

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

FORM 10-K

(Mark One)

ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

For the fiscal year ended December 31, 2017

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 000-55764

EXICURE, INC.

(Exact name of registrant as specified in its charter)

Delaware
(State or other jurisdiction of
incorporation or organization)

81-5333008
(I.R.S. Employer
Identification No.)

8045 Lamon Avenue
Suite 410
Skokie, IL 60077
(Address of principal executive offices and Zip Code)
(847) 673-1700
(Registrant's telephone number, including area code)

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

Common Stock, par value \$0.0001 per share
(Title of each class)

None

(Name of each exchange on which registered)

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

None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes No

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes No

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes No

Indicate by check mark whether the registrant has submitted electronically and posted on its corporate Web site, if any, every Interactive Data File required to be submitted and posted pursuant to Rule 405 of Regulation S-T (§232-405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit and post such files.) Yes No

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

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, 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 (Do not check if a smaller reporting company)

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

As of the last business day of the registrant's most recently completed second fiscal quarter, there was no public market for the registrant's common stock. As of February 28, 2018, the registrant had 39,454,821 shares of common stock outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's definitive Proxy Statement for the 2018 Annual Meeting of Stockholders, to be filed with the Securities and Exchange Commission pursuant to Regulation 14A not later than 120 days after the end of the fiscal year covered by this Form 10-K, are incorporated by reference in Part III, Items 10-14 of this Form 10-K. Except for the portions of the Proxy Statement specifically incorporated by reference in this Form 10-K, the Proxy Statement shall not be deemed to be filed as part hereof.

EXICURE, INC.

ANNUAL REPORT ON FORM 10-K

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CAUTIONARY NOTE REGARDING FORWARD-LOOKING STATEMENTS

This Annual Report on Form 10-K, including the sections entitled “Business,” “Risk Factors” and “Management’s Discussion and Analysis of Financial Condition and Results of Operations,” contains express or implied “forward-looking statements” within the meaning of Section 27A of the Securities Act of 1933, as amended (the “Securities Act”), and Section 21E of the Securities Exchange Act of 1934, as amended (the “Exchange Act”). All statements other than statements of historical fact contained in this Annual Report on Form 10-K are forward-looking statements. In some cases, you can identify forward-looking statements by terminology such as “may,” “could,” “will,” “would,” “should,” “expect,” “plan,” “anticipate,” “believe,” “estimate,” “intend,” “predict,” “seek,” “contemplate,” “project,” “continue,” “potential,” “ongoing” or the negative of these terms or other comparable terminology. Forward-looking statements also include the assumptions underