market exclusivity.

Orphan drug designation must be requested before submission of an application for marketing approval. Orphan drug designation does not convey any advantage in, or shorten the duration of the regulatory review and approval process.

Priority Review (United States) and Accelerated Review (European Union)

Based on results of the Phase 3 study(ies) submitted in an NDA, upon the request of an applicant, a priority review designation may be granted to a product by the FDA, which sets the target date for FDA action on the application at six months from FDA filing. Priority review is given where preliminary estimates indicate that a product, if approved, has the potential to provide a safe and effective therapy where no satisfactory alternative therapy exists, or a significant improvement compared to marketed products is possible. If criteria are not met for priority review, the standard FDA review period is ten months from FDA filing. Priority review designation does not change the scientific/medical standard for approval or the quality of evidence necessary to support approval.

Under the Centralized Procedure in the European Union, the maximum timeframe for the evaluation of a MAA 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 for Medicinal Products for Human Use, or CHMP). Accelerated evaluation might be granted by the CHMP in exceptional cases, when a medicinal product is expected to be of a major public health interest, defined by three cumulative criteria: the seriousness of the disease (e.g., heavy disabling or life-threatening diseases) to be treated; the absence or insufficiency of an appropriate alternative therapeutic approach; and anticipation of high therapeutic benefit. In this circumstance, EMA ensures that the opinion of the CHMP is given within 150 days.

Healthcare Reform

In March 2010, President Obama signed one of the most significant healthcare reform measures in decades. The Patient Protection and Affordable Care Act and the Health Care and Education Reconciliation Act of 2010, or Affordable Care Act, substantially changes the way healthcare will be financed by both governmental and private insurers, and significantly impacts the pharmaceutical industry. The Affordable Care Act will impact existing government healthcare programs and will result in the development of new programs. For example, the Affordable Care Act provides for Medicare payment for performance initiatives and improvements to the physician quality reporting system and feedback program.

Among the Affordable Care Act’s provisions of importance to the pharmaceutical industry are the following:

- an annual, nondeductible fee on any covered entity engaged in manufacturing or importing certain branded prescription drugs and biological products, apportioned among such entities in accordance with their respective market share in certain government healthcare programs;
- an increase in the statutory minimum rebates a manufacturer must pay under the Medicaid Drug Rebate Program, retroactive to January 1, 2010, to 23.0% and 13.0% of the average manufacturer price, or AMP, for most branded and generic drugs, respectively;
- expansion of healthcare fraud and abuse laws, including the False Claims Act and the Anti-Kickback Statute, new government investigative powers, and enhanced penalties for noncompliance;
- a new partial prescription drug benefit for Medicare recipients, or Medicare Part D, coverage gap discount program, in which manufacturers must agree to offer 50.0% point-of-sale discounts off negotiated prices of applicable brand drugs to eligible beneficiaries during their coverage gap period, as a condition for the manufacturers’ outpatient drugs to be covered under Medicare Part D;

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- extension of manufacturers' Medicaid rebate liability to covered drugs dispensed to individuals who are enrolled in Medicaid managed care organizations;
- expansion of eligibility criteria for Medicaid programs by, among other things, allowing states to offer Medicaid coverage to additional individuals beginning in 2014 and by adding new mandatory eligibility categories for individuals with income at or below 133.0% of the Federal Poverty Level, thereby potentially increasing manufacturers' Medicaid rebate liability;
- expansion of the entities eligible for discounts under the Public Health Service pharmaceutical pricing program;
- new requirements to report annually specified financial arrangements with physicians and teaching hospitals, as defined in the Affordable Care Act and its implementing regulations, including reporting any "payments or transfers of value" made or distributed to physicians and teaching hospitals, and reporting any ownership and investment interests held by physicians and their immediate family members and applicable group purchasing organizations during the preceding calendar year, with data collection to be required beginning August 1, 2013 and reporting to the Centers for Medicare and Medicaid Services, or CMS, to be required by March 31, 2014 and by the 90th day of each subsequent calendar year;
- a new requirement to annually report drug samples that manufacturers and distributors provide to physicians;
- a new Patient-Centered Outcomes Research Institute to oversee, identify priorities in, and conduct comparative clinical effectiveness research, along with funding for such research; and
- a mandatory nondeductible payment for employers with 50 or more full-time employees (or equivalents) who fail to provide certain minimum health insurance coverage for such employees and their dependents, beginning in 2015 (pursuant to relief enacted by the Treasury Department).

The Affordable Care Act also establishes an Independent Payment Advisory Board, or IPAB, to reduce the per capita rate of growth in Medicare spending. Beginning in 2014, IPAB is mandated to propose changes in Medicare payments if it determines that the rate of growth of Medicare expenditures exceeds target growth rates. The IPAB has broad discretion to propose policies to reduce expenditures, which may have a negative impact on payment rates for pharmaceutical products. A proposal made by the IPAB is required to be implemented by CMS unless Congress adopts a proposal with savings greater than those proposed by the IPAB. IPAB proposals may impact payments for physician and free-standing services beginning in 2015 and for hospital services beginning in 2020.

In addition, other legislative changes have been proposed and adopted since the Affordable Care Act was enacted. In August 2011, President Obama signed into law the Budget Control Act of 2011, which, among other things, created the Joint Select Committee on Deficit Reduction to recommend proposals in spending reductions to Congress. The Joint Select Committee did not achieve its targeted deficit reduction of an amount greater than $1.2 trillion for the years 2013 through 2021, triggering the legislation's automatic reductions to several government programs. These reductions include aggregate reductions to Medicare payments to healthcare providers of up to 2.0% per fiscal year, starting in 2013. In January 2013, President Obama signed into law the American Taxpayer Relief Act of 2012, which, among other things, reduced Medicare payments to several categories of healthcare providers and increased the statute of limitations period for the government to recover overpayments to providers from three to five years. These new laws may result in additional reductions in Medicare and other healthcare funding, which could have a material adverse effect on our customers and accordingly, our financial operations.

We anticipate that the Affordable Care Act will result in additional downward pressure on coverage and the price that we receive for any approved product, and could seriously harm our business. Any reduction in reimbursement from Medicare and other government programs may result in a similar reduction in payments from private payers. The implementation of cost containment measures or other healthcare reforms may prevent us from being able to generate

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revenue, attain profitability, or commercialize our products. In addition, it is possible that there will be further legislation or regulation that could harm our business, financial condition and results of operations.

Coverage and Reimbursement

Significant uncertainty exists as to the coverage and reimbursement status of any drug products for which we obtain regulatory approval. In the United States and markets in other countries, sales of any products for which we receive regulatory approval for commercial sale will depend in part on the availability of reimbursement from third-party payers. Third-party payers include government health administrative authorities, managed care providers, private health insurers and other organizations. The process for determining whether a payer will provide coverage for a drug product may be separate from the process for setting the price or reimbursement rate that the payer will pay for the drug product. Third-party payers may limit coverage to specific drug products on an approved list, or formulary, which might not include all of the FDA-approved drugs for a particular indication. Third-party payers are increasingly challenging the price and examining the medical necessity and cost-effectiveness of medical products and services, in addition to their safety and efficacy. We may need to conduct expensive pharmacoeconomic studies in order to demonstrate the medical necessity and cost-effectiveness of our products, in addition to the costs required to obtain FDA approvals. Ganaxolone may not be considered by payers to be medically necessary or cost-effective for particular diseases or conditions. A payer's decision to provide coverage for a drug product does not imply that an adequate reimbursement rate will be approved. Adequate third-party reimbursement may not be available to enable us to maintain price levels sufficient to realize an appropriate return on our investment in product development.

In 2003, the United States Congress enacted legislation providing Medicare Part D, which became effective at the beginning of 2006. Government payment for some of the costs of prescription drugs may increase demand for any products for which we receive marketing approval. However, to obtain payments under this program, we would be required to sell products to Medicare recipients through prescription drug plans operating pursuant to this legislation. These plans will likely negotiate discounted prices for our products. Federal, state and local governments in the United States continue to consider legislation to limit the growth of healthcare costs, including the cost of prescription drugs. Future legislation could limit payments for pharmaceuticals such as the product candidates that we are developing.

Different pricing and reimbursement schemes exist in other countries. In the European Union, governments influence the price of pharmaceutical products through their pricing and reimbursement rules and control of national healthcare systems that fund a large part of the cost of those products to consumers. Some jurisdictions operate positive and negative list systems under which products may only be marketed once a reimbursement price has been agreed upon. To obtain reimbursement or pricing approval, some of these countries may require the completion of clinical studies that compare the cost-effectiveness of a particular product candidate to currently available therapies. Other member states allow companies to fix their own prices for medicines, but monitor and control company profits. The downward pressure on healthcare costs in general, particularly prescription drugs, has become more intense. As a result, increasingly high barriers are being erected to the entry of new products. The European Union provides options for its member states to restrict the range of medicinal products for which their national health insurance systems provide reimbursement and to control the prices of medicinal products for human use. A member state may approve a specific price for the medicinal product or it may instead adopt a system of direct or indirect controls on the profitability of the company placing the medicinal product on the market. We may face competition for ganaxolone from lower-priced products in foreign countries that have placed price controls on pharmaceutical products. In addition, in some countries, cross-border imports from low-priced markets exert a commercial pressure on pricing within a country.

The marketability of any products for which we receive regulatory approval for commercial sale may suffer if the government and third-party payers fail to provide adequate coverage and reimbursement. In addition, an increasing emphasis on managed care in the United States has increased and will continue to increase the pressure on pharmaceutical pricing. Coverage policies and third-party reimbursement rates may change at any time.

Even if favorable coverage and reimbursement status is attained for one or more products for which we receive regulatory approval, less favorable coverage policies and reimbursement rates may be implemented in the future.

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Other Healthcare Laws and Compliance Requirements

The federal Anti-Kickback Statute prohibits, among other things, knowingly and willfully offering, paying, soliciting or receiving remuneration to induce or in return for purchasing, leasing, ordering or arranging for the purchase, lease or order of any healthcare item or service reimbursable under Medicare, Medicaid or other federally financed healthcare programs. This statute has been interpreted to apply to arrangements between pharmaceutical manufacturers on one hand and prescribers, purchasers, and formulary managers on the other. Although there are a number of statutory exemptions and regulatory safe harbors protecting some business arrangements from prosecution, the exemptions and safe harbors are drawn narrowly and practices that involve remuneration intended to induce prescribing, purchasing or recommending may be subject to scrutiny if they do not qualify for an exemption or safe harbor. Our practices may not in all cases meet all of the criteria for safe harbor protection from federal Anti-Kickback Statute liability. The reach of the Anti-Kickback Statute was broadened by the Affordable Care Act, which, among other things, amends the intent requirement of the federal Anti-Kickback Statute. Pursuant to the statutory amendment, a person or entity no longer needs to have actual knowledge of this statute or specific intent to violate it in order to have committed a violation. In addition, the Affordable Care Act 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 civil False Claims Act (discussed below) 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 or 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. As a result of a modification made by the Fraud Enforcement and Recovery Act of 2009, a claim includes “any request or demand” for money or property presented to the United States government. Recently, 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 the product for unapproved, and thus non-reimbursable, uses. The Health Insurance Portability and Accountability Act of 1996, or HIPAA, created new federal criminal statutes that prohibit knowingly and willfully executing a scheme to defraud any healthcare benefit program, including private third-party payers 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. Also, 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 payer.

In addition, we may 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, or HITECH, and its implementing regulations, imposes 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”—independent contractors or agents of covered entities that receive or obtain 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 specified circumstances, many of which differ from each other in significant ways and may not have the same effect, thus complicating compliance efforts.

In the United States our activities are potentially subject to additional regulation by various federal, state and local authorities in addition to the FDA, including CMS, other divisions of HHS (for example, the Office of Inspector General), the DOJ and individual United States Attorney offices within the DOJ, and state and local governments. If a drug product is reimbursed by Medicare or Medicaid, pricing and rebate programs must comply with, as applicable, The Medicare Prescription Drug, Improvement, and Modernization Act of 2003, or Medicare Modernization Act, as well as the Medicaid rebate requirements of the Omnibus Budget Reconciliation Act of 1990, or the OBRA, and the Veterans

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Health Care Act of 1992, or the VHCA, each as amended. Among other things, the OBRA requires drug manufacturers to pay rebates on prescription drugs to state Medicaid programs and empowers states to negotiate rebates on pharmaceutical prices, which may result in prices for our future products that will likely be lower than the prices we might otherwise obtain. If products are made available to authorized users of the Federal Supply Schedule of the General Services Administration, additional laws and requirements apply. Under the VHCA, drug companies are required to offer some drugs at a reduced price to a number of federal agencies including the United States Department of Veterans Affairs and the DoD, the Public Health Service and some private Public Health Service designated entities in order to participate in other federal funding programs including Medicaid. Recent legislative changes require that discounted prices be offered for specified DoD purchases for its TRICARE program via a rebate system. Participation under the VHCA requires submission of pricing data and calculation of discounts and rebates pursuant to complex statutory formulas, as well as the entry into government procurement contracts governed by the Federal Acquisition Regulation.

Because of the breadth of these laws and the narrowness of available statutory and regulatory exemptions, it is possible that some of our business activities could be subject to challenge under one or more of such laws. If our operations are found to be in violation of any of the federal and state laws described above or any other governmental regulations that apply to us, we may be subject to penalties, including criminal and significant civil monetary penalties, damages, fines, imprisonment, exclusion from participation in government programs, injunctions, recall or seizure of products, total or partial suspension of production, denial or withdrawal of pre-marketing product approvals, private “qui tam” actions brought by individual whistleblowers in the name of the government or refusal to allow us to enter into supply contracts, including government contracts, and the curtailment or restructuring of our operations, any of which could adversely affect our ability to operate our business and our results of operations. To the extent that any of our products 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, and implementation of corporate compliance programs and reporting of payments or transfers of value to healthcare professionals.

In order to distribute products commercially, we must comply with state laws that require the registration of manufacturers and wholesale distributors of pharmaceutical products in a state, including, in some states, manufacturers and distributors who ship products into the state even if such manufacturers or distributors have no place of business within the state. Some states also impose requirements on manufacturers and distributors to establish the pedigree of product in the chain of distribution, including some states that require manufacturers and others to adopt new technology capable of tracking and tracing product as it moves through the distribution chain. In addition, in November 2013, the Drug Quality and Security Act became law and establishes requirements to facilitate the tracing of prescription drug products through the pharmaceutical supply distribution chain. This law includes a number of new requirements that will be implemented over time and will require us to devote additional resources to satisfy these requirements. Several states have enacted legislation requiring pharmaceutical companies to, among other things, establish marketing compliance programs, file periodic reports with the state, make periodic public disclosures on sales, marketing, pricing, clinical studies and other activities, and/or register their sales representatives, as well as to prohibit pharmacies and other healthcare entities from providing specified physician prescribing data to pharmaceutical companies for use in sales and marketing, and to prohibit other specified sales and marketing practices. All of our activities are potentially subject to federal and state consumer protection and unfair competition laws.

Research and Development

Conducting research and development is central to our business model. We have invested and expect to continue to invest significant time and capital in our research and development operations. Our research and development expenses were $28.4 million, 12.4 million and $22.0 million in 2018, 2017 and 2016, respectively.

Employees

As of December 31, 2018, we had 28 full-time employees and one part time employee. In addition to our employees, we contract with third-parties for the conduct of certain clinical development, manufacturing, accounting and administrative activities. We anticipate increasing the number of our employees. We have no collective bargaining agreements with our employees, and none are represented by labor unions.

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Corporate Information

We were incorporated in Delaware in August 2003. Our principal executive offices are located at 170 N Radnor Chester Rd, Suite 250, Radnor, Pennsylvania 19087 and our telephone number is (484) 801-4670. Our website address is www.marinuspharma.com. The inclusion of our website address is, in each case, intended to be an inactive textual reference only and not an active hyperlink to our website. The information contained in, or that can be accessed through, our website is not part of this Annual Report on Form 10-K.

Item 1A. Risk Factors

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

We commenced operations in 2003 and our operations to date have been limited to conducting product development activities for ganaxolone and performing research and development with respect to our clinical and preclinical programs. In addition, as a clinical stage pharmaceutical company, we have not yet demonstrated an ability to successfully overcome many of the risks and uncertainties frequently encountered by companies in new and rapidly evolving fields, particularly in the pharmaceutical area. Nor have we demonstrated an ability to obtain regulatory approval to commercialize any of our product candidates. Consequently, any predictions about our future performance may not be as accurate as they would be if we had a history of successfully developing and commercializing pharmaceutical products.

We have incurred significant operating losses since our inception, including a net loss of $36.7 million for the year ended December 31, 2018. As of December 31, 2018, we had an accumulated deficit of $181.5 million. 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. Our losses have resulted principally from costs incurred in our research and development activities. We anticipate that our operating losses will substantially increase over the next several years as we execute our plan to expand our research, development and commercialization activities, including the clinical development and planned commercialization of our product candidate, ganaxolone. In addition, if we obtain regulatory approval of ganaxolone, we may incur significant sales and marketing expenses. Because of the numerous risks and uncertainties associated with developing pharmaceutical products, we are unable to predict the extent of any future losses or whether or when we will become profitable, if ever.

We have not generated any revenue to date from product sales. We may never achieve or sustain profitability, which could depress the market price of our common stock, and could cause you to lose all or a part of your investment.

To date, we have no products approved for commercial sale and have not generated any revenue from sales of any of our product candidates, and we do not know when, or if, we will generate revenues in the future. Our ability to generate revenue from product sales and achieve profitability will depend upon our ability to successfully gain regulatory approval and commercialize ganaxolone or other product candidates that we may develop, in-license or acquire in the future. Even if we obtain regulatory approval for ganaxolone, we do not know when we will generate revenue from product sales, if at all. Our ability to generate revenue from product sales from ganaxolone or any other future product candidates also depends on a number of additional factors, including our ability to:

· successfully complete development activities, including enrollment of study participants, completion of the necessary clinical studies and attainment of clinical study results that will support regulatory approvals;
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complete and submit NDAs to the FDA and obtain regulatory approval for indications for which there is a commercial market;

- complete and submit applications to, and obtain regulatory approval from, foreign regulatory authorities;
- make or have made commercial quantities of our products at acceptable cost levels;

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- develop a commercial organization capable of manufacturing, selling, marketing and distributing any products we intend to sell ourselves in the markets in which we choose to commercialize on our own;
- find suitable partners to help us market, sell and distribute our approved products in other markets; and
- obtain adequate pricing, coverage and reimbursement from third parties, including government and private payers.

In addition, because of the numerous risks and uncertainties associated with product development, including that ganaxolone may not advance through development or achieve the endpoints of applicable clinical studies, we are unable to predict the timing or amount of increased expenses, or if or when we will be able to achieve or maintain profitability. Even if we are able to complete the development and regulatory process for ganaxolone, we anticipate incurring significant costs associated with commercializing ganaxolone.

Even if we are able to generate revenue from the sale of ganaxolone or any future commercial products, we may not become profitable and will need to obtain additional funding to continue operations. If we fail to become profitable or are unable to sustain profitability on a continuing basis, and we are not successful in obtaining additional funding, then we may be unable to continue our operations at planned levels, or at all, which would likely materially and adversely affect the market price of our common stock.

We will require additional capital to fund our operations and if we fail to obtain necessary financing, we may be unable to complete the development and commercialization of ganaxolone.

Our operations have consumed substantial amounts of cash since inception. We expect to continue to spend substantial amounts to advance the clinical and regulatory development of ganaxolone, if approved, and commercialize ganaxolone. We will require additional capital for the further development and potential commercialization of ganaxolone and may also need to raise additional funds sooner should we choose to accelerate development of ganaxolone. If we are unable to raise capital when needed or on attractive terms, we could be forced to delay, reduce or eliminate our research and development programs or any future commercialization efforts.

We believe that our cash, cash equivalents and investments as of December 31, 2018, will enable us to fund our operating expenses and capital expenditure requirements into 2021. We have based this estimate on assumptions that may prove to be wrong, and we could exhaust our available capital resources sooner than we currently expect. Our future funding requirements, both near and long-term, will depend on many factors, including, but not limited to the:

- initiation, progress, timing, costs and results of preclinical studies and clinical studies, including patient enrollment in such studies, for ganaxolone or any other future product candidates;
- clinical development plans we establish for ganaxolone and any other future product candidates;
- obligation to make royalty and non-royalty sublicense receipt payments to third-party licensors, if any, under our licensing agreements;
- number and characteristics of product candidates that we discover or in-license and develop;
- outcome, timing and cost of regulatory review by the FDA and comparable foreign regulatory authorities, including the potential for the FDA or comparable foreign regulatory authorities to require that we perform more studies than those that we currently expect;
- costs of filing, prosecuting, defending and enforcing any patent claims and maintaining and enforcing other intellectual property rights;
- effects of competing technological and market developments;

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- costs and timing of the implementation of commercial-scale manufacturing activities; and
- costs and timing of establishing sales, marketing and distribution capabilities for any product candidates for which we may receive regulatory approval.

If we are unable to expand our operations or otherwise capitalize on our business opportunities due to a lack of capital, our ability to become profitable will be compromised. Failure to progress our product development or commercialization of ganaxolone as anticipated will have a negative effect on our business, future prospects and ability to obtain further financing on acceptable terms, if at all, and the value of the enterprise.

Raising additional capital could dilute our stockholders, restrict our operations or require us to relinquish rights to ganaxolone or any other future product candidates.

Until we can generate substantial revenue from product sales, if ever, we expect to seek additional capital through a combination of private and public equity offerings, debt financings, strategic collaborations and alliances and licensing arrangements. To the extent that we raise additional capital through the sale of equity or convertible debt securities, the ownership interests of stockholders will be diluted, and the terms may include liquidation or other preferences that adversely affect the rights of stockholders. Debt financing, if available, may involve agreements that include liens or restrictive covenants limiting our ability to take important actions, such as incurring additional debt, making capital expenditures or declaring dividends. If we raise additional funds through strategic collaborations and alliances or licensing arrangements with third parties, we may have to relinquish valuable rights to ganaxolone or any other future product candidates in particular countries, or grant licenses on terms that are not favorable to us. If we are unable to raise additional funds through equity or debt financing when needed, we may be required to delay, limit, reduce or terminate our product development or commercialization efforts or grant rights to develop and market ganaxolone or any other future product candidates that we would otherwise prefer to develop and market ourselves.

We intend to expend our limited resources to pursue our sole clinical stage product candidate, ganaxolone, and may fail to capitalize on other indications, technologies or product candidates that may be more profitable or for which there may be a greater likelihood of success.

Because we have limited financial and managerial resources, we are focusing on research programs relating to ganaxolone, which concentrates the risk of product failure in the event ganaxolone proves to be ineffective or inadequate for clinical development or commercialization in this indication. As a result, we may forego or delay pursuit of opportunities for other technologies or product candidates that later could prove to have greater commercial potential. We may be unable to capitalize on viable commercial products or profitable market opportunities as a result of our resource allocation decisions. Our spending on proprietary research and development programs relating to ganaxolone may not yield any commercially viable products. If we do not accurately evaluate the commercial potential or target market for ganaxolone, we may relinquish valuable rights to ganaxolone through collaboration, licensing or other royalty arrangements in cases in which it would have been more advantageous for us to retain sole development and commercialization rights to ganaxolone.

Risks Related to Our Business and Development of Our Product

Our future success is dependent on the successful clinical development, regulatory approval and commercialization of ganaxolone, which is currently undergoing four clinical studies and will require significant capital resources and years of additional clinical development effort.

We do not have any products that have gained regulatory approval. Currently, our only clinical stage product candidate is ganaxolone. As a result, our business is dependent on our ability to successfully complete clinical development of, obtain regulatory approval for, and, if approved, successfully commercialize ganaxolone in a timely manner. We cannot commercialize ganaxolone in the United States without first obtaining regulatory approval from

the FDA; similarly, we cannot commercialize ganaxolone outside of the United States without obtaining regulatory approval from comparable foreign regulatory authorities. Before obtaining regulatory approvals for the commercial sale of ganaxolone for a target indication, we must demonstrate with substantial evidence gathered in preclinical studies and

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clinical studies, generally including two adequate and well-controlled clinical studies, and, with respect to approval in the United States, to the satisfaction of the FDA, that ganaxolone is safe and effective for use for that target indication and that the manufacturing facilities, processes and controls are adequate. Even if ganaxolone were to obtain approval from the FDA and comparable foreign regulatory authorities, any approval might contain significant limitations, such as restrictions as to specified age groups, warnings, precautions or contraindications, or may be subject to burdensome post-approval study or risk management requirements. If we are unable to obtain regulatory approval for ganaxolone in one or more jurisdictions, or any approval contains significant limitations, we may not be able to obtain sufficient funding or generate sufficient revenue to continue the development of any other product candidate that we may in-license, develop or acquire in the future. Furthermore, even if we obtain regulatory approval for ganaxolone, we will still need to develop a commercial organization, establish commercially viable pricing and obtain approval for adequate reimbursement from third-party and government payers. If we are unable to successfully commercialize ganaxolone, we may not be able to earn sufficient revenue to continue our business.

Because the results of preclinical studies or earlier clinical studies are not necessarily predictive of future results, ganaxolone may not have favorable results in later preclinical studies or clinical studies or receive regulatory approval.

Success in preclinical studies and early clinical studies does not ensure that later studies will generate adequate data to demonstrate the efficacy and safety of ganaxolone. A number of companies in the pharmaceutical and biotechnology industries, including those with greater resources and experience, have suffered significant setbacks in preclinical studies and clinical studies, even after seeing promising results in earlier studies and studies. For example, while ganaxolone showed statistical separation from placebo in a Phase 2 study in adjunctive treatment of adults with focal onset seizures, ganaxolone failed to show a similar statistically significant separation in a Phase 3 study for the same indication. As a result, we discontinued our program in adult focal onset seizures and began to focus our efforts on advancing ganaxolone in postpartum depression, refractory status epilepticus, and pediatric orphan epilepsy indications. We do not know whether the clinical studies we may conduct will demonstrate adequate efficacy and safety to result in regulatory approval to market ganaxolone in any particular jurisdiction or indication. If clinical studies underway or conducted in the future do not produce favorable results, our ability to achieve regulatory approval for ganaxolone may be adversely impacted.

The therapeutic efficacy and safety of ganaxolone are unproven, and we may not be able to successfully develop and commercialize ganaxolone in the future.

Ganaxolone is a novel compound and its potential therapeutic benefit is unproven. Our ability to generate revenue from ganaxolone, which we do not expect will occur for at least the next several years, if ever, will depend heavily on our successful development and commercialization after regulatory approval, which is subject to many potential risks and may not occur. Ganaxolone may interact with human biological systems in unforeseen, ineffective or harmful ways. If ganaxolone is associated with undesirable side effects or has characteristics that are unexpected, we may need to abandon its development or limit 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 early stage testing for treating the target indications for ganaxolone have later been found to cause side effects that prevented further development of the compound. As a result of these and other risks described herein that are inherent in the development of novel therapeutic agents, we may never successfully develop, enter into or maintain third-party licensing or collaboration transactions with respect to, or successfully commercialize, ganaxolone, in which case we will not achieve profitability and the value of our stock may decline.

Clinical development of product candidates involves a lengthy and expensive process with an uncertain outcome.

Clinical testing is expensive, can take many years to complete, and is inherently uncertain as to outcome. Failure can occur at any time during the clinical study process.

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We may experience delays in our ongoing or future clinical studies and we do not know whether planned clinical studies will begin or enroll subjects on time, need to be redesigned or be completed on schedule, if at all. There can be no assurance that the FDA or other foreign regulatory authorities will not put clinical studies of ganaxolone on clinical hold now or in the future. Clinical studies may be delayed, suspended or prematurely terminated for a variety of reasons, such as:

- delay or failure in reaching agreement with the FDA or a comparable foreign regulatory authority on a study design that we are able to execute;
- delay or failure in obtaining authorization to commence a study or inability to comply with conditions imposed by a regulatory authority regarding the scope or design of a clinical study;
- delay or failure in reaching agreement on acceptable terms with prospective CROs and clinical study sites, the terms of which can be subject to extensive negotiation and may vary significantly among different CROs and study sites;
- delay or failure in obtaining institutional review board (IRB) approval or the approval of other reviewing entities, including comparable foreign regulatory authorities, to conduct a clinical study at each site;
- withdrawal of clinical study sites from our clinical studies as a result of changing standards of care or the ineligibility of a site to participate in our clinical studies;
- delay or failure in recruiting and enrolling suitable study subjects to participate in a study;
- delay or failure in study subjects completing a study or returning for post-treatment follow-up;
- clinical sites and investigators deviating from a study protocol, failing to conduct the study in accordance with regulatory requirements, or dropping out of a study;
- inability to identify and maintain a sufficient number of study sites, many of which may already be engaged in other clinical study programs, including some that may be for competing product candidates with the same indication;
- failure of our third-party clinical study managers to satisfy their contractual duties or meet expected deadlines;
- delay or failure in adding new clinical study sites;
- ambiguous or negative interim results or results that are inconsistent with earlier results;
- feedback from the FDA, IRBs, data safety monitoring boards, or a comparable foreign regulatory authority, or results from earlier stage or concurrent preclinical studies and clinical studies, that might require modification to the protocol for the study;
- decision by the FDA, an IRB, a comparable foreign regulatory authority, or us, or recommendation by a data safety monitoring board or comparable foreign regulatory authority, to suspend or terminate clinical studies at any time for safety issues or for any other reason;
- unacceptable risk-benefit profile, unforeseen safety issues or adverse side effects or adverse events;
- failure of a product candidate to demonstrate any benefit;

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- difficulties in manufacturing or obtaining from third parties sufficient quantities of a product candidate for use in clinical studies that meet internal and regulatory standards;
- lack of adequate funding to continue the clinical study, including the incurrence of unforeseen costs due to enrollment delays, requirements to conduct additional clinical studies or increased expenses associated with the services of our CROs and other third parties;
- political developments that affect our ability to develop and obtain approval for ganaxolone, or license rights to develop and obtain approval for ganaxolone, in a foreign country; or
- changes in governmental regulations or administrative actions.

Study subject enrollment, a significant factor in the timing of clinical studies, is affected by many factors including the size and nature of the subject population, the proximity of subjects to clinical sites, the eligibility criteria for the study, the design of the clinical study, ability to obtain and maintain subject consents, risk that enrolled subjects will drop out before completion, competing clinical studies and clinicians' and subjects' perceptions as to the potential advantages of the product candidate being studied in relation to other available therapies, including any new drugs that may be approved or product candidates that may be studied in competing clinical studies for the indications we are investigating. Some of our clinical studies are directed at small patient populations. Patient enrollment in these studies could be particularly challenging. In the past, we have experienced delays in enrolling patients in studies directed at small patient populations. We rely on CROs and clinical study sites to ensure the proper and timely conduct of our clinical studies, and while we have agreements governing their committed activities, we have limited influence over their actual performance.

If we experience delays in the completion of any clinical study of ganaxolone, the commercial prospects of ganaxolone may be harmed, and our ability to generate product revenue from ganaxolone, if approved, will be delayed. In addition, any delays in completing our clinical studies will increase our costs, slow down our development and approval process for ganaxolone and jeopardize our ability to commence product sales and generate revenues. In addition, many of the factors that could cause a delay in the commencement or completion of clinical studies may also ultimately lead to the denial of regulatory approval of ganaxolone.

Ganaxolone may cause undesirable side effects or have other properties that could delay or prevent its regulatory approval, limit the commercial profile of an approved label, or result in significant negative consequences following any marketing approval.

Undesirable side effects caused by ganaxolone could cause us or regulatory authorities to interrupt, delay or halt clinical studies and could result in a restrictive label or the delay or denial of regulatory approval by the FDA or other comparable foreign regulatory authority. Although ganaxolone has generally been well tolerated by subjects in our earlier-stage clinical studies, in some cases there were side effects, and some of the side effects were severe. The most frequent side effects were dizziness, fatigue and somnolence (or drowsiness). More side effects of the Central Nervous System (CNS) were categorized as severe as compared to side effects of other body systems.

If these side effects are reported in future clinical studies, or if other safety or toxicity issues are reported in our future clinical studies, we may not receive approval to market ganaxolone, which could prevent us from ever generating revenue or achieving profitability. Furthermore, although we are currently developing ganaxolone for three indications, negative safety findings in any one indication could force us to delay or discontinue development in other indications. Results of our clinical studies could reveal an unacceptably high severity and prevalence of side effects. In such an event, our clinical studies could be suspended or terminated, and the FDA or comparable foreign regulatory authorities could order us to cease further development, or deny approval, of ganaxolone for any or all targeted indications. Drug-related side effects could affect study subject recruitment or the ability of enrolled subjects to complete our future clinical studies and may result in potential product liability claims.

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In addition, if ganaxolone receives marketing approval, and we or others later identify undesirable side effects caused by ganaxolone, a number of potentially significant negative consequences could result, including:

- we may be forced to suspend marketing of ganaxolone;
- regulatory authorities may withdraw their approvals of ganaxolone;
- regulatory authorities may require additional warnings on the label that could diminish the usage or otherwise limit the commercial success of ganaxolone;
- we may be required to conduct post-marketing studies;
- we could be sued and held liable for harm caused to subjects or patients; and
- our reputation may suffer.

Any of these events could prevent us from achieving or maintaining market acceptance of ganaxolone, if approved.

Even if ganaxolone receives regulatory approval, we may still face regulatory difficulties.

Even if we obtain regulatory approval for ganaxolone, it would be subject to ongoing requirements by the FDA and comparable foreign regulatory authorities governing the manufacture, quality control, further development, labeling, packaging, storage, distribution, safety surveillance, patient registry, import, export, advertising, promotion, recordkeeping and reporting of safety and other post-market information. The safety profile of ganaxolone will continue to be closely monitored by the FDA and comparable foreign regulatory authorities after approval. If new safety information becomes available after approval of ganaxolone, the FDA or comparable foreign regulatory authorities may require labeling changes or establishment of a Risk Evaluation and Mitigation Strategy (REMS) or similar strategy, impose significant restrictions on ganaxolone's indicated uses or marketing, or impose ongoing requirements for potentially costly post-approval studies or post-market surveillance. For example, the label ultimately approved for ganaxolone, if it achieves marketing approval, may include restrictions on use.

In addition, manufacturers of drug products and their facilities are subject to continual review and periodic inspections by the FDA and other regulatory authorities for compliance with current good manufacturing practices (cGMP) and other regulations. If we or a regulatory authority discover previously unknown problems with a product, such as adverse events of unanticipated severity or frequency, or problems with the facility where the product is manufactured, a regulatory authority may impose restrictions on that product, the manufacturing facility or us, including requiring recall or withdrawal of the product from the market or suspension of manufacturing. If we, ganaxolone or the manufacturing facilities for ganaxolone fail to comply with applicable regulatory requirements, a regulatory authority may:

- issue warning letters or untitled letters;
- mandate modifications to promotional materials or require us to provide corrective information to healthcare practitioners;
- require us to enter into a consent decree, which can include imposition of various fines, reimbursements for inspection costs, required due dates for specific actions and penalties for noncompliance;
- seek an injunction or impose civil or criminal penalties or monetary fines;
- suspend or withdraw regulatory approval;

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- suspend any ongoing clinical studies;
- refuse to approve pending applications or supplements to applications filed by us;
- suspend or impose restrictions on operations, including costly new manufacturing requirements; or
- seize or detain products, refuse to permit the import or export of products, or require us to initiate a product recall.

The occurrence of any event or penalty described above may inhibit or preclude our ability to commercialize ganaxolone and generate revenue.

The FDA's and other regulatory authorities' policies may change, and additional government regulations may be enacted that could prevent, limit or delay regulatory approval of ganaxolone. 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 abroad. If we are slow or unable to adapt to changes in existing requirements or the adoption of new requirements or policies, or if we are not able to maintain regulatory compliance, we may lose any marketing approval that we may have obtained, and we may not achieve or sustain profitability, which would adversely affect our business, prospects, financial condition and results of operations.

Advertising and promotion of any product candidate that obtains approval in the United States will be heavily scrutinized by, among others, the FDA, the Department of Justice (DOJ), the Office of Inspector General of the Department of Health and Human Services (HHS), state attorneys general, members of Congress and the public. Violations, including promotion of our products for unapproved or off-label uses, are subject to enforcement letters, inquiries and investigations, and civil and criminal sanctions by the FDA or other government agencies. In addition, advertising and promotion of any product candidate that obtains approval outside of the United States will be heavily scrutinized by comparable foreign regulatory authorities.

In the United States, promoting ganaxolone for unapproved indications can also subject us to false claims litigation under federal and state statutes, and other litigation and/or investigation, which can lead to civil and criminal penalties and fines and agreements that materially restrict the manner in which we promote or distribute our drug products. These false claims statutes include the federal False Claims Act, which allows any individual to bring a lawsuit against a pharmaceutical company on behalf of the federal government alleging submission of false or fraudulent claims, or causing to present such false or fraudulent claims, for payment by a federal program such as Medicare or Medicaid. If the government prevails in the lawsuit, the individual will share in any fines or settlement funds. Since 2004, these False Claims Act lawsuits against pharmaceutical companies have increased significantly in volume and breadth, leading to several substantial civil and criminal settlements based on certain sales practices promoting off-label drug uses. This increasing focus and scrutiny has increased the risk that a pharmaceutical company will have to defend a false claim action, pay settlement fines or restitution, agree to comply with burdensome reporting and compliance obligations, and be excluded from the Medicare, Medicaid and other federal and state healthcare programs. If we do not lawfully promote our approved products, we may become subject to such litigation and/or investigation and, if we are not successful in defending against such actions, those actions could compromise our ability to become profitable.

Failure to obtain regulatory approval in international jurisdictions would prevent ganaxolone from being marketed in these jurisdictions.

In order to market and sell our products in the European Union and many other jurisdictions, we must obtain separate marketing approvals and comply with numerous and varying regulatory requirements. The approval procedure varies among countries and can involve additional testing. The time required to obtain approval may differ substantially from that required to obtain FDA approval. The regulatory approval process outside the United States generally includes all of the risks associated with obtaining FDA approval. In addition, many countries outside the United States require that a product be approved for reimbursement before the product can be approved for sale in that country. We may not obtain approvals from regulatory authorities outside the United States on a timely basis, if at all. Approval by the FDA

does not ensure approval by regulatory authorities in other countries or jurisdictions, and approval by one regulatory

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authority outside the United States does not ensure approval by regulatory authorities in other countries or jurisdictions or by the FDA. We may not be able to file for marketing approvals and may not receive necessary approvals to commercialize our products in any market. If we are unable to obtain approval of ganaxolone by regulatory authorities in the European Union or another country or jurisdiction, the commercial prospects of ganaxolone may be significantly diminished and our business prospects could decline.

We may not be able to obtain orphan drug exclusivity for ganaxolone or any other product candidates for which we seek it, which could limit the potential profitability of ganaxolone or such other product candidates.

Regulatory authorities in some jurisdictions, including the United States and Europe, may designate drugs for relatively small patient populations as orphan drugs. Under the Orphan Drug Act, the FDA may designate a product as an orphan drug if it is a drug intended to treat a rare disease or condition, which is generally defined as a patient population of fewer than 200,000 individuals in the United States. Generally, if a product with an orphan drug designation subsequently receives the first marketing approval for an indication for which it receives the designation, then the product is entitled to a period of marketing exclusivity that precludes the applicable regulatory authority from approving another marketing application for the same drug for the same indication for the exclusivity period except in limited situations. For purposes of small molecule drugs, the FDA defines “same drug” as a drug that contains the same active moiety and is intended for the same use as the drug in question. A designated orphan drug may not receive orphan drug exclusivity if it is approved for a use that is broader than the indication for which it received orphan designation.

We have received orphan drug designation for treating CDD, PCDH19-RE, FXS and SE with ganaxolone and expect that we may in the future pursue orphan drug designations for ganaxolone for one or more additional indications. However, obtaining an orphan drug designation can be difficult and we may not be successful in doing so for additional ganaxolone indications or any future product candidates. Even if we were to obtain orphan drug exclusivity for a product candidate, that exclusivity may not effectively protect the product from the competition of different drugs for the same condition, which could be approved during the exclusivity period. In addition, after an orphan drug is approved, the FDA could subsequently approve another application for the same drug for the same indication if the FDA concludes that the later drug is shown to be safer, more effective or makes a major contribution to patient care. Orphan drug exclusive marketing rights in the United States also may be lost if the FDA later determines that the request for designation was materially defective or if the manufacturer is unable to assure sufficient quantity of the drug to meet the needs of patients with the rare disease or condition. The failure to obtain an orphan drug designation for any product candidates we may develop, the inability to maintain that designation for the duration of the applicable period, or the inability to obtain or maintain orphan drug exclusivity could reduce our ability to make sufficient sales of the applicable product candidate to balance our expenses incurred to develop it, which would have a negative impact on our operational results and financial condition.

Our business and operations would suffer in the event of computer system failures.

Despite the implementation of security measures, our internal computer systems, and those of our CROs and other third parties on which we rely, are vulnerable to damage from computer viruses, unauthorized access, natural disasters, fire, terrorism, war and telecommunication and electrical failures. In addition, our systems safeguard important confidential personal data regarding subjects enrolled in our clinical studies. If a disruption event were to occur and cause interruptions in our operations, it could result in a material disruption of our drug development programs. For example, the loss of data relating to completed, ongoing or planned clinical studies could result in delays in our regulatory approval efforts and cause us to incur significant additional costs to recover or reproduce the data. To the extent that any disruption or security breach results in a loss of or damage to our data or applications, or inappropriate disclosure of confidential or proprietary information, we could incur liability and the further development of ganaxolone could be delayed.

Business disruptions could seriously harm our future revenue and financial condition and increase our costs and expenses.

Our operations could be subject to earthquakes, power shortages, telecommunications failures, water shortages, floods, hurricanes, typhoons, fires, extreme weather conditions, medical epidemics and other natural or man-made

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disasters or business interruptions, for which we are predominantly self-insured. The occurrence of any of these business disruptions could seriously harm our operations and financial condition and increase our costs and expenses. We rely on third-party manufacturers to produce ganaxolone. Our ability to obtain clinical supplies of ganaxolone could be disrupted if the operations of these suppliers are affected by a man-made or natural disaster or other business interruption. The ultimate impact on us, our significant suppliers and our general infrastructure of being in certain geographical areas is unknown, but our operations and financial condition could suffer in the event of a major earthquake, fire or other natural disaster.

Risks Related to the Commercialization of Our Product

Our commercial success depends upon attaining significant market acceptance of ganaxolone, if approved, among physicians, patients, government and private payers and others in the medical community.

Even if ganaxolone receives regulatory approval, it may not gain market acceptance among physicians, patients, government and private payers, or others in the medical community. Market acceptance of ganaxolone, if we receive approval, depends on a number of factors, including the:

- efficacy and safety of ganaxolone, or ganaxolone administered with other drugs, each as demonstrated in clinical studies and post-marketing experience;
- clinical indications for which ganaxolone is approved;
- acceptance by physicians and patients of ganaxolone as a safe and effective treatment;
- potential and perceived advantages of ganaxolone over alternative treatments;
- safety of ganaxolone seen in a broader patient group, including its use outside the approved indications should physicians choose to prescribe for such uses;
- prevalence and severity of any side effects;
- product labeling or product insert requirements of the FDA or other regulatory authorities;
- timing of market introduction of ganaxolone as well as competitive products;
- cost of treatment in relation to alternative treatments;
- availability of coverage and adequate reimbursement and pricing by government and private payers;
- relative convenience and ease of administration; and
- effectiveness of our sales and marketing efforts.

If ganaxolone is approved but fails to achieve market acceptance among physicians, patients, government or private payers or others in the medical community, or the products or product candidates that are being administered with ganaxolone are restricted, withdrawn or recalled, or fail to be approved, as the case may be, we may not be able to generate significant revenues, which would compromise our ability to become profitable.

If we are unable to establish sales and marketing capabilities or enter into agreements with third parties to market and sell ganaxolone, we may be unable to generate any revenue.

We do not currently have an organization for the sale, marketing and distribution of pharmaceutical products and the cost of establishing and maintaining such an organization may exceed the cost-effectiveness of doing so. In order

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to market any products that may be approved by the FDA and comparable foreign regulatory authorities, we must build our sales, marketing, managerial and other non-technical capabilities or make arrangements with third parties to perform these services. If we are unable to establish adequate sales, marketing and distribution capabilities, whether independently or with third parties, we may not be able to generate product revenue and may not become profitable. We will be competing with many companies that currently have extensive and well-funded sales and marketing operations. Without an internal commercial organization or the support of a third party to perform sales and marketing functions, we may be unable to compete successfully against these more established companies. To the extent we rely on third parties to commercialize ganaxolone, if approved, we may have little or no control over the marketing and sales efforts of such third parties, and our revenues from product sales may be lower than if we had commercialized ganaxolone ourselves.

A variety of risks associated with marketing ganaxolone internationally could materially adversely affect our business.

We plan to seek regulatory approval for ganaxolone outside of the United States, and, accordingly, we expect that we will be subject to additional risks related to operating in foreign countries if we obtain the necessary approvals, including:

- differing regulatory requirements in foreign countries;
- the potential for so-called parallel importing, which is what happens when a local seller, faced with high or higher local prices, opts to import goods from a foreign market (with low or lower prices) rather than buying them locally;
- unexpected changes in tariffs, trade barriers, price and exchange controls and other regulatory requirements;
- 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 taxes, including withholding of payroll taxes;
- foreign currency fluctuations, which could result in increased operating expenses and reduced revenues, and other obligations incident to doing business in another country;
- difficulties staffing and managing foreign operations;
- workforce uncertainty in countries where labor unrest is more common than in the United States;
- challenges enforcing our contractual and intellectual property rights, especially in those foreign countries that do not respect and protect intellectual property rights to the same extent as the United States;
- production shortages resulting from any events affecting raw material supply or manufacturing capabilities abroad; and
- business interruptions resulting from geo-political actions, including war and terrorism.

These and other risks associated with our international operations may materially adversely affect our ability to attain or maintain profitable operations.

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Even if we are able to commercialize ganaxolone, it may not receive coverage and adequate reimbursement from third-party payers, which could harm our business.

Our ability to commercialize ganaxolone successfully will depend, in part, on the extent to which coverage and adequate reimbursement for ganaxolone and related treatments will be available from government health administration authorities, private health insurers and other organizations. Government authorities and third-party payers, such as private health insurers and health maintenance organizations, determine which medications they will cover and establish reimbursement levels. A primary trend in the United States healthcare industry and elsewhere is cost containment. Government authorities and third-party payers have attempted to control costs by limiting coverage and the amount of reimbursement for particular medications. Increasingly, third-party payers are requiring that drug companies provide them with predetermined discounts from list prices and are challenging the prices charged for drugs. Third-party payers may also seek additional clinical evidence, beyond the data required to obtain marketing approval, demonstrating clinical benefits and value in specific patient populations before covering ganaxolone for those patients. We cannot be sure that coverage and adequate reimbursement will be available for ganaxolone and, if reimbursement is available, what the level of reimbursement will be. Coverage and reimbursement may impact the demand for, or the price of, ganaxolone, if we obtain marketing approval. If reimbursement is not available or is available only at limited levels, we may not be able to successfully commercialize ganaxolone even if we obtain marketing approval.

There may be significant delays in obtaining coverage and reimbursement for newly approved drugs, and coverage may be more limited than the purposes for which the drug is approved by the FDA or comparable foreign regulatory authorities. Moreover, eligibility for coverage and reimbursement does not imply that any drug will be paid for in all cases or at a rate that covers our costs, including research, development, manufacture, sale and distribution. Interim reimbursement levels for new drugs, if applicable, may also not be sufficient to cover our costs and may only be temporary. Reimbursement rates may vary according to the use of the drug and the clinical setting in which it is used, may be based on reimbursement levels already set for lower cost drugs and may be incorporated into existing payments for other services. Net prices for drugs may be reduced by mandatory discounts or rebates required by government healthcare programs or private payers and by any future relaxation of laws that presently restrict imports of drugs from countries where they may be sold at lower prices than in the United States. Third-party payers often rely upon Medicare coverage policy and payment limitations in setting their own reimbursement policies. Our inability to obtain coverage and profitable reimbursement rates from both government-funded and private payers for any approved products that we develop could have a material adverse effect on our operating results, our ability to raise capital needed to commercialize products and our overall financial condition.

We face substantial competition, which may result in others discovering, developing or commercializing products before or more successfully than we do.

The development and commercialization of new drug products is highly competitive. We face competition with respect to ganaxolone and will face competition with respect to any other product candidates that we may seek to develop or commercialize in the future, from major pharmaceutical companies, specialty pharmaceutical companies and biotechnology companies worldwide. There are a number of large pharmaceutical and biotechnology companies that currently market and sell products or are pursuing the development of products for the treatment of the disease indications for which we are developing ganaxolone. Some of these competitive products and therapies are based on scientific approaches that are the same as, or similar to, our approach, and others are based on entirely different approaches. For example, there are several companies developing product candidates that target the same $GABA_A$, neuroreceptor that we are targeting or that are testing product candidates in the same indications that we are testing. Potential competitors also include academic institutions, government agencies and other public and private research organizations that conduct research, seek patent protection and establish collaborative arrangements for research, development, manufacturing and commercialization.

Ganaxolone is presently being developed as an antiepileptic and neuropsychiatric therapeutic. There are a variety of marketed therapies available for these patients.

Specifically, there are more than 25 approved AEDs available in the United States and worldwide, including the generic products levetiracetam, lamotrigine, carbamazepine, oxcarbazepine, valproic acid and topiramate. Recent market

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entrants include branded products developed by Lundbeck, UCB, Eisai, and Sunovion Pharmaceuticals. In addition, there are several drugs in development for the treatment of pediatric orphan indications, including compounds being developed by GW Pharmaceuticals, Zogenix, Zynerba and Ovid Therapeutics. Sage Therapeutics is developing molecules with a similar mechanism of action as ganaxolone for the treatment of PPD.

Many of the approved drugs are well established therapies or products and are widely accepted by physicians, patients and third-party payers. Insurers and other third-party payers may also encourage the use of generic products. These factors may make it difficult for us to achieve market acceptance at desired levels or in a timely manner to ensure viability of our business.

More established companies may have a competitive advantage over us due to their greater size, cash flows and institutional experience. Compared to us, many of our competitors may have significantly greater financial, technical and human resources.

As a result of these factors, our competitors may obtain regulatory approval of their products before we are able to, which may limit our ability to develop or commercialize ganaxolone. Our competitors may also develop drugs that are safer, more effective, more widely used and cheaper than ours, and may also be more successful than us in manufacturing and marketing their products. These appreciable advantages could render ganaxolone obsolete or non-competitive before we can recover the expenses of ganaxolone’s development and commercialization.

Mergers and acquisitions in the pharmaceutical and biotechnology industries may result in even more resources being concentrated among a smaller number of our competitors. Smaller and other early-stage companies may also prove to be significant competitors, particularly through collaborative arrangements with large and established companies. These third parties compete with us in recruiting and retaining qualified scientific, management and commercial personnel, establishing clinical study sites and subject registration for clinical studies, as well as in acquiring technologies complementary to, or necessary for, our programs.

Product liability lawsuits against us could cause us to incur substantial liabilities and to limit commercialization of ganaxolone or other product candidates that we may develop.

We face an inherent risk of product liability exposure related to the testing of ganaxolone by us or our investigators in human clinical studies and will face an even greater risk if ganaxolone receives regulatory approval and we subsequently commercialize it. Product liability claims may be brought against us by study subjects enrolled in our clinical studies, patients, healthcare providers or others using, administering or selling ganaxolone. If we cannot successfully defend ourselves against claims that ganaxolone caused injuries, we could incur substantial liabilities. Regardless of merit or eventual outcome, liability claims may result in, for example:

- decreased demand for ganaxolone;
- termination of clinical study sites or entire study programs;
- injury to our reputation and significant negative media attention;
- withdrawal of clinical study subjects;
- significant costs to defend the related litigation;
- substantial monetary awards to clinical study subjects or patients;
- loss of revenue;
- diversion of management and scientific resources from our business operations;

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- the inability to commercialize ganaxolone; and
- increased scrutiny and potential investigation by, among others, the FDA, the DOJ, the Office of Inspector General of the HHS, state attorneys general, members of Congress and the public.

We currently have product liability insurance coverage, which may not be adequate to cover all liabilities that we may incur. Insurance coverage is increasingly expensive. We may not be able to maintain insurance coverage at a reasonable cost or in an amount adequate to satisfy any liability that may arise. We intend to expand our product liability insurance coverage to include the sale of commercial products if we obtain marketing approval for ganaxolone, but we may be unable to obtain commercially reasonable product liability insurance for ganaxolone, if approved for marketing. Large judgments have been awarded in class action lawsuits based on drugs that had unanticipated side effects. A successful product liability claim or series of claims brought against us, particularly if judgments exceed our insurance coverage, could decrease our cash and adversely affect our business.

Risks Related to Our Dependence on Third Parties

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

We rely on third-party CROs to monitor and manage data for our ongoing preclinical and clinical programs. We rely on these parties for execution of our preclinical studies and clinical studies, and we control only some aspects of their activities. Nevertheless, we are responsible for ensuring that each of our preclinical studies and clinical studies are conducted in accordance with the applicable protocol and legal, regulatory and scientific requirements and standards, and our reliance on the CROs does not relieve us of our regulatory responsibilities. We also rely on third parties to assist in conducting our preclinical studies in accordance with Good Laboratory Practices (GLP) and the Animal Welfare Act requirements. We and our CROs are required to comply with federal regulations and Good Clinical Practices (GCP), which are international requirements meant to protect the rights and health of subjects that are enforced by the FDA, the Competent Authorities of the Member States of the European Economic Area and comparable foreign regulatory authorities for ganaxolone and any future product candidates in clinical development. Regulatory authorities enforce GCP through periodic inspections of study sponsors, principal investigators and study sites. If we or any of our CROs fail to comply with applicable GCP, the clinical data generated in our clinical studies may be deemed unreliable and the FDA or comparable foreign regulatory authorities may require us to perform additional clinical studies before approving our marketing applications. We cannot assure you that upon inspection by a given regulatory authority, such regulatory authority will determine that any of our clinical studies comply with GCP requirements. In addition, our clinical studies must be conducted with product produced under cGMP requirements. Failure to comply with these regulations may require us to repeat preclinical studies and clinical studies, which would delay the regulatory approval process.

Our CROs are not our employees, and except for remedies available to us under our agreements with such CROs, we cannot control whether or not they devote sufficient time and resources to our ongoing clinical, nonclinical and preclinical programs. If CROs do not successfully carry out their contractual duties or obligations or meet expected deadlines or if the quality or accuracy of the data they obtain is compromised due to the failure to adhere to our protocols, regulatory requirements or for other reasons, our preclinical studies and clinical studies may be extended, delayed or terminated and we may not be able to obtain regulatory approval for or successfully commercialize ganaxolone. As a result, our results of operations and the commercial prospects for ganaxolone would be harmed, our costs could increase and our ability to generate revenue could be delayed.

Because we have relied on third parties, our internal capacity to perform these functions is limited. Outsourcing these functions involves risk that third parties may not perform to our standards, may not produce results in a timely manner or may fail to perform at all. In addition, the use of third-party service providers requires us to disclose our proprietary

information to these parties, which could increase the risk that this information will be misappropriated. We currently have a small number of employees, which limits the internal resources we have available to identify and monitor our third-party providers. To the extent we are unable to identify and successfully manage the performance of third-party service providers in the future, our business may be adversely affected. Though we carefully manage our

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relationships with our CROs, there can be no assurance that we will not encounter 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.

If we lose our relationships with CROs, our drug development efforts could be delayed.

We rely on third-party vendors and CROs for preclinical studies and clinical studies related to our drug development efforts. Switching or adding additional CROs would involve additional cost and requires management time and focus. Our CROs generally have the right to terminate their agreements with us in the event of an uncured material breach. In addition, some of our CROs have an ability to terminate their respective agreements with us, or research projects pursuant to such agreements, if, in the reasonable opinion of the relevant CRO, the safety of the subjects participating in our clinical studies warrants such termination. These agreements or research projects may also be terminated if we make a general assignment for the benefit of our creditors or if we are liquidated. Identifying, qualifying and managing performance of third-party service providers can be difficult, time consuming and cause delays in our development programs. In addition, there is a natural transition period when a new CRO commences work and the new CRO may not provide the same type or level of services as the original provider. If any of our relationships with our third-party CROs terminate, we may not be able to enter into arrangements with alternative CROs or to do so on commercially reasonable terms.

Our experience manufacturing ganaxolone is limited to the needs of our preclinical studies and clinical studies. We have no experience manufacturing ganaxolone on a commercial scale and have no manufacturing facility. We are dependent on third-party manufacturers for the manufacture of ganaxolone as well as on third parties for our supply chain, and if we experience problems with any such third parties, the manufacturing of ganaxolone could be delayed.

We do not own or operate facilities for the manufacture of ganaxolone. We currently have no plans to build our own clinical or commercial scale manufacturing capabilities. We currently rely on contract manufacturing organizations (CMOs) for the chemical manufacture of raw materials and active pharmaceutical ingredients for ganaxolone and other CMOs for the production of the ganaxolone nanoparticulate formulation into capsules, liquid suspension and IV. To meet our projected needs for preclinical and clinical supplies to support our activities through regulatory approval and commercial manufacturing, the CMOs with whom we currently work will need to increase the scale of production. We may need to identify additional CMOs for continued production of supply for ganaxolone. Although alternative third-party suppliers with the necessary manufacturing and regulatory expertise and facilities exist, it could be expensive and take a significant amount of time to arrange for alternative suppliers. If we are unable to arrange for alternative third-party manufacturing sources on commercially reasonable terms, in a timely manner or at all, we may not be able to complete development of ganaxolone, or market or distribute ganaxolone.

Reliance on third-party manufacturers entails risks to which we would not be subject if we manufactured ganaxolone ourselves, including reliance on the third party for regulatory compliance and quality assurance, the possibility of breach of the manufacturing agreement by the third party because of factors beyond our control, including a failure to synthesize and manufacture ganaxolone or any products we may eventually commercialize in accordance with our specifications, and the possibility of termination or nonrenewal of the agreement by the third party, based on its own business priorities, at a time that is costly or damaging to us. In addition, the FDA and other regulatory authorities would require that ganaxolone and any products that we may eventually commercialize be manufactured according to cGMP and similar foreign standards. Any failure by our third-party manufacturers to comply with cGMP or failure to scale up manufacturing processes, including any failure to deliver sufficient quantities of ganaxolone in a timely manner, could lead to a delay in, or failure to obtain, regulatory approval of ganaxolone. In addition, such failure could be the basis for the FDA to issue a warning letter, withdraw approvals for ganaxolone previously granted to us, or take other regulatory or legal action, including recall or seizure of outside supplies of ganaxolone, total or partial suspension of production, suspension of ongoing clinical studies, refusal to approve pending applications or

supplemental applications, detention of product, refusal to permit the import or export of products, injunction, or imposing civil and criminal penalties.

Any significant disruption in our supplier relationships could harm our business. Any significant delay in the supply of ganaxolone or its key materials for an ongoing preclinical study or clinical study could considerably delay

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completion of our preclinical study or clinical study, product testing and potential regulatory approval of ganaxolone. If our manufacturers or we are unable to purchase these key materials after regulatory approval has been obtained for ganaxolone, the commercial launch of ganaxolone would be delayed or there would be a shortage in supply, which would impair our ability to generate revenues from the sale of ganaxolone.

We may elect to enter into licensing or collaboration agreements to partner ganaxolone in territories currently retained by us. Our dependence on such relationships may adversely affect our business.

Because we have limited resources, we may seek to enter into collaboration agreements with other pharmaceutical or biotechnology companies. Any failure by our partners to perform their obligations or any decision by our partners to terminate these agreements could negatively impact our ability to successfully develop, obtain regulatory approvals for and commercialize ganaxolone. In the event we grant exclusive rights to such partners, we would be precluded from potential commercialization of ganaxolone within the territories in which we have a partner. In addition, any termination of our collaboration agreements will terminate the funding we may receive under the relevant collaboration agreement and may impair our ability to fund further development efforts and our progress in our development programs.

Our commercialization strategy for ganaxolone may depend on our ability to enter into agreements with collaborators to obtain assistance and funding for the development and potential commercialization of ganaxolone in the territories in which we seek to partner. Despite our efforts, we may be unable to secure additional collaborative licensing or other arrangements that are necessary for us to further develop and commercialize ganaxolone. Supporting diligence activities conducted by potential collaborators and negotiating the financial and other terms of a collaboration agreement are long and complex processes with uncertain results. Even if we are successful in entering into one or more collaboration agreements, collaborations may involve greater uncertainty for us, as we have less control over certain aspects of our collaborative programs than we do over our proprietary development and commercialization programs. We may determine that continuing a collaboration under the terms provided is not in our best interest, and we may terminate the collaboration. Our potential future collaborators could delay or terminate their agreements, and as a result ganaxolone may never be successfully commercialized.

Further, our potential future collaborators may develop alternative products or pursue alternative technologies either on their own or in collaboration with others, including our competitors, and the priorities or focus of our collaborators may shift such that ganaxolone receives less attention or resources than we would like, or they may be terminated altogether. Any such actions by our potential future collaborators may adversely affect our business prospects and ability to earn revenue. In addition, we could have disputes with our potential future collaborators, such as the interpretation of terms in our agreements. Any such disagreements could lead to delays in the development or commercialization of ganaxolone or could result in time-consuming and expensive litigation or arbitration, which may not be resolved in our favor.

Government funding for certain of our programs adds uncertainty to our research 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 preclinical studies and clinical studies to evaluate ganaxolone in FXS patients have been conducted with the MIND Institute at the University of California, Davis which receives funding from the United States Department of Defense (DoD) for such studies and studies. In addition, our preclinical studies and clinical studies to evaluate ganaxolone in patients suffering from posttraumatic stress disorder (PTSD) have been primarily conducted by the United States Department of Veterans Affairs, which also receives funding from the DoD. Programs funded by the United States government and its agencies, including the DoD, include provisions that confer on the government 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;

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- 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 United States 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; and
- control and potentially prohibit the export of products.

We may not have the right to prohibit the United States 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 United States government. The United States government generally obtains the right to royalty-free use of technologies that are developed under United States 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, 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 liability and to termination of our contracts.

Changes in government budgets and agendas may result in a decreased and de-prioritized emphasis on supporting the development of ganaxolone in patients suffering from certain FXS-associated behavioral symptoms. Any reduction or delay in DoD funding to our collaborators may force us to seek alternative funding in order to progress these programs, which may not be available on non-dilutive terms, terms favorable to us or at all.

If our third-party manufacturers use hazardous and biological materials in a manner that causes injury or violates applicable law, we may be liable for damages.

Our research and development activities involve the controlled use of potentially hazardous substances, including chemical and biological materials by our third-party manufacturers. Our manufacturers are subject to federal, state and local laws and regulations in the United States governing the use, manufacture, storage, handling and disposal of medical, radioactive and hazardous materials. We cannot completely eliminate the risk of contamination or injury

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resulting from medical, radioactive or hazardous materials. As a result of any such contamination or injury we may incur liability or local, city, state or federal authorities may curtail the use of these materials and interrupt our business operations. In the event of an accident, we could be held liable for damages or penalized with fines, and the liability could exceed our resources. We do not have any insurance for liabilities arising from medical radioactive or hazardous materials. Compliance with applicable environmental laws and regulations is expensive, and current or future environmental regulations may impair our research, development and production efforts, which could harm our business, prospects, financial condition or results of operations.

Risks Related to Regulatory Compliance

Recently enacted and future legislation, including potentially unfavorable pricing regulations or other healthcare reform initiatives, may increase the difficulty and cost for us to obtain marketing approval of and commercialize ganaxolone and affect the prices we may obtain.

The regulations that govern, among other things, marketing approvals, coverage, pricing and reimbursement for new drug products vary widely from country to country. In the United States and some foreign jurisdictions, there have been a number of legislative and regulatory changes and proposed changes regarding the healthcare system that could prevent or delay marketing approval of ganaxolone, restrict or regulate post-approval activities and affect our ability to successfully sell ganaxolone, if we obtain marketing approval.

In the United States, the Medicare Prescription Drug, Improvement, and Modernization Act of 2003, or Medicare Modernization Act, changed the way Medicare covers and pays for pharmaceutical products. The legislation expanded Medicare coverage for drug purchases by the elderly and introduced a new reimbursement methodology based on average sales prices for physician administered drugs. In recent years, Congress has considered further reductions in Medicare reimbursement for drugs administered by physicians. The Centers for Medicare and Medicaid Services, the agency that runs the Medicare program, also has the authority to revise reimbursement rates and to implement coverage restrictions for some drugs. Cost reduction initiatives and changes in coverage implemented through legislation or regulation could decrease utilization of and reimbursement for any approved products, which in turn would affect the price we can receive for those products. While the Medicare Modernization Act and Medicare regulations apply only to drug benefits for Medicare beneficiaries, private payers often follow Medicare coverage policy and payment limitations in setting their own reimbursement rates. Therefore, any reduction in reimbursement that results from federal legislation or regulation may result in a similar reduction in payments from private payers.

In March 2010, the Patient Protection and Affordable Care Act and the Health Care and Education Affordability Reconciliation Act of 2010 (Affordable Care Act), a sweeping law intended to broaden access to health insurance, reduce or constrain the growth of healthcare spending, enhance remedies against fraud and abuse, add new transparency requirements for healthcare and health insurance industries, impose new taxes and fees on pharmaceutical and medical device manufacturers and impose additional health policy reforms was signed into law. The Affordable Care Act expanded manufacturers' rebate liability to include covered drugs dispensed to individuals who are enrolled in Medicaid managed care organizations, increased the minimum rebate due for innovator drugs from 15.1% of average manufacturer price (AMP) to 23.1% of AMP and capped the total rebate amount for innovator drugs at 100.0% of AMP. The Affordable Care Act and subsequent legislation also changed the definition of AMP. Furthermore, the Affordable Care Act imposes a significant annual, nondeductible fee on companies that manufacture or import certain branded prescription drug products. Substantial new provisions affecting compliance have also been enacted, which may affect our business practices with healthcare practitioners, and a significant number of provisions are not yet, or have only recently become, effective. Although it is too early to determine the effect of the Affordable Care Act, it appears likely to continue the pressure on pharmaceutical pricing, especially under the Medicare program, and may also increase our regulatory burdens and operating costs.

In addition, other legislative changes have been proposed and adopted since the Affordable Care Act was enacted. In August 2011, the Budget Control Act of 2011 was signed into law, which, among other things, creates the Joint Select Committee on Deficit Reduction to recommend to Congress proposals in spending reductions. The Joint Select Committee did not achieve a targeted deficit reduction of an amount greater than $1.2 trillion for the years 2013 through 2021, triggering the legislation's automatic reduction to several government programs. This includes aggregate

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reductions to Medicare payments to healthcare providers of up to 2.0% per fiscal year, starting in 2013. In January 2013, the American Taxpayer Relief Act of 2012 was signed into law, which, among other things, reduced Medicare payments to several categories of healthcare providers and increased the statute of limitations period for the government to recover overpayments to providers from three to five years. If we ever obtain regulatory approval and commercialization of ganaxolone, these new laws may result in additional reductions in Medicare and other healthcare funding, which could have a material adverse effect on our customers and accordingly, our financial operations. Legislative and regulatory proposals have been made to expand post-approval requirements and restrict sales and promotional activities for pharmaceutical products. We cannot be sure whether additional legislative changes will be enacted, or whether FDA regulations, guidance or interpretations will be changed, or what the impact of such changes on the marketing approvals of ganaxolone may be.

In the United States, the European Union and other potentially significant markets for ganaxolone, government authorities and third-party payers are increasingly attempting to limit or regulate the price of medical products and services, particularly for new and innovative products and therapies, which has resulted in lower average selling prices. Furthermore, the increased emphasis on managed healthcare in the United States and on country and regional pricing and reimbursement controls in the European Union will put additional pressure on product pricing, reimbursement and usage, which may adversely affect our future product sales and results of operations. These pressures can arise from rules and practices of managed care groups, judicial decisions and governmental laws and regulations related to Medicare, Medicaid and healthcare reform, pharmaceutical reimbursement policies and pricing in general.

Some countries require approval of the sale price of a drug before it can be marketed. In many countries, the pricing review period begins after marketing or product licensing approval is granted. In some foreign markets, prescription pharmaceutical pricing remains subject to continuing governmental control even after initial approval is granted. As a result, we might obtain marketing approval for ganaxolone in a particular country, but then be subject to price regulations that delay our commercial launch of the product, possibly for lengthy time periods, which could negatively impact the revenue we are able to generate from the sale of the product in that particular country. Adverse pricing limitations may hinder our ability to recoup our investment in ganaxolone even if ganaxolone obtains marketing approval.

Laws and regulations governing international operations may preclude us from developing, manufacturing and selling product candidates outside of the United States and require us to develop and implement costly compliance programs.

As we seek to expand our operations outside of the United States, we must comply with numerous laws and regulations in each jurisdiction in which we plan to operate. The creation and implementation of international business practices compliance programs is costly and such programs are difficult to enforce, particularly where reliance on third parties is required.

The Foreign Corrupt Practices Act (FCPA) prohibits any United States individual or business from paying, offering, authorizing payment or offering of anything of value, directly or indirectly, to any foreign official, political party or candidate for the purpose of influencing any act or decision of the foreign entity in order to assist the individual or business in obtaining or retaining business. The FCPA also obligates companies whose securities are listed in the United States to comply with certain accounting provisions requiring such companies to maintain books and records that accurately and fairly reflect all transactions of the corporation, including international subsidiaries, and to devise and maintain an adequate system of internal accounting controls for international operations. The anti-bribery provisions of the FCPA are enforced primarily by the DOJ. The SEC is involved with enforcement of the books and records provisions of the FCPA.

Compliance with the FCPA is expensive and difficult, particularly in countries in which corruption is a recognized problem. In addition, the FCPA presents particular challenges in the pharmaceutical industry, because, in many countries, hospitals are operated by the government, and doctors and other hospital employees are considered foreign officials. Certain payments to hospitals in connection with clinical studies and other work have been deemed to be improper payments to government officials and have led to FCPA enforcement actions.

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Various laws, regulations and executive orders also restrict the use and dissemination outside of the United States, or the sharing with certain foreign nationals, of information classified for national security purposes, as well as certain products and technical data relating to those products. Our expanding presence outside of the United States will require us to dedicate additional resources to comply with these laws, and these laws may preclude us from developing, manufacturing, or selling ganaxolone outside of the United States, which could limit our growth potential and increase our development costs.

The failure to comply with laws governing international business practices may result in substantial penalties, including suspension or debarment from government contracting. Violation of the FCPA can result in significant civil and criminal penalties. Indictment alone under the FCPA can lead to suspension of the right to do business with the United States government until the pending claims are resolved. Conviction of a violation of the FCPA can result in long-term disqualification as a government contractor. The termination of a government contract or relationship as a result of our failure to satisfy any of our obligations under laws governing international business practices would have a negative impact on our operations and harm our reputation and ability to procure government contracts. The SEC also may suspend or bar issuers from trading securities on United States exchanges for violations of the FCPA's accounting provisions.

Our relationships with customers and third-party payers will be subject to applicable anti-kickback, fraud and abuse and other healthcare laws and regulations, which could expose us to criminal sanctions, civil penalties, contractual damages, reputational harm and diminished profits and future earnings.

Healthcare providers, physicians and third-party payers will play a primary role in the recommendation and prescription of any product candidates for which we obtain marketing approval. Our future arrangements with third-party payers and customers may expose us to broadly applicable fraud and abuse and other healthcare laws and regulations that may affect the business or financial arrangements and relationships through which we would market, sell and distribute our products. Even though we do not and will not control referrals of healthcare services or bill directly to Medicare, Medicaid or other third-party payers, federal and state healthcare laws and regulations pertaining to fraud and abuse and patients' rights are and will be applicable to our business. Restrictions under applicable federal and state healthcare laws and regulations that may affect our operations (including our marketing, promotion, educational programs, pricing, and relationships with healthcare providers or other entities, among other things) and expose us to areas of risk including the following:

- the federal Anti-Kickback Statute prohibits, among other things, persons from knowingly and willfully soliciting, offering, receiving or providing remuneration, directly or indirectly, in cash or in kind, to induce or reward, or in return for, either the referral of an individual for, or the purchase, order or recommendation of, any good or service, for which payment may be made under a federal healthcare program such as Medicare and Medicaid;
- federal civil and criminal false claims laws and civil monetary penalty laws impose criminal and civil penalties, including through civil whistleblower or qui tam actions, against individuals or entities for knowingly presenting, or causing to be presented, to the federal government, including the Medicare and Medicaid programs, claims for payment that are false or fraudulent or making a false statement to avoid, decrease or conceal an obligation to pay money to the federal government;
- the federal Health Insurance Portability and Accountability Act of 1996 (HIPAA) imposes criminal and civil liability for executing a scheme to defraud any healthcare benefit program and also created federal criminal laws that prohibit knowingly and willfully falsifying, concealing or covering up a material fact or making any materially false statements in connection with the delivery of or payment for healthcare benefits, items or services;
- HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act (HITECH) also imposes obligations, including mandatory contractual terms, with respect to safeguarding the privacy, security and transmission of individually identifiable health information;

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- the Affordable Care Act requires manufacturers of drugs, devices, biologics and medical supplies that are reimbursable under Medicare, Medicaid, or Children's Health Insurance Program, to report annually to HHS information related to payments and other transfers of value to physicians and teaching hospitals, and ownership and investment interests held by physicians and their immediate family members and applicable group purchasing organizations; and
- analogous state and foreign laws and regulations, such as state anti-kickback and false claims laws, may apply to sales or marketing arrangements and claims involving healthcare items or services reimbursed by non-governmental third-party payers, including private insurers; some state laws require pharmaceutical companies to comply with the pharmaceutical industry's voluntary compliance guidelines and the relevant compliance guidance promulgated by the federal government and may require drug manufacturers to report information related to payments and other transfers of value to physicians and other healthcare providers or marketing expenditures; and state and foreign laws govern the privacy and security of health information in specified circumstances, many of which differ from each other in significant ways and often are not preempted by HIPAA, thus complicating compliance efforts.

Efforts to ensure that our business arrangements with third parties are compliant with applicable healthcare laws and regulations will involve the expenditure of appropriate, and possibly significant, resources. Nonetheless, it is possible that governmental authorities will conclude that our business practices may not comply with current or future statutes, regulations or case law involving applicable fraud and abuse or other healthcare laws and regulations. If our operations are found to be in violation of any of these laws or any other governmental regulations that may apply to us, we may be subject to significant civil, criminal and administrative penalties, damages, fines, imprisonment, exclusion from government funded healthcare programs, such as Medicare and Medicaid, and the curtailment or restructuring of our operations. If any physicians or other healthcare providers or entities with whom we expect to do business are found to not be in compliance with applicable laws, they may be subject to criminal, civil or administrative sanctions, including exclusions from government funded healthcare programs.

Risks Related to Our Intellectual Property

If we are unable to protect our intellectual property rights or if our intellectual property rights are inadequate for our technology and product candidates, our competitive position could be harmed.

Our commercial success will depend in large part on our ability to obtain and maintain patent and other intellectual property protection in the United States and other countries with respect to our technology and products. We rely on trade secret, patent, copyright and trademark laws, and confidentiality, licensing and other agreements with employees and third parties, all of which offer only limited protection. We seek to protect our proprietary position by filing and prosecuting patent applications in the United States and abroad related to our novel technologies and products that are important to our business.

The patent positions of biotechnology and pharmaceutical companies generally are highly uncertain, involve complex legal and factual questions and have in recent years been the subject of much litigation. As a result, the issuance, scope, validity, enforceability and commercial value of our patents, including those patent rights licensed to us by third parties, are highly uncertain. The steps we or our licensors have taken to protect our proprietary rights may not be adequate to preclude misappropriation of our proprietary information or infringement of our intellectual property rights, both inside and outside the United States. Further, the examination process may require us or our licensors to narrow the claims for our pending patent applications, which may limit the scope of patent protection that may be obtained if these applications issue. The rights already granted under any of our currently issued patents or those licensed to us and those that may be granted under future issued patents may not provide us with the protection or competitive advantages we are seeking. If we or our licensors are unable to obtain and maintain patent protection for our technology and products, or if the scope of the patent protection obtained is not sufficient, our competitors could develop and commercialize technology and products similar or superior to ours, and our ability to successfully commercialize our technology and products may be adversely affected. It is also possible that we or our licensors will

fail to identify patentable aspects of inventions made in the course of our development and commercialization activities before it is too late to obtain patent protection on them.

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With respect to patent rights, we do not know whether any of our granted or issued patents will effectively prevent others from commercializing competitive technologies and products. Publications of discoveries in the scientific literature often lag behind the actual discoveries, and patent applications in the United States and other jurisdictions are typically not published until 18 months after filing or in some cases not at all, until they are issued as a patent. Therefore we cannot be certain that we or our licensors were the first to make the inventions claimed in our owned or licensed patents or pending patent applications, or that we or our licensors were the first to file for patent protection of such inventions.

Our pending applications cannot be enforced against third parties practicing the technology claimed in such applications unless and until a patent issues from such applications. Because the issuance of a patent is not conclusive as to its inventorship, scope, validity or enforceability, issued patents that we own or have licensed from third parties may be challenged in the courts or patent offices in the United States and abroad. Such challenges may result in the loss of patent protection, the narrowing of claims in such patents or the invalidity or unenforceability of such patents, which could limit our ability to stop others from using or commercializing similar or identical technology and products, or limit the duration of the patent protection for our technology and products. Protecting against the unauthorized use of our or our licensors' patented technology, trademarks and other intellectual property rights is expensive, difficult and may in some cases not be possible. In some cases, it may be difficult or impossible to detect third-party infringement or misappropriation of our intellectual property rights, even in relation to issued patent claims, and proving any such infringement may be even more difficult.

Competitors may infringe our patents or misappropriate or otherwise violate our intellectual property rights. To counter infringement or unauthorized use, litigation may be necessary in the future to enforce or defend our intellectual property rights, to protect our trade secrets or to determine the validity and scope of our own intellectual property rights or the proprietary rights of others. Also, third parties may initiate legal proceedings against us to challenge the validity or scope of intellectual property rights we own or control. These proceedings can be expensive and time consuming. Many of our current and potential competitors have the ability to dedicate substantially greater resources to defend their intellectual property rights than we can. Accordingly, despite our efforts, we may not be able to prevent third parties from infringing upon or misappropriating our intellectual property. Litigation could result in substantial costs and diversion of management resources, which could harm our business and financial results. In addition, in an infringement proceeding, a court may decide that a patent owned or controlled by us is invalid or unenforceable, or may refuse to stop the other party 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 proceeding could put one or more of our patents at risk of being invalidated, held unenforceable or interpreted narrowly. 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. There could also 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 material adverse effect on the price of shares of our common stock.

Third parties may initiate legal proceedings alleging that we are infringing their intellectual property rights, the outcome of which would be uncertain and could harm our business.

Our commercial success depends upon our ability to develop, manufacture, market and sell ganaxolone, and to use our related technologies. We may become party to, or threatened with, adversarial proceedings or litigation regarding intellectual property rights with respect to ganaxolone, including interference or derivation proceedings before the United States Patent and Trademark Office (USPTO). Third parties may assert infringement claims against us based on existing patents or patents that may be granted in the future. If we are found to infringe a third party's intellectual property rights, we could be required to obtain a license from such third party to continue commercializing ganaxolone. However, we may not be able to obtain any required license on commercially reasonable terms or at all.

Under certain circumstances, we could be forced, including by court order, to cease commercializing ganaxolone. In addition, in any such proceeding or litigation, we could be found liable for monetary damages. A finding of infringement could prevent us from commercializing ganaxolone or force us to cease some of our business operations, which could materially harm our business. Any claims by third parties that we have misappropriated their confidential information or trade secrets could have a similar negative impact on our business.

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While ganaxolone is in preclinical studies and clinical studies, we believe that the use of ganaxolone in these preclinical studies and clinical studies falls within the scope of the exemptions provided by 35 U.S.C. Section 271(e) in the United States, which exempts from patent infringement liability activities reasonably related to the development and submission of information to the FDA. As ganaxolone progresses toward commercialization, the possibility of a patent infringement claim against us increases. While ganaxolone itself is off patent, we attempt to ensure that our solid and liquid nanoparticulate formulation of ganaxolone and the methods we employ to manufacture ganaxolone do not infringe other parties' patents and other proprietary rights. There can be no assurance they do not, however, and competitors or other parties may assert that we infringe their proprietary rights in any event.

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

Filing, prosecuting and defending patents on ganaxolone and any future product candidates throughout the world would be prohibitively expensive, and our or our licensors' intellectual property rights in some countries outside the United States can be less extensive than those in the United States. In addition, the laws and practices of some foreign countries, particularly those relating to pharmaceuticals, do not protect intellectual property rights to the same extent as federal and state laws in the United States. For example, novel formulations and manufacturing processes may not be patentable in certain jurisdictions, and the requirements for patentability may differ in certain countries, particularly developing countries. Furthermore, generic drug manufacturers or other competitors may challenge the scope, validity or enforceability of our patents, requiring us to engage in complex, lengthy and costly litigation or other proceedings. Generic drug manufacturers may develop, seek approval for, and launch generic versions of our products. Many countries, including European Union countries, India, Japan and China, have compulsory licensing laws under which a patent owner may be compelled under certain circumstances to grant licenses to third parties. In those countries, we may have limited remedies if patents are infringed or if we are compelled to grant a license to a third party, which could materially diminish the value of our patents. This could limit our potential revenue opportunities. Accordingly, our efforts to enforce intellectual property rights around the world may be inadequate to obtain a significant commercial advantage from our intellectual property.

We may not be able to prevent third parties from practicing our inventions in all countries outside the United States, or from selling or importing products made using our inventions into or within the United States or other jurisdictions. Competitors may use our technologies in jurisdictions where we have not obtained patent protection to develop their own products, and may export otherwise infringing products to territories where we have patent protection, but where enforcement is not as strong as that 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 competing with us in these jurisdictions.

Many companies have encountered significant problems in protecting and defending intellectual property rights in certain foreign jurisdictions. 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, could put our patents at risk of being invalidated or interpreted narrowly and our patent applications at risk of not issuing and could provoke third parties to assert claims against us. We may not prevail in any lawsuits that we initiate and the damages or other remedies awarded, if any, may not be commercially meaningful.

Patent terms may be inadequate to protect our competitive position on our products for an adequate amount of time.

Given the amount of time required for the development, testing and regulatory review of new product candidates, such as ganaxolone, patents protecting such candidates might expire before or shortly after such candidates are commercialized. We expect to seek extensions of patent terms in the United States and, if available, in other countries where we are prosecuting patents. In the United States, the Drug Price Competition and Patent Term Restoration Act of 1984 permits a patent term extension of up to five years beyond the normal expiration of the patent, which is

limited to the approved indication (or any additional indications approved during the period of extension). However, the applicable authorities, including the FDA and the USPTO in the United States, and any equivalent regulatory authority in other countries, may not agree with our assessment of whether such extensions are available, and may refuse to grant extensions to our patents, or may grant more limited extensions than we request. If this occurs, our competitors may be able to take advantage of our investment in development and clinical studies by referencing our

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clinical and preclinical data and launch their product earlier than might otherwise be the case.

Changes in patent laws, including recent patent reform legislation, could increase the uncertainties and costs surrounding the prosecution of our patent applications and the enforcement or defense of our issued patents.

As is the case with other pharmaceutical companies, our success is heavily dependent on intellectual property, particularly patents. Obtaining and enforcing patents in the pharmaceutical industry involve technological and legal complexity, and obtaining and enforcing pharmaceutical patents is costly, time-consuming, and inherently uncertain. Changes in either the patent laws or interpretation of the patent laws in the United States and other countries may diminish the value of our patents or narrow the scope of our patent protection. For example, the United States Supreme Court has ruled on several patent cases in recent years, either narrowing the scope of patent protection available in certain circumstances or weakening the rights of patent owners in certain situations. In addition to increasing uncertainty with regard to our ability to obtain patents in the future, this combination of events has created uncertainty with respect to the value of patents, once obtained. Depending on decisions by Congress, the federal courts, and the USPTO, the laws and regulations governing patents could change in unpredictable ways that would weaken our ability to obtain new patents or to enforce existing patents and patents we may obtain in the future. Recent patent reform legislation could increase the uncertainties and costs surrounding the prosecution of our patent applications and the enforcement or defense of our issued patents.

In September 2011, the Leahy-Smith America Invents Act (Leahy-Smith Act) was signed into law. The Leahy-Smith Act includes a number of significant changes to United States patent law. These include provisions that affect the way patent applications will be prosecuted and may also affect patent litigation. In particular, under the Leahy-Smith Act, the United States transitioned in March 2013 to a “first to file” system in which the first inventor to file a patent application will be entitled to the patent. Third parties are allowed to submit prior art before the issuance of a patent by the USPTO and may become involved in opposition, derivation, reexamination, inter-parties review or interference proceedings challenging our patent rights or the patent rights of our licensors. An adverse determination in any such submission, proceeding or litigation could reduce the scope of, or invalidate patent rights, which could adversely affect our competitive position.

Obtaining and maintaining our patent protection depends on compliance with various procedural, document submissions, 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 on any issued patent are due to be paid to the USPTO and foreign patent agencies in several stages over the lifetime of the patent. The USPTO and various foreign governmental patent agencies require compliance with a number of procedural, documentary, fee payment and other similar provisions during the patent application process. While an inadvertent lapse can in many cases be cured by payment of a late fee or by other means in accordance with the applicable rules, 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. Non-compliance events that could result in abandonment or lapse of a patent or patent application include, but are not limited to, failure to respond to official actions within prescribed time limits, non-payment of fees and failure to properly legalize and submit formal documents. If we or our licensors fail to maintain the patents and patent applications covering our product candidates, our competitive position would be adversely affected.

We may be subject to claims by third parties asserting that we have misappropriated their intellectual property, or claiming ownership of what we regard as our own intellectual property.

Some of our employees were previously employed at universities or at other biotechnology or pharmaceutical companies, including our competitors or potential competitors. Some of these employees, including each member of

our senior management, executed proprietary rights, non-disclosure and non-competition agreements, or similar agreements, in connection with such previous employment. Although we try to ensure that our employees do not use the proprietary information or know-how of others in their work for us, we may be subject to claims that we or these employees have used or disclosed intellectual property, including trade secrets or other proprietary information, of any such third party. Litigation may be necessary to defend against such claims. If we fail in defending any such claims, in addition to paying

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monetary damages, we may lose valuable intellectual property rights or personnel or sustain damages. Such intellectual property rights could be awarded to a third party, and we could be required to obtain a license from such third party to commercialize our technology or products. Such a license may not be available on commercially reasonable terms or at all. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management.

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 or ganaxolone formulations that are similar to our ganaxolone formulations but that are not covered by the claims of the patents that we own or control;
- we or any strategic partners might not have been the first to make the inventions covered by the issued patents or pending patent applications that we own or control;
- we might not have been the first to file patent applications covering certain of our inventions;
- others may independently develop similar or alternative technologies or duplicate any of our technologies without infringing our intellectual property rights;
- it is possible that our pending patent applications will not lead to issued patents;
- issued patents that we own or control may not provide us with any competitive advantages, or may be held invalid or unenforceable as a result of legal challenges;
- our competitors might conduct research and development activities in the United States and other countries that provide a safe harbor from patent infringement claims for certain research and development activities, as well as 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 additional proprietary technologies that are patentable; and
- the patents of others may have an adverse effect on our business.

Risks Related to Employee Matters and Managing Growth

We will need to grow the size of our organization, and we may experience difficulties in managing this growth.

As of December 31, 2018, we had one part-time and 28 full-time employees. As our development and commercialization plans and strategies develop, or as a result of any future acquisitions, we will need additional managerial, operational, sales, marketing, financial and other resources. In addition, it may become more cost effective to bring in house certain resources currently outsourced to consultants and other third-parties. Our management, personnel and systems currently in place may not be adequate to support our future growth. Future growth would impose significant added responsibilities on members of management, including:

- managing our clinical studies effectively;
- identifying, recruiting, maintaining, motivating and integrating additional employees;
- managing our internal development efforts effectively while complying with our contractual obligations to

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licensors, licensees, contractors and other third parties;
- improving our managerial, development, operational and finance systems; and
- expanding our facilities.

As our operations expand, we will need to manage additional relationships with various strategic partners, suppliers and other third parties. Our future financial performance and our ability to commercialize ganaxolone, if approved, and to compete effectively will depend, in part, on our ability to manage any future growth effectively. To that end, we must be able to manage our development efforts and clinical studies effectively and hire, train and integrate additional management, administrative and sales and marketing personnel. Our failure to accomplish any of these tasks could prevent us from successfully growing our company.

If we are unable to attract and retain highly qualified employees, and other personnel, advisors and consultants with scientific, technical and managerial expertise, we may not be able to grow effectively.

Our future growth and success depend on our ability to recruit, retain, manage and motivate our employees, consultants and other third-parties. The loss of any member of our senior management team or the inability to hire or retain experienced management personnel could compromise our ability to execute our business plan and harm our operating results.

Because of the specialized scientific and managerial nature of our business, we rely heavily on our ability to attract and retain qualified scientific, technical and managerial personnel, advisors and consultants. The competition for qualified personnel in the pharmaceutical field is significant and, as a result, we may be unable to continue to attract and retain qualified personnel necessary for the development of our business.

We may acquire other assets or businesses, or form collaborations or make investments in other companies or technologies that could harm our operating results, dilute our stockholders' ownership, increase our debt or cause us to incur significant expense.

As part of our business strategy, we may pursue acquisitions of assets, including preclinical, clinical or commercial stage products or product candidates, or businesses, or strategic alliances and collaborations, to expand our existing technologies and operations. We may not identify or complete these transactions in a timely manner, on a cost-effective basis, or at all, and we may not realize the anticipated benefits of any such transaction, any of which could have a detrimental effect on our financial condition, results of operations and cash flows. We have no experience with acquiring other companies, products or product candidates, and limited experience with forming strategic alliances and collaborations. We may not be able to find suitable acquisition candidates, and if we make any acquisitions, we may not be able to integrate these acquisitions successfully into our existing business and we may incur additional debt or assume unknown or contingent liabilities in connection therewith. Integration of an acquired company or assets may also disrupt ongoing operations, require the hiring of additional personnel and the implementation of additional internal systems and infrastructure, especially the acquisition of commercial assets, and require management resources that would otherwise focus on developing our existing business. We may not be able to find suitable strategic alliance or collaboration partners or identify other investment opportunities, and we may experience losses related to any such investments.

To finance any acquisitions or collaborations, we may choose to issue debt or equity securities as consideration. Any such issuance of shares would dilute the ownership of our stockholders. If the price of our common stock is low or volatile, we may not be able to acquire other assets or companies or fund a transaction using our stock as consideration. Alternatively, it may be necessary for us to raise additional funds for acquisitions through public or private financings. Additional funds may not be available on terms that are favorable to us, or at all.

Our employees may engage in misconduct or other improper activities, including noncompliance with regulatory standards and requirements, which could cause significant liability for us and harm our reputation.

We are exposed to the risk of employee fraud or other misconduct, including intentional failures to comply with

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FDA regulations or similar regulations of comparable foreign regulatory authorities, provide accurate information to the FDA or comparable foreign regulatory authorities, comply with manufacturing standards we have established, comply with federal and state healthcare fraud and abuse laws and regulations and similar laws and regulations established and enforced by comparable foreign regulatory authorities, report financial information or data accurately or disclose unauthorized activities to us. Employee misconduct could also involve the improper use of information obtained in the course of clinical studies, which could result in regulatory sanctions and serious harm to our reputation. We have adopted a code of conduct for our directors, officers and employees (Code of Conduct) but it is not always possible to identify and deter employee misconduct, and the precautions we take to detect and prevent this activity may not be effective in controlling unknown or unmanaged risks or losses or in protecting us from 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 and results of operations, including the imposition of significant fines or other sanctions.

Risks Related to Ownership of Our Common Stock

The market price of our stock may be volatile, and you could lose all or part of your investment.

The trading price of our common stock is likely to be highly volatile and could be subject to wide fluctuations in response to various factors, some of which are beyond our control. In addition to the factors discussed in this “Risk Factors” section, these factors include:

- the success of competitive products or technologies;
- regulatory actions with respect to our products or our competitors’ products;
- actual or anticipated changes in our growth rate relative to our competitors;
- announcements by us or our competitors of significant acquisitions, strategic partnerships, joint ventures, collaborations or capital commitments;
- results of clinical studies of ganaxolone or product candidates of our competitors;
- regulatory or legal developments in the United States and other countries;
- developments or disputes concerning patent applications, issued patents or other proprietary rights;
- the recruitment or departure of key personnel;
- the level of expenses related to our clinical development programs;
- the results of our efforts to in-license or acquire additional product candidates or products;
- actual or anticipated changes in estimates as to financial results, development timelines or recommendations by securities analysts;
- variations in our financial results or those of companies that are perceived to be similar to us;
- fluctuations in the valuation of companies perceived by investors to be comparable to us;
- share price and volume fluctuations attributable to inconsistent trading volume levels of our shares;
- announcement or expectation of additional financing efforts;

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- sales of our common stock by us, our insiders or our other stockholders;
- changes in the structure of healthcare payment systems;
- market conditions in the pharmaceutical and biotechnology sectors;
- general economic, industry and market conditions; and
- other events or factors, many of which are beyond our control.

In addition, the stock market in general, The NASDAQ Global Market and pharmaceutical and biotechnology companies in particular, have experienced extreme price and volume fluctuations that have often been unrelated or disproportionate to the operating performance of these companies. Broad market and industry factors may negatively affect the market price of our common stock, regardless of our actual operating performance. The realization of any of these risks or any of a broad range of other risks, including those described in these "Risk Factors," could have a dramatic and material adverse impact on the market price of our common stock.

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

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

Insiders have substantial influence over us and could delay or prevent a change in corporate control.

We estimate that our executive officers, directors, and holders of 5% or more of our capital stock collectively beneficially own approximately 34.2% of our voting stock. This concentration of ownership could harm the market price of our common stock by:

- delaying, deferring or preventing a change in control of our company;
- impeding a merger, consolidation, takeover or other business combination involving our company; or
- discouraging a potential acquirer from making a tender offer or otherwise attempting to obtain control of our company.

The interests of this group of stockholders may not always coincide with your interests or the interests of other stockholders and they may act in a manner that advances their best interests and not necessarily those of other stockholders, including seeking a premium value for their common stock, and might negatively affect the prevailing market price for our common stock.

We are an "emerging growth company" and we intend to take advantage of reduced disclosure and governance requirements applicable to emerging growth companies, which could result in our common stock being less attractive to investors.

We are an emerging growth company, as defined in the Jumpstart Our Business Startups Act of 2012 (JOBS Act). For as long as we continue to be an emerging growth company, we may take advantage of exemptions from various reporting requirements that are applicable to other public companies that are not emerging growth companies, including not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act, reduced disclosure obligations regarding executive compensation in our periodic reports and proxy statements, and exemptions from the requirements of holding nonbinding advisory votes on executive compensation and stockholder approval of any golden parachute payments not previously approved. We could be an emerging growth company for up

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to five years following the year in which we completed our initial public offering, although circumstances could cause us to lose that status earlier, including if the market value of our common stock held by non-affiliates exceeds $700.0 million as of any June 30 before that time or if we have total annual gross revenue of $1.0 billion or more during any fiscal year before that time, in which cases we would no longer be an emerging growth company as of the following December 31. If we issue more than $1.0 billion in non-convertible debt during any three-year period before that time, we would cease to be an emerging growth company immediately. Even after we no longer qualify as an emerging growth company, we may still qualify as a "smaller reporting company" which would allow us to take advantage of many of the same exemptions from disclosure requirements including not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act and reduced disclosure obligations regarding executive compensation in our periodic reports and proxy statements. We cannot predict if investors will find our common stock less attractive because we may rely on these exemptions. If some investors find our common stock less attractive as a result, there may be a less active trading market for our common stock and our stock price may be more volatile.

Under the JOBS Act, emerging growth companies can also delay adopting new or revised accounting standards until such time as those standards apply to private companies. We have irrevocably elected not to avail ourselves of this exemption from new or revised accounting standards and, therefore, will be subject to the same new or revised accounting standards as other public companies that are not emerging growth companies. As a result, changes in rules of United States generally accepted accounting principles or their interpretation, the adoption of new guidance or the application of existing guidance to changes in our business could significantly affect our financial position and results of operations.

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

We have never declared or paid cash dividends on our capital stock. We currently intend to retain all of our future earnings, if any, to finance the growth and development of our business. As a result, capital appreciation, if any, of our common stock will be your sole source of gain for the foreseeable future.

Sales of a substantial number of shares of our common stock in the public market could cause our stock price to fall.

If our stockholders sell, or indicate an intention to sell, substantial amounts of our common stock in the public market, the trading price of our common stock could decline. As of December 31, 2018 we had outstanding a total of 52,519,013 shares of common stock. In addition, shares of common stock that are either subject to outstanding options or reserved for future issuance under our employee benefit plans will become eligible for sale in the public market to the extent permitted by the provisions of various vesting schedules and either the registration of such shares under the Securities Act or the application of exemptions from such registration with respect to any sales such as Rule 144 and Rule 701 under the Securities Act. If these additional shares of common stock are sold, or if it is perceived that they will be sold, in the public market, the trading price of our common stock could decline.

Future sales and issuances of our common stock or rights to purchase common stock, including pursuant to our equity incentive plans, could result in additional dilution of the percentage ownership of our stockholders and could cause our stock price to fall.

We expect that significant additional capital will be needed in the future to continue our planned operations. To raise capital, we may sell substantial amounts of common stock or securities convertible into or exchangeable for common stock. These future issuances of equity or equity-linked securities, together with the exercise of stock options, warrants outstanding or granted in the future and any additional shares issued in connection with acquisitions, if any, may result in material dilution to our investors. Such sales may also result in material dilution to our stockholders, and

new investors could gain rights, preferences and privileges senior to those of holders of our common stock.

Pursuant to our equity incentive plans, our compensation committee is authorized to grant equity-based incentive awards to our directors, executive officers and other employees and service providers. As of December 31, 2018, there were no shares of our common stock available for future grant under our 2005 Stock Option and Incentive

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Plan, as amended. The number of shares of our common stock available for future grant under our 2014 Equity Incentive Plan, as Amended, was 1,302,703 as of December 31, 2018. Future equity incentive grants and issuances of common stock under our equity incentive plans may have an adverse effect on the market price of our common stock.

We have broad discretion in the use of our cash reserves and may not use them effectively.

Our management has broad discretion over the management of our operations and cash resources and could deploy our resources in ways that do not improve our business, including our ganaxolone clinical development programs, or enhance the value of our common stock. The failure by our management to apply these funds effectively could result in financial losses that could have a material adverse effect on our business, cause the market price of our common stock to decline and delay the development of ganaxolone.

Some provisions of our charter documents and Delaware law may have anti-takeover effects that could discourage an acquisition of us by others, even if an acquisition would be beneficial to our stockholders and may prevent attempts by our stockholders to replace or remove our current management.

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

- permit our board of directors to issue up to 25,000,000 shares of preferred stock, with any rights, preferences and privileges as it may designate;
- provide that all vacancies on our board of directors, including as a result of newly created directorships, may, except as otherwise required by law, be filled by the affirmative vote of a majority of directors then in office, even if less than a quorum;
- establish a classified board of directors such that only one of three classes of directors is elected each year;
- provide that directors can only be removed for cause;
- require that any action to be taken by our stockholders must be effected at a duly called annual or special meeting of stockholders and not be taken by written consent;
- provide that stockholders seeking to present proposals before a meeting of stockholders or to nominate candidates for election as directors at a meeting of stockholders must provide advance notice in writing, and also specify requirements as to the form and content of a stockholder's notice;
- not provide for cumulative voting rights, thereby allowing the holders of a majority of the shares of common stock entitled to vote in any election of directors to elect all of the directors standing for election; and
- provide that special meetings of our stockholders may be called only by the chairperson of the board of directors, the chief executive officer or the board of directors.

These provisions may frustrate or prevent any attempts by our stockholders to replace or remove our current management by making it more difficult for stockholders to replace members of our board of directors, who are responsible for appointing the members of our management. Because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporation Law, which may discourage, delay or prevent someone from acquiring us or merging with us whether or not it is desired by or beneficial to our stockholders. Under Delaware law, a corporation may not, in general, engage in a business combination with any holder of 15.0% or more of its capital stock unless the holder has held the stock for three years or, among other things, the board of directors has approved the transaction. Any provision of our amended and restated certificate of incorporation or amended and

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

We are required to meet the NASDAQ Stock Market's continued listing requirements and other NASDAQ rules, or we may risk delisting. Delisting could negatively affect the price of our common stock, which could make it more difficult for us to sell securities in a future financing or for you to sell our common stock.

We are required to meet the continued listing requirements of the NASDAQ Stock Market and other NASDAQ rules, including those regarding director independence and independent committee requirements, minimum stockholders' equity, minimum share price and certain other corporate governance requirements. In particular, we are required to maintain a minimum bid price for our listed common stock of $1.00 per share. If we do not meet these continued listing requirements, our common stock could be delisted. Delisting from the NASDAQ Stock Market would cause us to pursue eligibility for trading of these securities on other markets or exchanges, or on the "pink sheets." In such case, our stockholders' ability to trade, or obtain quotations of the market value of our common stock would be severely limited because of lower trading volumes and transaction delays. These factors could contribute to lower prices and larger spreads in the bid and ask prices of these securities. There can be no assurance that our securities, if delisted from the NASDAQ Stock Market in the future, would be listed on a national securities exchange, a national quotation service, the over-the-counter markets or the pink sheets. Delisting from the NASDAQ Stock Market, or even the issuance of a notice of potential delisting, would also result in negative publicity, make it more difficult for us to raise additional capital, cause us to lose eligibility to register the sale or resale of our shares on Form S-3 and the automatic exemption from registration under state securities laws for exchange-listed securities, adversely affect the market liquidity of our securities, decrease securities analysts' coverage of us or diminish investor, supplier and employee confidence.

Item 1B. Unresolved Staff Comments.

None.

Item 2. Properties.

Our principal offices occupy approximately 8,500 square feet of leased office space in Radnor, Pennsylvania pursuant to a lease agreement that expires in 2021. In December 2018, we entered into an amendment to this lease agreement for office space of approximately 22,500, to commence on or around April 1, 2019, replacing our current leased office space. We believe that our new facilities are suitable and adequate to meet our current needs. We may add new facilities or expand existing facilities as we add employees, and we believe that suitable additional or substitute space will be available as needed to accommodate any such expansion of our operations.

Item 3. Legal Proceedings.

From time to time, we may become subject to litigation and claims arising in the ordinary course of business. We are not currently a party to any material legal proceedings, and we are not aware of any pending or threatened legal proceedings against us that we believe could have a material adverse effect on our business, operating results or

financial condition.

Item 4. Mine Safety Disclosures.

Not applicable.

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PART II

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

Market Information

Our common stock is listed on the NASDAQ Global Market under the symbol MRNS.

Holders of Record

As of March 8, 2019 there were approximately 33 holders of record of shares of our common stock. This number does not reflect the beneficial holders of our common stock who hold shares in street name through brokerage accounts or other nominees.

Dividend Policy

We have never declared or paid any cash dividends on our common stock. We currently intend to retain all available funds and any future earnings to support our operations and finance the growth and development of our business. We do not intend to pay cash dividends on our common stock for the foreseeable future.

Stock Performance Graph

The following graph compares the annual percentage change in the cumulative total shareholder return on the Company's common stock with the cumulative total return of (i) the NASDAQ Composite Total Return Index and (ii) the NASDAQ US Benchmark Pharmaceuticals Index. The comparison assumes $100 was invested on July 31, 2014 (the first day the Company's stock was traded on the NASDAQ Global Market) in the Company's common stock and in each of the following indices, and assumes the reinvestment of dividends.

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	7/31/2014	12/31/2014	12/31/2015	12/31/2016	12/31/2017	12/31/2018
Marinus Pharmaceuticals	$ 100	$ 132.13	$ 95.50	$ 12.63	$ 102.00	$ 35.88
NASDAQ Composite Total Return Index	$ 100	$ 108.96	$ 116.54	$ 126.88	$ 164.48	$ 159.81
NASDAQ US Benchmark Pharmaceuticals Index	$ 100	$ 111.80	$ 117.87	$ 116.59	$ 139.75	$ 149.93

This performance graph shall not be deemed “filed” for purposes of Section 18 of the Securities Exchange Act of 1934, as amended, or incorporated by reference into any filing of ours under the Securities Act of 1933, as amended, or the Securities Exchange Act, except as shall be expressly set forth by specific reference to such filing.

Recent Sales of Unregistered Securities

None.

Item 6. Selected Financial Data

The information below was derived from the audited Consolidated Financial Statements included within this report and in previous annual reports we filed with the SEC. This information should be read together with those Consolidated Financial Statements and the notes thereto. These historical results are not necessarily indicative of the results to be expected in the future.

	Year Ended December 31,				
	2018	2017	2016	2015	2014
	(in thousands, except share and per share amounts)				
Statement of Operations Data:					
Operating expenses:					
Research and development (1)	$ 28,394	$ 12,376	$ 22,005	$ 18,916	$ 8,690
General and administrative (2)	8,785	6,667	6,237	5,516	3,230
Loss from operations	(37,179)	(19,043)	(28,242)	(24,432)	(11,920)
Other income (expense), net (3)	453	145	(401)	(418)	1,087
Net loss	$ (36,726)	$ (18,898)	$ (28,643)	$ (24,850)	$ (10,833)
Cumulative preferred stock dividends (4)	—	—	—	—	(2,545)
Net loss available to common stockholders	$ (36,726)	$ (18,898)	$ (28,643)	$ (24,850)	$ (13,378)
Per share information:					
Net loss per share of common stock—basic and diluted	$ (0.90)	$ (0.80)	$ (1.47)	$ (1.67)	$ (2.17)
	40,895,406	23,540,748	19,498,143	14,919,783	6,152,669

Basic and diluted weighted average shares outstanding					

	As of December 31,				
	2018	2017	2016	2015	2014
Balance Sheet Data:	(in thousands)				
Cash, cash equivalents and investments (5)	$ 72,725	$ 53,392	$ 30,100	$ 57,684	$ 49,720
Total assets	75,234	60,672	31,447	59,648	50,213
Current portion of notes payable (6)	—	—	3,500	2,128	—
Notes payable (6)	—	—	1,743	5,236	7,000
Total stockholders' equity (deficit)	68,325	58,008	21,479	46,921	41,154

(1) Research and development expenses increased from 2014 to 2015 due to the then-increasing activity related to our clinical study with ganaxolone in focal-onset seizures. This study was discontinued in June 2016. During 2016, research and development expenses increased due to preclinical activities and drug development and manufacturing with respect to our IV formulation, offset by reductions in clinical study expenses related to the discontinuation of our study in focal-onset seizures.

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(2) General and administrative expenses increase from 2014 to 2015 and to 2016 due to scaling up of our operations as a then newly-public company and increases in noncash stock based compensation expense.
(3) Other income in 2014 was primarily due to a $1.2 million favorable change in the fair value of existing warrants. These warrants were converted to common stock upon our initial public offering in July 2014. Other expense in 2015 and 2016 was due to outstanding term loans which were paid in full in 2017.
(4) Cumulative preferred stock dividends represented dividends payable upon a liquidation or deemed liquidation in connection with our Series B and C convertible preferred stock. Effective upon the closing of our initial public offering, all outstanding shares of preferred stock converted into common stock during the third quarter of 2014.
(5) Our cash, cash equivalents and investments balance fluctuate based on operating expenses offset by capital raises. We completed our initial public offering in 2014, followed by three secondary public offerings each in 2015, 2017 and 2018.
(6) In 2014 we borrowed an aggregate of $7 million in term loans. In 2017 we paid off the remaining balance.
Additional information required by Item 6 is included in Part II, Item 7 "Management's Discussion and Analysis of Financial Condition and Results of Operations."

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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 financial statements and the related notes appearing at the end of this Annual Report on Form 10-K. Some of the information contained in this discussion and analysis or set forth elsewhere in this Annual Report on Form 10-K, including information with respect to our plans and strategy for our business and related financing, includes forward-looking statements that involve risks and uncertainties. You should read "Cautionary Note Regarding Forward-Looking Statements" and Item 1A. Risk Factors of this Annual Report on Form 10-K for a discussion of important factors that could cause actual results to differ materially from the results described in or implied by the forward-looking statements contained in the following discussion and analysis.

Overview

We are a clinical stage pharmaceutical company focused on developing and commercializing innovative therapeutics to treat epilepsy and neuropsychiatric disorders. Our clinical stage product candidate, ganaxolone, is a positive allosteric modulator of $GABA_A$ being developed in three different dose forms: intravenous (IV), oral capsule and oral liquid. The multiple dose forms are intended to maximize the therapeutic range of ganaxolone for adult and pediatric patient populations, in acute and chronic care, and both in-patient and self-administered settings. Ganaxolone exhibits anti-seizure, anti-depression and anti-anxiety actions via its effects on synaptic and extrasynaptic $GABA_A$ receptors.

Our operations to date have consisted primarily of organizing and staffing our company, developing ganaxolone, including conducting preclinical testing and clinical studies, and raising capital. We have funded our operations primarily through sales of equity and debt securities. At December 31, 2018, we had cash, cash equivalents and investment balances of $72.7 million. We have no products currently available for sale, have incurred operating losses since inception, have not generated any product sales revenue and have not achieved profitable operations. We incurred a net loss of $36.7 million for the year ended December 31, 2018. Our accumulated deficit as of December 31, 2018 was $181.5 million, and we expect to continue to incur substantial losses in future periods. We anticipate that our operating expenses will increase substantially as we continue to advance our clinical-stage product candidate, ganaxolone.

We anticipate that our expenses will increase substantially as we:

- conduct later stage clinical studies in targeted indications, which could include CDD, PPD, SE, PCDH19-RE, LGS, FXS and other indications;
- continue the research, development and scale-up manufacturing capabilities to optimize products and dose forms for which we may obtain regulatory approval;
- conduct other preclinical and clinical studies to support the filing of New Drug Applications (NDAs) with the Food and Drug Administration (FDA) and other regulatory agencies in other countries;
- acquire the rights to other product candidates and fund their development;
- maintain, expand and protect our global intellectual property portfolio;
- hire additional clinical, manufacturing and scientific personnel; and
- add operational, financial and management information systems and personnel, including personnel to support our drug development and potential future commercialization efforts.

We believe that our cash, cash equivalents and investments as of December 31, 2018 will enable us to fund our operating expenses and capital expenditure requirements into 2021. However, we will need to secure additional funding

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in the future, from one or more equity or debt financings, collaborations, or other sources, in order to carry out all of our planned research and development activities with respect to ganaxolone.

Financial Overview

Research and Development Expenses

Our research and development expenses consist primarily of costs incurred for the development of ganaxolone, which include:

- employee-related expenses, including salaries, benefits, travel and stock-based compensation expense;
- expenses incurred under agreements with Clinical Research Organizations (CROs) and investigative sites that conduct our clinical studies and preclinical studies;
- the cost of acquiring, developing and manufacturing clinical study materials;
- facilities, depreciation and other expenses, which include direct and allocated expenses for rent and maintenance of facilities, insurance and other supplies; and
- costs associated with preclinical activities and regulatory operations.

We expense research and development costs when we incur them. We record costs for some development activities, such as clinical studies, based on an evaluation of the progress to completion of specific tasks using data such as subject enrollment, clinical site activations or information our vendors provide to us.

We will incur substantial costs beyond our present and planned clinical studies in order to file an NDA and Supplemental New Drug Applications (sNDAs) for ganaxolone for various clinical indications, and in each case, the nature, design, size and cost of further studies and studies will depend in large part on the outcome of preceding studies and studies and discussions with regulators. It is difficult to determine with certainty the costs and duration of our current or future clinical studies and preclinical studies, or if, when or to what extent we will generate revenue from the commercialization and sale of ganaxolone if we obtain regulatory approval. We may never succeed in achieving regulatory approval for ganaxolone. The duration, costs and timing of clinical studies and development of ganaxolone will depend on a variety of factors, including the uncertainties of future clinical studies and preclinical studies, uncertainties in clinical study enrollment rate and significant and changing government regulation.

In addition, the probability of success for our clinical programs will depend on numerous factors, including competition, manufacturing capability and commercial viability. See “Risk Factors.” Our commercial success depends upon attaining significant market acceptance, if approved, among physicians, patients, healthcare payers and the medical community. We will determine which programs to pursue and how much to fund each program in response to the scientific and clinical success, as well as an assessment of commercial potential.

General and Administrative Expenses

General and administrative expenses consist principally of salaries and related costs for executive and other administrative personnel and consultants, including stock-based compensation and travel expenses. Other general and administrative expenses include professional fees for legal, patent review, consulting and accounting services. General and administrative expenses are expensed when incurred.

We expect that our general and administrative expenses will increase in the future as a result of employee hiring and our scaling operations commensurate with supporting more advanced clinical studies and in preparation for commercial infrastructure. These increases will likely include increased costs for insurance, hiring of additional personnel, outside consultants, legal counsel and accountants, among other expenses.

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Interest Income

Interest income consists principally of interest income earned on cash and cash equivalent and investment balances.

Interest Expense

Interest expense is attributable to interest expense associated with our credit facility entered into in April 2014, as amended, which was paid in full and closed in July 2017.

Results of Operations

Research and Development Expenses

The primary drivers of our research and development expenditures are currently in our programs in CDD, PPD, and RSE. We have initiated a Phase 3 study in CDD and Phase 2 studies each in PPD and RSE. The following table shows our research and development expenses incurred with respect to each active program, in thousands:

	Year Ended December 31,		
	2018	2017	2016
CDKL5 disorder (1)	$ 2,942	$ 389	$ —
Postpartum depression (2)	7,891	2,291	65
Refractory status epilepticus (3)	681	637	1,425
Other indications (4)	1,089	604	791
General supportive studies (5)	6,693	2,440	7,024
Indirect research and development (6)	9,096	4,889	5,030
Focal onset seizures (7)	2	1,126	7,670
Total	$ 28,394	$ 12,376	$ 22,005

(1) The increases in each year were due primarily to the startup activities in 2017 and initiation of our Phase 3 study in 2018.

(2) The increase for the year ended December 31, 2018 compared to 2017 was due primarily to increased patient enrollment after the Magnolia study initiated in the second quarter of 2017, and the expansion of our Amaryllis Phase 2 study to include our oral formulation of ganaxolone. The increase for the year ended December 31, 2017 compared to 2016 was due primarily to the startup activities in 2016 and eventual initiation of our Phase 2 studies in 2017.

(3) The decrease for the year ended December 31, 2017 compared to 2016 was due to our Phase 1 healthy volunteers study of our IV formulation during 2016, while our Phase 2 study in RSE did not commence until late 2017.

(4) Other indications represent costs of exploratory studies in various other indications where we may consider developing ganaxolone in the future.

(5) General supportive studies include preclinical and manufacturing activities in support of all formulations and indications for ganaxolone. The increase for the year ended December 31, 2018 compared to 2017 was due primarily to further the advancement of ganaxolone in clinical studies to support a future NDA. The decrease for the year ended December 31, 2017 compared to 2016 was due primarily to the completion of significant drug manufacturing activities in 2016.

(6) Indirect research and development expenses in support of all our programs increase and decrease each year commensurate with the overall increase or decrease in preclinical, clinical, and manufacturing activities.

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(7) We discontinued further development in our focal onset seizure program in 2016. Costs incurred with respect to this program in 2017 represent residual costs to wind down a completed Phase 3 study.

General and Administrative Expenses

General and administrative expenses increased $2.1 million and $0.4 million for the year ended December 31, 2018 compared to 2017 and the year ended December 31, 2017 compared to 2016, respectively. The increase in both periods was primarily due to an increase in noncash stock-based compensation expense.

Cash Flows

Operating Activities. Cash used in operating activities increased to $27.8 million for the year ended December 31, 2018 compared to $18.8 million for the same period a year ago. The increase was driven primarily by a $17.5 million increase in net loss offset by a $1.9 million increase in stock-based compensation and increase of $6.4 million in the change in accounts payable and accrued liabilities. The increase in the change in accounts payable and accrued liabilities was due to increased research and development activities in support of our ongoing clinical programs and preclinical supportive studies.

Cash used in operating activities decreased to $18.8 million for the year ended December 31, 2017 compared to $24.8 million for the same period a year ago. The decrease was driven primarily by a decrease in our net loss of $9.7 million, partially offset by a decrease in the change in operating assets and liabilities of $3.7 million. The net decrease in the change in operating assets and liabilities was primarily due to upfront payments for planned clinical studies in our IV program, payment of corporate insurance premiums and the timing of payment obligations related to our drug supply in 2016.

Investing Activities. Cash provided by investing activities during the year ended December 31, 2018 represents the maturities of $20.0 million of short-term investments offset by the purchase of $0.1 million in laboratory equipment and furniture.

Cash used in investing activities during the year ended December 31, 2017 represents the purchase of $24.9 million in investments and $0.5 million in laboratory equipment, offset by maturities of short-term investments of $3.9 million. Cash provided by investing activities during the year ended December 31, 2016 represents the purchase of $2.4 million in investments and $0.6 million on laboratory equipment, offset by maturities of short-term investments of $4.4 million.

Financing Activities. Cash provided by financing activities during the year ended December 31, 2018 includes $42.3 million in net proceeds from a secondary public offering, offset by $0.2 million in repayments of short-term bank borrowings.

Cash provided by financing activities during the year ended December 31, 2017 includes $52.5 million in net proceeds from equity offerings, $0.2 million in proceeds from short-term bank borrowings and $0.1 million in proceeds from the exercise of stock options. These proceeds were offset by $5.2 million in principal payments of notes payable. Cash used in financing activities during the year ended December 31, 2016 represents principal payments of notes payable of $2.1 million and payment of public offering costs of $0.2 million, offset by proceeds from the exercise of outstanding stock options of $0.1 million.

Liquidity and Capital Resources

Since inception, we have incurred net losses and negative cash flows from our operations. We incurred a net loss of $36.7 million for the year ended December 31, 2018. Our cash used in operating activities was $27.8 million for year

ended December 31, 2018 compared to $18.8 million for the same period a year ago. Historically, we have financed our operations principally through the sale of common stock, notes payable, preferred stock and convertible debt. At December 31, 2018, we had cash, cash equivalents and investment balances of $72.7 million.

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Funding Requirements

We have not achieved profitability since our inception, and we expect to continue to incur net losses for the foreseeable future. We expect our cash expenditures to increase in the near term as we fund our planned clinical studies for ganaxolone.

We believe that our cash, cash equivalents and investments as of December 31, 2018, will enable us to fund our operating expenses and capital expenditure requirements into 2021. However, we will need to raise substantial additional financing in the future to fund our operations. In order to meet these additional cash requirements, we may seek to sell additional equity or convertible debt securities, including securities from our Equity Distribution Agreement with JMP Securities, that may result in dilution to our stockholders. If we raise additional funds through the issuance of convertible debt securities, these securities could have rights senior to those of our common stock and could contain covenants that restrict our operations. There can be no assurance that we will be able to obtain additional equity or debt financing on terms acceptable to us, if at all. Our failure to obtain sufficient funds on acceptable terms when needed could have a negative impact on our business, results of operations, and financial condition. Our future capital requirements will depend on many factors, including:

- the results of our preclinical studies and clinical studies;
- the development, formulation and commercialization activities related to ganaxolone;
- the scope, progress, results and costs of researching and developing ganaxolone or any other future product candidates, and conducting preclinical studies and clinical studies;
- the timing of, and the costs involved in, obtaining regulatory approvals for ganaxolone or any other future product candidates;
- the cost of commercialization activities if ganaxolone or any other future product candidates are approved for sale, including marketing, sales and distribution costs;
- the cost of manufacturing and formulating ganaxolone, or any other future product candidates, to internal and regulatory standards for use in preclinical studies, clinical studies and, if approved, in commercial sale;
- our ability to establish and maintain strategic collaborations, licensing or other arrangements and the financial terms of such agreements;
- any product liability, infringement or other lawsuits related to our products;
- capital needed to attract and retain skilled personnel;
    - the costs involved in preparing, filing, prosecuting, maintaining, defending and enforcing patent claims, including litigation costs and the outcome of such litigation; and
- the timing, receipt and amount of sales of, or royalties on, future approved products, if any.

Please see “Risk Factors” for additional risks associated with our substantial capital requirements.

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Significant Contractual Obligations and Commitments

The following summarizes our significant contractual obligations as of December 31, 2018 (in thousands):

	Payment due by period				
Contractual Obligations	Total	Less than 1 year	1 - 3 years	3 - 5 years	More than 5 years
Operating lease obligations(1)	$ 5,036	$ 298	$ 1,625	$ 1,631	$ 1,482
Total	$ 5,036	$ 298	$ 1,625	$ 1,631	$ 1,482

(1) Represents commitments for future minimum lease payments.

Off-Balance Sheet Arrangements

We do not have any off-balance sheet arrangements, as defined by applicable SEC regulations.

Discussion of Critical Accounting Policies and Significant Judgments and Estimates

We base this management's discussion and analysis of our financial condition and results of operations on our financial statements, which we have prepared in accordance with accounting principles generally accepted in the United States (GAAP). The preparation of our financial statements requires us to make estimates and judgments that affect the reported amounts of assets, liabilities, revenue and expenses and the disclosure of contingent assets and liabilities in our financial statements. We evaluate our estimates and judgments, including those related to warrant liabilities, stock-based compensation and accrued clinical study expenses on an ongoing basis. We base our estimates on historical experience, known trends and events and various other factors that we believe to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions. You should consider your evaluation of our financial condition and results of operations with these policies, judgments and estimates in mind.

While we describe our significant accounting policies in the notes to our financial statements appearing elsewhere in this Annual Report on Form 10-K, we believe the following accounting policies are the most critical to the judgments and estimates we use in the preparation of our financial statements.

Clinical Study Expenses

As part of the process of preparing our financial statements, we are required to estimate our clinical study expenses. Our clinical study accrual process seeks to account for expenses resulting from our obligations under contracts with vendors, consultants and CROs and clinical site agreements in connection with conducting clinical studies. The financial terms of these contracts are subject to negotiations, which vary from contract to contract and may result in payment flows that do not match the periods over which materials or services are provided to us under such contracts. Our objective is to reflect the appropriate clinical study expenses in our financial statements by matching the appropriate expenses with the period in which services and efforts are expended. We account for these expenses according to the progress of the study as measured by subject progression and the timing of various aspects of the study.

We determine accrual estimates based on estimates of the services received and efforts expended that take into account discussion with applicable personnel and outside service providers as to the progress or state of completion of studies. During the course of a clinical study, we adjust our clinical expense recognition if actual results differ from our estimates. We make estimates of our accrued expenses and prepaid assets as of each balance sheet date in our financial statements based on the facts and circumstances known to us at that time. Our clinical study accrual and prepaid assets are dependent, in part, upon the receipt of timely and accurate reporting from CROs and other third-party vendors. Although we do not expect our estimates to differ materially from amounts we actually incur, our understanding of the status and timing of services performed relative to the actual status and timing of services performed may vary and may result in us reporting amounts that are too high or too low for any particular period.

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JOBS Act

Section 107 of the JOBS Act also provides that an “emerging growth company” can take advantage of the extended transition period provided in Section 7(a)(2)(B) of the Securities Act for complying with new or revised accounting standards. In other words, an “emerging growth company” can delay the adoption of new or revised accounting standards until those standards would otherwise apply to private companies. We have irrevocably elected not to avail ourselves of this exemption from new or revised accounting standards and, therefore, we will be subject to the same new or revised accounting standards as other public companies that are not emerging growth companies.

Recent Accounting Pronouncements

In January 2016, the Financial Accounting Standard Board (FASB) issued Accounting Standards Update (ASU) 2016-01, Financial Instruments - Overall (Subtopic 825-10), Recognition and Measurement of Financial Assets and Financial Liabilities, which addresses certain aspects of recognition, measurement, presentation, and disclosure of financial instruments. ASU 2016-01 will be effective for annual periods and interim periods within those annual periods beginning after December 15, 2017 and early adoption is not permitted. We adopted this ASU in the first quarter of 2018. The adoption of this ASU did not have a material impact on our consolidated financial statements.

In February 2016, the FASB established Topic 842, Leases, by issuing ASU No. 2016-02, which requires lessees to recognize leases on-balance sheet and disclose key information about leasing arrangements. Topic 842 was subsequently amended by ASU No. 2018-01, Land Easement Practical Expedient for Transition to Topic 842; ASU No. 2018-10, Codification Improvements to Topic 842, Leases; and ASU No. 2018-11, Targeted Improvements. The new standard establishes a right-of-use model (ROU) that requires a lessee to recognize a ROU asset and lease liability on the balance sheet for all leases with a term longer than 12 months. Leases will be classified as finance or operating, with classification affecting the pattern and classification of expense recognition in the income statement.

The new standard is effective for us on January 1, 2019, with early adoption permitted. A modified retrospective transition approach is required, applying the new standard to all leases existing at the date of initial application. An entity may choose to use either (1) its effective date or (2) the beginning of the earliest comparative period presented in the financial statements as its date of initial application. If an entity chooses the second option, the transition requirements for existing leases also apply to leases entered into between the date of initial application and the effective date. The entity must also recast its comparative period financial statements and provide the disclosures required by the new standard for the comparative periods. We expect to adopt the new standard on January 1, 2019 and use the effective date as our date of initial application. Consequently, financial information will not be updated and the disclosures required under the new standard will not be provided for dates and periods before January 1, 2019.

The new standard provides a number of optional practical expedients in transition. We elected the ‘package of practical expedients,’ which permits us not to reassess under the new standard our prior conclusions about lease identification, lease classification and initial direct costs. We do not expect to elect the use-of- hindsight or the practical expedient pertaining to land easements; the latter not being applicable to us.

We expect that this standard will have a material effect on our financial statements. We currently believe the most significant effects relate to (1) the recognition of new right of use (ROU) assets and lease liabilities on our balance sheet for our real estate operating leases and (2) providing significant new disclosures about our leasing activities. During the first fiscal quarter of adoption, we currently expect to recognize additional operating liabilities of approximately $3.4 million, with corresponding ROU assets of approximately $2.5 million, based on the present value of the remaining minimum rental payments and other adjustments required by Topic 842 for existing operating leases.

The new standard also provides practical expedients for an entity's ongoing accounting. We elected the short-term lease recognition exemption for all leases that qualify. For those leases that qualify, we will not recognize ROU assets or lease liabilities, and this includes not recognizing ROU assets or lease liabilities for existing short-term leases of those assets in transition. We also elected the practical expedient to not separate lease and non-lease components for all of our leases.

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In August 2016, the FASB issued ASU 2016-15, Statement of Cash Flows, which amends the guidance in Accounting Standards Codification (ASC) 230 on the classification of certain cash receipts and payments in the statement of cash flows. The primary purpose of the ASU is to reduce the diversity in practice that has resulted from the lack of consistent principles on this topic. The guidance in the ASU is effective for fiscal years beginning after December 15, 2017, including interim periods within those fiscal years. We adopted this ASU in the first quarter of 2018. The adoption of this ASU did not have a material impact on our consolidated financial statements.

In May 2017, the FASB issued ASU 2017-09, Scope of Modification Accounting, which amends the scope of modification accounting for share-based payment arrangements. The ASU provides guidance on the types of changes to the terms or conditions of share-based payment awards to which an entity would be required to apply modification accounting under ASC 718. Specifically, an entity would not apply modification accounting if the fair value, vesting conditions, and classification of the awards are the same immediately before and after the modification. For all entities, the ASU is effective for annual reporting periods, including interim periods within those annual reporting periods, beginning after December 15, 2017, with early adoption permitted. We adopted this ASU in the first quarter of 2018. The adoption of this ASU did not have a material impact on our consolidated financial statements.

In June 2018, the FASB issued ASU 2018-07, Improvements to Nonemployee Share-Based Payment Accounting, which superseded ASC 505-50 and expands the scope of ASC 718 to include all share-based payment arrangements related to the acquisition of goods and services from both nonemployees and employees. As a result, most of the guidance in ASC 718 associated with employee share-based payments, including most of its requirements related to classification and measurement, applies to nonemployee share-base payment arrangements. We early-adopted this guidance effective January 1, 2018. The adoption of this guidance did not have a material impact on our consolidated financial statements.

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

We are exposed to market risks in the ordinary course of our business. These market risks are principally limited to interest rate fluctuations.

We had cash, cash equivalents and investment balances of $72.7 million at December 31, 2018, consisting of funds in cash, money market accounts and U.S. Treasury securities. The primary objective of our investment activities is to preserve principal and liquidity while maximizing income without significantly increasing risk. We do not enter into investments for trading or speculative purposes. Due to the conservative nature of our investment portfolio, we do not believe an immediate 1.0% increase in interest rates would have a material effect on the fair market value of our portfolio, and accordingly we do not expect a sudden change in market interest rates to affect materially our operating results or cash flows.

Item 8. Financial Statements and Supplementary Data.

Our financial statements, accompanying notes and Report of Independent Registered Public Accounting Firm are included in this Annual Report on Form 10-K beginning on page F-1, which are incorporated in this Item 8 by reference.

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.

Our management, with the participation of our Chief Executive Officer and Chief Financial Officer, has evaluated the effectiveness 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 the end of the period covered by this Annual Report on Form 10-K.

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Management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving their objectives and management necessarily applies its judgment in evaluating the cost benefit relationship of possible controls and procedures. Based on such evaluation, our Chief Executive Officer and Chief Financial Officer have concluded that, as of the end of the period covered by this report, our disclosure controls and procedures were effective to ensure that the information required to be disclosed by the Company in the reports that it files or submits under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in SEC rules and forms, and that information required to be disclosed in the reports we file or submit under the Exchange Act is accumulated and communicated to our management, including our Chief Executive Officer and Chief Financial Officer, as our principal financial and accounting officer, to allow timely decisions regarding required disclosures.

Management's Report on Internal Control Over Financial Reporting

Management of Marinus Pharmaceuticals, Inc. is responsible for establishing and maintaining adequate internal control over financial reporting as defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act. Our 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. 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.

Management utilized the criteria established in the Internal Control – Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO) to conduct an assessment of the effectiveness of our internal control over financial reporting as of December 31, 2018. Based on the assessment, management has concluded that, as of December 31, 2018, our internal control over financial reporting was effective.

Changes in Internal Control Over Financial Reporting

There was no change in our internal control 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 quarter ended December 31, 2018 that has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. Other Information.

None.

PART III

Item 10. Directors and Executive Officers and Corporate Governance.

We incorporate the information required by this Item 10 by reference to the definitive proxy statement for our 2019 annual meeting of shareholders, to be filed with the SEC.

Item 11. Executive Compensation.

We incorporate the information required by this Item 11 by reference to the definitive proxy statement for our 2019 annual meeting of shareholders, to be filed with the SEC.

Item 12. Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters.

We incorporate the information required by this Item 12 by reference to the definitive proxy statement for our 2019 annual meeting of shareholders, to be filed with the SEC.

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Item 13. Certain Relationships and Related Transactions and Director Independence.

We incorporate the information required by this Item 13 by reference to the definitive proxy statement for our 2019 annual meeting of shareholders, to be filed with the SEC.

Item 14. Principal Accountants Fees and Services.

We incorporate the information required by this Item 14 by reference to the definitive proxy statement for our 2019 annual meeting of shareholders, to be filed with the SEC.

Item 15. Exhibits and Financial Statement Schedules.

(a) Documents filed as part of this report:

1. Financial Statements. The financial statements as set forth under Item 8 of this Annual Report on Form 10-K are incorporated herein.

2. Financial Statement Schedules. All financial statement schedules have been omitted because they are not applicable, not required, or the information is shown in the financial statements or related notes.

3. Exhibits. See (b) below.

(b) Exhibits:

Exhibit No.	Description of Exhibit
3.1	Fourth Amended and Restated Certificate of Incorporation. (Incorporated by reference to Exhibit 3.1 to Form 8-K current report filed on August 7, 2014.)
3.2	Amended and Restated By-laws. (Incorporated by reference to Exhibit 3.2 to Form 8-K current report filed on August 7, 2014.)
4.1	Specimen Certificate evidencing shares of the Company's common stock. (Incorporated by reference to Exhibit 4.1 to Form S-1/A registration statement filed on July 18, 2014.)
4.2	Form of Third Amended and Restated Investors' Rights Agreement by and among the Company and the parties listed therein. (Incorporated by reference to Exhibit 4.2 to Form S-1/A registration statement filed on July 9, 2014.)
10.1+	Marinus Pharmaceuticals, Inc. 2005 Stock Option and Incentive Plan, as amended. (Incorporated by reference to Exhibit 10.1 to Form S-1 registration statement filed on May 12, 2014.)
10.2+	Forms of Stock Option Agreement under the 2005 Stock Option and Incentive Plan. (Incorporated by reference to Exhibit 10.2 to Form S-1 registration statement filed on May 12, 2014.)
10.3+	Amended and Restated Employment Agreement dated as of August 3, 2016 between the Company and Christopher M. Cashman. (Incorporated by reference to Exhibit 10.1 to Form 10-Q quarterly report filed on August 9, 2016.)

10.4+	Amended and Restated Employment Agreement dated as of August 3, 2016 between the Company and Edward F. Smith. (Incorporated by reference to Exhibit 10.1 to Form 10-Q quarterly report filed on August 9, 2016.)
10.5+	Employment Agreement dated as of April 10, 2017 between the Company and Lorianne Masuoka. (Incorporated by reference to Exhibit 10.1 to Form 8-K current report filed on April 12, 2017.)
10.6*	Technology Transfer Agreement dated December 4, 2012 between Domain Russia Investments Limited and the Company. (Incorporated by reference to Exhibit 10.6 to Form S-1 registration statement filed on May 12, 2014.)
10.7	Assignment and Assumption Agreement dated as of December 4, 2012 among Domain Russia Investments Limited, the Company and NovaMedica, LLC. (Incorporated by reference to Exhibit 10.7 to Form S-1 registration statement filed on May 12, 2014.)

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Exhibit No.	Description of Exhibit
10.8	Clinical Development and Collaboration Agreement dated as of June 25, 2013 between NovaMedica, LLC and the Company. (Incorporated by reference to Exhibit 10.8 to Form S-1 registration statement filed on May 12, 2014.)
10.9	Form of Amended and Restated Indemnification Agreement (VC Directors). (Incorporated by reference to Exhibit 10.10 to Form S-1 registration statement filed on May 12, 2014.)
10.10	Form of Amended and Restated Indemnification Agreement (Non-VC Directors). (Incorporated by reference to Exhibit 10.11 to Form S-1 registration statement filed on May 12, 2014.)
10.11*	Amended and Restated Agreement dated as of May 23, 2008 between the Company and Purdue Neuroscience Company. (Incorporated by reference to Exhibit 10.12 to Form S-1 registration statement filed on May 12, 2014.)
10.12+	Marinus Pharmaceuticals, Inc. 2014 Equity Incentive Plan, as amended, effective as of May 11, 2017. (Incorporated by reference to Exhibit 10.1 to Form 10-Q quarterly report filed on August 1, 2017.)
10.13+	Marinus Pharmaceuticals, Inc. Change in Control Severance Plan effective November 7, 2016. (Incorporated by reference to Exhibit 10.1 to Form 10-Q quarterly report filed on November 8, 2016.)
10.14+	Form of Incentive Stock Option Agreement for Officers Under 2014 Equity Incentive Plan. (Incorporated by reference to Exhibit 10.16 to Form 10-K annual report filed on March 12, 2015.)
10.15+	Form of Incentive Stock Option Agreement for Employees Under 2014 Equity Incentive Plan. (Incorporated by reference to Exhibit 10.17 to Form 10-K annual report filed on March 12, 2015.)
10.16+	Form of Nonqualified Stock Option Agreement Under 2014 Equity Incentive Plan. (Incorporated by reference to Exhibit 10.18 to Form 10-K annual report filed on March 12, 2015.)
10.17	First Amendment to Lease agreement dated as of December 28, 2015 between Radnor Properties-SDC, L.P. and Marinus Pharmaceuticals, Inc. amending Lease agreement dated as of October 14, 2014 between Radnor Center Associates and Marinus Pharmaceuticals, Inc. (Incorporated by reference to Exhibit 10.1 to Form 8-K current report filed on January 4, 2016.)
10.18	Equity Distribution Agreement dated as of October 31, 2017 between the Company and JMP Securities LLC. (Incorporated by reference to Exhibit 1.1 to Form 10-Q quarterly report filed on October 31, 2017.)
10.19	License Agreement by and between Marinus Pharmaceuticals, Inc. and CyDex Pharmaceuticals, Inc., dated March 31, 2017. (Incorporated by reference to Exhibit 10.1 to Form 8-K current report filed on April 6, 2017.)
10.20	Supply Agreement by and between Marinus Pharmaceuticals, Inc. and CyDex Pharmaceuticals, Inc., dated March 31, 2017. (Incorporated by reference to Exhibit 10.2 to Form 8-K current report filed on April 6, 2017.)
10.21	Second Amendment to Lease agreement dated as of December 7, 2018 between Radnor Properties-SDC, L.P., Radnor Center Associates and Marinus Pharmaceuticals, Inc, amending Lease agreement, as amended, dated as of December 28, 2015 between Radnor Properties-SDC, L.P. and Marinus Pharmaceuticals, Inc. (Incorporated by reference to Exhibit 10.1 to Form 8-K current report filed on December 7, 2018.)
10.22+	Employment Agreement dated as of February 26, 2019 between the Company and Scott Braunstein (Filed herewith).
21	Subsidiaries of the Registrant. (Filed herewith.)
23.1	Consent of KPMG LLP. (Filed herewith)
31.1	Certification Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002. (Filed herewith)
31.2	Certification Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002. (Filed herewith.)
32.1	Certification Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002. (Filed herewith.)
101.INS	XBRL Instance Taxonomy

101.SCH	XBRL Taxonomy Extension Schema Document
101.CAL	XBRL Taxonomy Extension Calculation Linkbase Document
101.DEF	XBRL Taxonomy Extension Definition Linkbase Document
101.LAB	XBRL Taxonomy Extension Labels Linkbase Document
101.PRE	XBRL Taxonomy Extension Presentation Linkbase Document

+ Indicates management contract or compensatory plan.

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* Portions of this exhibit (indicated by asterisks) have been omitted pursuant to an order granting confidential treatment under the Securities Act of 1933.

(c) None.

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SIGNATURES

In accordance with the requirements Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

Marinus Pharmaceuticals, Inc.

Date: March 12, 2019 By: /s/ Christopher M. Cashman
Christopher M. Cashman
President and Chief Executive Officer

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

Name	Capacity	Date
/s/ Christopher M. Cashman Christopher M. Cashman	President, Chief Executive Officer (Principal Executive Officer) and Chairman	March 12, 2019
/s/ Edward F. Smith Edward F. Smith	Vice President, Chief Financial Officer, Secretary and Treasurer (Principal Finance and Accounting Officer)	March 12, 2019
/s/ Scott Braunstein Scott Braunstein	Executive Chairman and Director	March 12, 2019
/s/ Enrique J. Carrazana Enrique J. Carrazana, M.D.	Director	March 12, 2019
/s/ Michael R. Dougherty Michael R. Dougherty	Director	March 12, 2019
/s/ Seth H.Z. Fischer Seth H.Z. Fischer	Director	March 12, 2019
/s/ Tim M. Mayleben Tim M. Mayleben	Director	March 12, 2019
/s/ Nicole Vitullo Nicole Vitullo	Director	March 12, 2019

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CONSOLIDATED FINANCIAL STATEMENTS

MARINUS PHARMACEUTICALS, INC. AND SUBSIDIARY

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To the Stockholders and Board of Directors
Marinus Pharmaceuticals, Inc.:

Opinion on the Consolidated Financial Statements

We have audited the accompanying consolidated balance sheets of Marinus Pharmaceuticals, Inc. and subsidiary (the Company) as of December 31, 2018 and 2017, the related consolidated statements of operations and comprehensive loss, stockholders' equity, and cash flows for each of the years in the three year period ended December 31, 2018, and the related notes (collectively, the consolidated financial statements). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2018 and 2017, and the results of its operations and its cash flows for each of the years in the three year period ended December 31, 2018, in conformity with U.S. generally accepted accounting principles.

Basis for Opinion

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

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud. The Company is not required to have, nor were we engaged to perform, an audit of its internal control over financial reporting. As part of our audits, we are required to obtain an understanding of internal control over financial reporting but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control over financial reporting. Accordingly, we express no such opinion.

Our audits included performing procedures to assess the risks of material misstatement of the consolidated 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 consolidated 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 consolidated financial statements. We believe that our audits provide a reasonable basis for our opinion.

/s/ KPMG LLP

We have served as the Company's auditor since 2014.

Philadelphia, Pennsylvania
March 12, 2019

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MARINUS PHARMACEUTICALS, INC. AND SUBSIDIARY

CONSOLIDATED BALANCE SHEETS

(In thousands, except share and per share amounts)

	December 31, 2018	2017
ASSETS		
Current assets:		
Cash and cash equivalents	$ 67,727	$ 33,531
Short-term investments	4,998	19,861
Prepaid expenses and other current assets	1,215	978
Total current assets	73,940	54,370
Property and equipment, net	1,294	1,338
Investments	—	4,964
Total assets	$ 75,234	$ 60,672
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Accounts payable	$ 2,472	$ 927
Accrued expenses	4,437	1,617
Total current liabilities	6,909	2,544
Other long-term liabilities	—	120
Total liabilities	6,909	2,664
Stockholders' equity:		
Preferred stock, $0.001 par value; 25,000,000 shares authorized, no shares issued and outstanding	—	—
Common stock, $0.001 par value; 100,000,000 shares authorized, 52,548,244 issued and 52,519,013 outstanding at December 31, 2018 and 40,549,936 issued and 40,520,705 outstanding at December 31, 2017	53	41
Additional paid-in capital	249,727	202,790
Treasury stock at cost, 29,231 shares at December 31, 2018 and December 31, 2017	—	—
Accumulated other comprehensive loss	(2)	(96)
Accumulated deficit	(181,453)	(144,727)
Total stockholders' equity	68,325	58,008
Total liabilities and stockholders' equity	$ 75,234	$ 60,672

See accompanying notes to consolidated financial statements.

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MARINUS PHARMACEUTICALS, INC. AND SUBSIDIARY

CONSOLIDATED STATEMENTS OF OPERATIONS AND COMPREHENSIVE LOSS

(In thousands, except share and per share amounts)

	Year Ended December 31,		
	2018	2017	2016
Expenses:			
Research and development	$ 28,394	$ 12,376	$ 22,005
General and administrative	8,785	6,667	6,237
Loss from operations	(37,179)	(19,043)	(28,242)
Interest income	454	324	128
Interest expense	—	(159)	(464)
Other expense	(1)	(20)	(65)
Net loss	$ (36,726)	$ (18,898)	$ (28,643)
Per share information:			
Net loss per share of common stock—basic and diluted	$ (0.90)	$ (0.80)	$ (1.47)
Basic and diluted weighted average shares outstanding	40,895,406	23,540,748	19,498,143
Net loss	$ (36,726)	$ (18,898)	$ (28,643)
Other comprehensive loss:			
Unrealized gain (loss) on available-for-sale securities	94	(96)	—
Total comprehensive loss	$ (36,632)	$ (18,994)	$ (28,643)

See accompanying notes to consolidated financial statements.

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MARINUS PHARMACEUTICALS, INC. AND SUBSIDIARY

CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY

(In thousands, except share and per share amounts)

	Common Stock		Additional Paid in	Treasury Stock		Accumulated Other Comprehensive	Accumulated	Total Stockholders'
	Shares	Amount	Capital	Shares	Amount	Loss	Deficit	Equity
Balance, December 31, 2015	19,420,086	$ 19	$ 144,088	29,231	$ —	$ —	$ (97,186)	$ 46,921
Stock based compensation expense	—	—	3,077	—	—	—	—	3,077
Exercise of stock options	118,365	1	123	—	—	—	—	124
Issuance of restricted stock	195,900	—	—	—	—	—	—	—
Net loss	—	—	—	—	—	—	(28,643)	(28,643)
Balance, December 31, 2016	19,734,351	20	147,288	29,231	—	—	(125,829)	21,479
Stock based compensation expense	—	—	2,880	—	—	—	—	2,880
Issuance of common stock under equity distribution agreement, net of expenses of $380 (Note 8)	9,768,142	10	14,843	—	—	—	—	14,853
Issuance of common stock in connection with secondary public offering ($3.75 per share), net of expenses of $2,555	10,733,334	10	37,684	—	—	—	—	37,694
Exercise of stock options	90,509	1	95	—	—	—	—	96

Issuance of restricted stock	223,600	—	—	—	—	—	—	—
Net loss	—	—	—	—	—	—	(18,898)	(18,898)
Unrealized loss on investments	—	—	—	—	—	(96)	—	(96)
Balance, December 31, 2017	40,549,936	41	202,790	29,231	—	(96)	(144,727)	58,008
Stock based compensation expense	—	—	4,788	—	—	—	—	4,788
Issuance of common stock in connection with secondary public offering ($3.75 per share), net of expenses of $2,853	12,000,000	12	42,135	—	—	—	—	42,147
Exercise of stock options	12,308	—	14	—	—	—	—	14
Forfeiture of restricted stock	(14,000)	—	—	—	—	—	—	—
Unrealized loss on investments	—	—	—	—	—	94	—	94
Net loss	—	—	—	—	—	—	(36,726)	(36,726)
Balance, December 31, 2018	52,548,244	$ 53	$ 249,727	29,231	$ —	$ (2)	$ (181,453)	$ 68,325

See accompanying notes to consolidated financial statements.

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MARINUS PHARMACEUTICALS, INC. AND SUBSIDIARY

CONSOLIDATED STATEMENTS OF CASH FLOWS

(In thousands)

	Year Ended December 31,		
	2018	2017	2016
Cash flows from operating activities			
Net loss	$ (36,726)	$ (18,898)	$ (28,643)
Adjustments to reconcile net loss to net cash used in operating activities:			
Depreciation	127	126	23
Stock-based compensation expense	4,788	2,880	3,077
Amortization of debt issuance costs	—	4	7
Amortization of discount on investments	(79)	(28)	—
Changes in operating assets and liabilities:			
Prepaid expenses and other current assets	(237)	(779)	1,396
Accounts payable and accrued expenses	4,285	(2,121)	(629)
Net cash used in operating activities	(27,842)	(18,816)	(24,769)
Cash flows from investing activities			
Purchases of investments	—	(24,892)	(2,434)
Maturities of short-term investments	20,000	3,922	4,474
Purchases of property and equipment	(83)	(450)	(644)
Net cash provided by (used in) investing activities	19,917	(21,420)	1,396
Cash flows from financing activities			
Proceeds from exercise of stock options	14	96	124
Principal payments of notes payable	—	(5,247)	(2,128)
Proceeds from equity offerings, net of offering costs	42,300	52,547	(167)
Proceeds from short-term bank borrowings	—	193	—
Repayments of short-term bank borrowings	(193)	—	—
Net cash provided by (used in) financing activities	42,121	47,589	(2,171)
Net increase (decrease) in cash and cash equivalents	34,196	7,353	(25,544)
Cash and cash equivalents—beginning of year	33,531	26,178	51,722
Cash and cash equivalents—end of year	$ 67,727	$ 33,531	$ 26,178
Supplemental disclosure of cash flow information			
Cash paid for interest	$ —	$ 184	$ 460
Accrued equity offering costs	$ 153	$ —	$ —
Property and equipment in accounts payable	$ —	$ —	$ 134

See accompanying notes to consolidated financial statements.

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MARINUS PHARMACEUTICALS, INC. AND SUBSIDIARY

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

1. Organization and Description of the Business

We are a clinical stage pharmaceutical company focused on developing and commercializing innovative therapeutics to treat epilepsy and neuropsychiatric disorders. Our clinical stage product candidate, ganaxolone, is a positive allosteric modulator of the $GABA_A$ receptor being developed in three different dose forms (intravenous, oral capsule and oral liquid) intended to maximize therapeutic reach to adult and pediatric patient populations in acute and chronic care, in-patient and self-administered settings. The $GABA_A$ receptor is a well characterized target in the brain known for both anti seizure, anti-depression and anti anxiety effects. Our primary focus to date has been directed towards developing business strategies, conducting research and development activities, and conducting preclinical testing and human clinical studies for our product candidate.

Liquidity

We have not generated any product revenues and have incurred operating losses since inception. There is no assurance that profitable operations will ever be achieved, and if achieved, could be sustained on a continuing basis. In addition, development activities, clinical and preclinical testing, and commercialization of our product candidates will require significant additional financing. Our accumulated deficit as of December 31, 2018 was $181.5 million and we expect to incur substantial losses in future periods. We plan to finance our future operations with a combination of proceeds from the issuance of equity securities, the issuance of additional debt, potential collaborations and revenues from potential future product sales, if any. We have not generated positive cash flows from operations, and there are no assurances that we will be successful in obtaining an adequate level of financing for the development and commercialization of our planned product candidates.

In connection with the closing of a secondary public offering during the fourth quarter of 2018, we issued a total of 12,000,000 shares of common stock resulting in aggregate net proceeds, after underwriting discounts and commissions and other estimated offering expenses, of $42.1 million. In connection with the closing of a secondary public offering during the third quarter of 2017, we issued a total of 10,733,334 shares of common stock resulting in aggregate net proceeds, after underwriting discounts and commissions and other estimated offering expenses, of $37.7 million.

2. Summary of Significant Accounting Policies

Principles of Consolidation

The consolidated financial statements include the accounts of the Company and its wholly-owned subsidiary. All intercompany accounts and transactions have been eliminated.

Use of Estimates

The preparation of financial statements in conformity with generally accepted accounting principles (GAAP) requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. Actual results could differ from such estimates.

Fair Value of Financial Instruments and Credit Risk

At December 31, 2018 and 2017, our financial instruments included cash equivalents, U.S. Treasury securities, accounts payable and accrued expenses. The carrying amount of cash equivalents, certificates of deposit, accounts payable and accrued expenses approximated fair value, given their short-term nature. The carrying amount of U.S. Treasury securities is recorded at amortized cost based on the current market price of each security at the measurement date. The

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MARINUS PHARMACEUTICALS, INC. AND SUBSIDIARY

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

carrying amount of our notes payable approximate fair value because the interest rates on these instruments are reflective of rates that we could obtain on debt with similar terms and conditions.

Cash equivalents and U.S. Treasury securities subject us to concentrations of credit risk. However, we invest our cash in accordance with a policy objective that seeks to ensure both liquidity and safety of principal. The policy limits investments to instruments issued by the U.S. government, certain Securities and Exchange Commission (SEC)-registered money market funds that invest only in U.S. government obligations and various other low-risk liquid investment options, and places restrictions on portfolio maturity terms.

Cash and Cash Equivalents

We consider all highly liquid investments that have maturities of three months or less when acquired to be cash equivalents. As of December 31, 2018 and 2017, we invested a portion of our cash balances in money market investments, which we have included as cash equivalents on our balance sheets.

Investments

As of December 31, 2018, our investments consisted of U.S. Treasury securities and are classified as available-for-sale and are recorded at amortized cost with unrealized gains and losses recorded in accumulated other comprehensive loss, as a separate component of stockholders' equity. Interest income includes interest and dividends, realized gains and losses on sales of securities and other-than-temporary impairment (OTTI) declines in the fair value of securities, if any. U.S. Treasury securities with maturities less than 12 months are classified as short-term investments and maturities greater than 12 months are classified as long-term investments on our balance sheet.

The Company reviews its available-for-sale securities for OTTI declines in fair value below its cost basis each quarter and whenever events or changes in circumstances indicate that the cost basis of an asset may not be recoverable. This evaluation is based on a number of factors, including the length of time and the extent to which the fair value has been below its cost basis and adverse conditions related specifically to the security, including any changes to the credit rating of the security, and the intent to sell, or whether the Company will more likely than not be required to sell, the security before recovery of its amortized cost basis. The Company's assessment of whether a security is other-than-temporarily impaired could change in the future due to new developments or changes in assumptions related to any particular security.

If a decline in the fair value of an available-for-sale security in the Company's investment portfolio is deemed to be other-than-temporary, the Company writes down the security to its current fair value. If the Company intends to sell the security or it is more likely than not that the Company will be forced to sell the security before recovery of the amortized cost of the security, the loss is recognized in net income. Otherwise, the loss is separated into a portion representing a credit loss, which is recorded in net income, and the remainder is recorded in other comprehensive income, net of taxes.

Prepaid Expenses and Other Current Assets

Prepaid expenses and other current assets generally represent payments made for goods or services to be received within one year, and are expensed as the related benefit is received.

Property and Equipment

Property and equipment consist of laboratory and office equipment and are recorded at cost. Property and equipment are depreciated on a straight line basis over their estimated useful lives. We estimate a life of three years for computer equipment, including software, five years for office equipment and furniture, and five to fifteen years for

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MARINUS PHARMACEUTICALS, INC. AND SUBSIDIARY

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

laboratory equipment. When property and equipment are sold or otherwise disposed of, the cost and related accumulated depreciation are removed from the accounts and the resulting gain or loss is included in operating expenses.

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 an asset may not be fully recoverable. If the estimated undiscounted future cash flows expected to result from the use of the asset and its eventual disposition is less than its carrying amount an impairment loss would be recognized if the carrying value of the asset exceeded its fair value. Fair value is generally determined using discounted cash flows.

Research and Development

Research and development costs are expensed as incurred. Costs for certain development activities, such as clinical studies, are recognized based on an evaluation of the progress to completion of specific tasks using data such as subject enrollment, monitoring visits, clinical site activations, or information provided to us by our vendors with respect to their actual costs incurred. Payments for these activities are based on the terms of the individual arrangements, which may differ from the pattern of costs incurred, and are reflected in the financial statements as prepaid or accrued research and development expense, as the case may be.

Income Taxes

We recognize deferred tax assets and liabilities for temporary differences between the financial reporting basis and the tax basis of our assets and liabilities and the expected benefits of net operating loss carryforwards. The impact of changes in tax rates and laws on deferred taxes, if any, applied during the years in which temporary differences are expected to be settled, is reflected in the financial statements in the period of enactment. The measurement of deferred tax assets is reduced, if necessary, if, based on weight of the evidence, it is more likely than not that some, or all, of the deferred tax assets will not be realized. The effect on deferred tax assets and liabilities of a change in tax rates is recognized in the period that such tax rate changes are enacted. At December 31, 2018 and 2017, we have concluded that a full valuation allowance is necessary for our net deferred tax assets. We had no material amounts recorded for uncertain tax positions, interest or penalties in the accompanying financial statements.

Loss Per Share of Common Stock

Basic loss per share is computed by dividing net loss applicable to common stockholders by the weighted average number of shares of common stock outstanding during each period. Diluted loss per share includes the effect, if any, from the potential exercise or conversion of securities, such as convertible preferred stock, convertible notes payable, warrants, stock options, and unvested restricted stock, which would result in the issuance of incremental shares of common stock. In computing the basic and diluted net loss per share applicable to common stockholders, the weighted average number of shares remains the same for both calculations due to the fact that when a net loss exists, dilutive shares are not included in the calculation. These potentially dilutive securities are more fully described in Note 8.

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MARINUS PHARMACEUTICALS, INC. AND SUBSIDIARY

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

The following table sets forth the computation of basic and diluted earnings per share for the years ended December 31, 2018, 2017 and 2016 (in thousands, except share and per share amounts):

	Year Ended December 31,		
	2018	2017	2016
Basic and diluted net loss per share of common stock:			
Net loss	$ (36,726)	$ (18,898)	$ (28,643)
Weighted average shares of common stock outstanding	40,895,406	23,540,748	19,498,143
Net loss per share of common stock—basic and diluted	$ (0.90)	$ (0.80)	$ (1.47)

The following potentially dilutive securities have been excluded from the computation of diluted weighted average shares outstanding, as they would be antidilutive:

	December 31,	
	2018	2017
Restricted stock	105,200	239,800
Stock options	4,951,409	3,754,320
	5,056,609	3,994,120

As of December 31, 2018, 2017 and 2016, we had no other potentially dilutive securities.

Comprehensive Loss

Comprehensive loss is defined as the change in equity of a business enterprise during a period from transactions and other events and circumstances from non owner sources. As of December 31, 2018 and 2017, comprehensive loss includes net loss and unrealized gain or loss on available-for-sale securities.

Segment Information

Operating segments are defined as components of an enterprise about which separate discrete information is available for evaluation by the chief operating decision maker, or decision making group, in deciding how to allocate resources and in assessing performance. We view our operations and manage our business in one segment, which is the identification and development of neuropsychiatric therapeutics.

Stock Based Compensation

We account for stock based compensation in accordance with the provisions of Accounting Standards Codification (ASC) Topic 718, Compensation—Stock Compensation, or ASC 718, which requires the recognition of expense related to the fair value of stock based awards in the statements of operations. For stock options issued to employees, non-employees and members of our board of directors for their services on our board of directors, we estimate the grant date fair value of options using the Black Scholes option pricing model. The use of the Black Scholes option pricing model requires management to make assumptions with respect to the expected term of the option, the expected volatility of the common stock consistent with the expected life of the option, risk free interest rates, and, for grants prior to our initial public offering, the value of the common stock. For restricted stock awards, the grant date fair value is determined by the closing market price of our common stock on the date of grant. For awards subject to time based vesting, we recognize stock based compensation expense, on a straight line basis over the requisite service period, which is generally the vesting term of the award. For awards subject to performance based vesting conditions, we recognize stock based compensation expense when it is probable that the performance condition will be achieved.

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MARINUS PHARMACEUTICALS, INC. AND SUBSIDIARY

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

Clinical Study Expenses

As part of the process of preparing our financial statements, we are required to estimate our expenses resulting from our obligations under contracts with vendors, clinical research organizations and consultants and under clinical site agreements in connection with conducting clinical studies. The financial terms of these contracts are subject to negotiations, which vary from contract to contract and may result in payment flows that do not match the periods over which materials or services are provided under such contracts. Our objective is to reflect the appropriate study expenses in our financial statements by matching those expenses with the period in which services are performed and efforts are expended. We account for these expenses according to the progress of the study as measured by patient progression and the timing of various aspects of the study. We determine accrual estimates based on estimates of services received and efforts expended that take into account discussion with applicable personnel and outside service providers as to the progress or state of consummation of studies. During the course of a clinical study, we adjust our clinical expense recognition if actual results differ from its estimates. We make estimates of our accrued expenses as of each balance sheet date based on the facts and circumstances known at that time. Our clinical study accruals are dependent upon the timely and accurate reporting of contract research organizations and other third party vendors. Although we do not expect our estimates to be materially different from amounts actually incurred, our understanding 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 amounts that are too high or too low for any particular period. For the years ended December 31, 2018, 2017 and 2016 there were no material adjustments to our prior period estimates of accrued expenses for clinical studies.

Recent Accounting Pronouncements

In January 2016, the Financial Accounting Standard Board (FASB) issued Accounting Standards Update (ASU) 2016-01, Financial Instruments - Overall (Subtopic 825-10), Recognition and Measurement of Financial Assets and Financial Liabilities, which addresses certain aspects of recognition, measurement, presentation, and disclosure of financial instruments. ASU 2016-01 will be effective for annual periods and interim periods within those annual periods beginning after December 15, 2017 and early adoption is not permitted. We adopted this ASU in the first quarter of 2018. The adoption of this ASU did not have a material impact on our interim consolidated financial statements.

In February 2016, the FASB established Topic 842, Leases, by issuing ASU No. 2016-02, which requires lessees to recognize leases on-balance sheet and disclose key information about leasing arrangements. Topic 842 was subsequently amended by ASU No. 2018-01, Land Easement Practical Expedient for Transition to Topic 842; ASU No. 2018-10, Codification Improvements to Topic 842, Leases; and ASU No. 2018-11, Targeted Improvements. The new standard establishes a right-of-use model (ROU) that requires a lessee to recognize a ROU asset and lease liability on the balance sheet for all leases with a term longer than 12 months. Leases will be classified as finance or operating, with classification affecting the pattern and classification of expense recognition in the income statement.

The new standard is effective for us on January 1, 2019, with early adoption permitted. A modified retrospective transition approach is required, applying the new standard to all leases existing at the date of initial application. An entity may choose to use either (1) its effective date or (2) the beginning of the earliest comparative period presented in the financial statements as its date of initial application. If an entity chooses the second option, the transition

requirements for existing leases also apply to leases entered into between the date of initial application and the effective date. The entity must also recast its comparative period financial statements and provide the disclosures required by the new standard for the comparative periods. We expect to adopt the new standard on January 1, 2019 and use the effective date as our date of initial application. Consequently, financial information will not be updated and the disclosures required under the new standard will not be provided for dates and periods before January 1, 2019.

The new standard provides a number of optional practical expedients in transition. We elected the ‘package of practical expedients,’ which permits us not to reassess under the new standard our prior conclusions about lease identification, lease classification and initial direct costs. We do not expect to elect the use-of- hindsight or the practical expedient pertaining to land easements; the latter not being applicable to us.

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We expect that this standard will have a material effect on our financial statements. We currently believe the most significant effects relate to (1) the recognition of new right of use (ROU) assets and lease liabilities on our balance sheet for our real estate operating leases and (2) providing significant new disclosures about our leasing activities. We do not expect a significant change in our leasing activities. During the first fiscal quarter of adoption, we currently expect to recognize additional operating liabilities of approximately $3.4 million, with corresponding ROU assets of approximately $2.5 million, based on the present value of the remaining minimum rental payments and other adjustments required by Topic 842 for existing operating leases.

The new standard also provides practical expedients for an entity's ongoing accounting. We elected the short-term lease recognition exemption for all leases that qualify. For those leases that qualify, we will not recognize ROU assets or lease liabilities, and this includes not recognizing ROU assets or lease liabilities for existing short-term leases of those assets in transition. We also elected the practical expedient to not separate lease and non-lease components for all of our leases.

In August 2016, the FASB issued ASU 2016-15, Statement of Cash Flows, which amends the guidance in Accounting Standards Codification (ASC) 230 on the classification of certain cash receipts and payments in the statement of cash flows. The primary purpose of the ASU is to reduce the diversity in practice that has resulted from the lack of consistent principles on this topic. The guidance in the ASU is effective for fiscal years beginning after December 15, 2017, including interim periods within those fiscal years. We adopted this ASU in the first quarter of 2018. The adoption of this ASU did not have a material impact on our consolidated financial statements.

In May 2017, the FASB issued ASU 2017-09, Scope of Modification Accounting, which amends the scope of modification accounting for share-based payment arrangements. The ASU provides guidance on the types of changes to the terms or conditions of share-based payment awards to which an entity would be required to apply modification accounting under ASC 718. Specifically, an entity would not apply modification accounting if the fair value, vesting conditions, and classification of the awards are the same immediately before and after the modification. For all entities, the ASU is effective for annual reporting periods, including interim periods within those annual reporting periods, beginning after December 15, 2017, with early adoption permitted. We adopted this ASU in the first quarter of 2018. The adoption of this ASU did not have a material impact on our consolidated financial statements.

In June 2018, the FASB issued ASU 2018-07, Improvements to Nonemployee Share-Based Payment Accounting, which superseded ASC 505-50 and expands the scope of ASC 718 to include all share-based payment arrangements related to the acquisition of goods and services from both nonemployees and employees. As a result, most of the guidance in ASC 718 associated with employee share-based payments, including most of its requirements related to classification and measurement, applies to nonemployee share-base payment arrangements. We early-adopted this guidance effective January 1, 2018. The adoption of this guidance did not have a material impact on our consolidated financial statements.

3. Fair Value Measurements

FASB accounting guidance defines fair value as the price that would be received to sell an asset or paid to transfer a liability (the exit price) in an orderly transaction between market participants at the measurement date. The accounting guidance outlines a valuation framework and creates a fair value hierarchy in order to increase the consistency and comparability of fair value measurements and the related disclosures. In determining fair value, we use quoted prices and observable inputs. Observable inputs are inputs that market participants would use in pricing the asset or liability based on market data obtained from independent sources.

The fair value hierarchy is broken down into three levels based on the source of inputs as follows:

· Level 1—Valuations based on unadjusted quoted prices in active markets for identical assets or liabilities.

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- Level 2—Valuations based on observable inputs and quoted prices in active markets for similar assets and liabilities.
- Level 3—Valuations based on inputs that are unobservable and models that are significant to the overall fair value measurement.

If the inputs used to measure fair value fall within different levels of the hierarchy, the category level is based on the lowest priority level input that is significant to the fair value measurement of the instrument.

Valuation Techniques - Level 2 Inputs

The Company estimates the fair values of its financial instruments categorized as level 2 in the fair value hierarchy, including U.S. Treasury securities, by taking into consideration valuations obtained from third-party pricing services. The pricing services use industry standard valuation models, including both income- and market-based approaches, for which all significant inputs are observable, either directly or indirectly, to estimate fair value. These inputs include reported trades of and broker/dealer quotes on the same or similar securities, benchmark yields, issuer credit spreads, benchmark securities, and other observable inputs. The Company obtains a single price for each financial instrument and does not adjust the prices obtained from the pricing service. The Company validates the prices provided by its third-party pricing services by reviewing their pricing methods, obtaining market values from other pricing sources and comparing them to the share prices presented by the third-party pricing services. After completing its validation procedures, the Company did not adjust or override any fair value measurements provided by its third-party pricing services as of December 31, 2018 or 2017.

The following fair value hierarchy table presents information about each major category of our financial assets and liabilities measured at fair value on a recurring basis (in thousands):

	Level 1	Level 2	Level 3	Total
December 31, 2018				
Assets				
Money market funds (cash equivalents)	$ 14,049	$ —	$ —	$ 14,049
U.S. Treasury securities	—	4,998	—	4,998
Total assets	$ 14,049	$ 4,998	$ —	$ 19,047
December 31, 2017				
Assets				
Money market funds (cash equivalents)	$ 33,531	$ —	$ —	$ 33,531
U.S. Treasury securities	—	24,825	—	24,825
Total assets	$ 33,531	$ 24,825	$ —	$ 58,356

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4. Property and Equipment

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

	December 31,	
	2018	2017
Laboratory equipment	$ 1,756	$ 1,684
Office equipment	148	139
	1,904	1,823
Less: accumulated depreciation	(610)	(484)
	$ 1,294	$ 1,338

Depreciation expense was $127 thousand, $126 thousand, and $23 thousand for the years ended December 31, 2018, 2017 and 2016, respectively.

5. Accrued Expenses

Accrued expenses consisted of the following (in thousands):

	December 31,	
	2018	2017
Payroll and related costs	$ 1,364	$ 1,323
Clinical studies and drug development	2,781	156
Professional fees	204	113
Other	88	25
Total accrued expenses	$ 4,437	$ 1,617

6. Notes Payable

In 2014, we borrowed an aggregate of $7.0 million in connection with a Loan and Security Agreement, as amended (LSA). In July 2017, we paid in full the entire outstanding term loans balance of $3.5 million and accrued interest, with no penalty for prepayment. Interest expense related to the term loans was $0.2 million and $0.5 million for the years ended December 31, 2017 and 2016, respectively.

7. Investments

As of December 31, 2018 and 2017, our investments consisted of U.S. Treasury securities, maturing at various dates through January 2019. Investments are classified as short- or long-term investments on our consolidated balance sheets based on maturity. U.S. Treasury securities are classified as available-for-sale and are recorded at amortized cost.

As of December 31, 2018, our one U.S. Treasury security was in an unrealized loss position. While this security has been in an unrealized loss position for more than 12 months, the security matured in January 2019 and we recovered the full amortized cost basis. Accordingly, we believe that there was no other-than-temporary impairment as of December 31, 2018. Total amortized cost and fair value each were $5.0 million as of December 31, 2018, with an unrealized loss of $1 thousand. Total amortized cost and fair value were $24.9 million and $24.8 million as of December 31, 2017, respectively, with a combined unrealized loss of $96 thousand.

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8. Stockholders' Equity

In 2005, we adopted the 2005 Stock Option and Incentive Plan (2005 Plan) that authorizes us to grant options, restricted stock and other equity-based awards. As of December 31, 2018, 362,112 options to purchase shares of common stock were outstanding pursuant to grants in connection with the 2005 Plan. No additional shares are available for issuance under the 2005 Plan. The amount, terms of grants, and exercisability provisions are determined and set by our board of directors.

Effective August 2014, we adopted our 2014 Equity Incentive Plan, as amended (2014 Plan) that authorizes us to grant options, restricted stock, and other equity-based awards, subject to adjustment in accordance with the 2014 Plan. As of December 31, 2018, 4,278,297 options to purchase shares of common stock and 105,200 restricted shares of common stock were outstanding pursuant to grants in connection with the 2014 Plan, and 1,302,703 shares of common stock were available for future issuance. The amount, terms of grants, and exercisability provisions are determined and set by our board of directors. In accordance with the 2014 Plan, on January 1, 2018, shares of common stock available for future grants under the 2014 plan was increased to 3,302,703.

In addition, during the year ended December 31, 2018, we granted 311,000 options to purchase shares of common stock outside of our 2014 Plan as inducements material to new employees entering into employment agreements with us pursuant to NASDAQ Listing Rule 5635(c)(4). The amount, terms of grants, and exercisability provisions of these grants are determined and set by our board of directors, and are largely consistent with the terms and exercisability provisions of grants under our 2014 Plan.

Stock Options

Total compensation cost recognized for all stock option awards in the statements of operations is as follows (in thousands):

	Year Ended December 31,		
	2018	2017	2016
Research and development	$ 1,712	$ 724	$ 980
General and administrative	2,995	1,697	1,975
Total	$ 4,707	$ 2,421	$ 2,955

Options issued under both the 2005 Plan and 2014 Plan and the inducement grants may have a contractual life of up to 10 years and may be exercisable in cash or as otherwise determined by the board of directors. Vesting generally

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occurs over a period of not greater than four years. A summary of activity for the years ended December 31, 2018, 2017 and 2016 is presented below (in thousands, except share and per share amounts):

	Shares	Weighted Average Exercise Price Per Share	Aggregate Intrinsic Value
Outstanding—December 31, 2015	1,799,226	$ 7.74	
Granted	603,975	2.42	
Exercised	(118,365)	1.04	
Forfeited	(45,792)	12.08	
Outstanding—December 31, 2016	2,239,044	6.57	
Granted	1,884,800	4.02	
Exercised	(98,402)	1.46	
Forfeited	(141,358)	7.09	
Expired	(129,764)	11.75	
Outstanding—December 31, 2017	3,754,320	5.22	
Granted	1,372,000	6.60	
Exercised	(12,308)	1.18	
Forfeited	(162,603)	5.00	
Outstanding—December 31, 2018	4,951,409	$ 5.62	$ 2,429
Exercisable—December 31, 2018	2,894,726	$ 5.69	$ 1,836
Exercisable and expected to vest—December 31, 2018	4,951,409	$ 5.62	$ 2,429

Included in the 2017 exercised shares above are options that were net shares settled for an exercise price of $49 thousand (7,893 shares).

The weighted average remaining contractual term of options outstanding and exercisable as of December 31, 2018 is 7.9 and 7.1 years, respectively.

Intrinsic value in the table above was determined by calculating the difference between the market value of our common stock on the last trading day of 2018 of $2.87 per share and the exercise price, multiplied by the number of in-the-money options.

The weighted average grant date fair value of options granted was $5.51, $2.67 and $1.60 per share in 2018, 2017 and 2016, respectively, and was estimated at the date of grant using the Black Scholes option pricing model with the following ranges of weighted average assumptions: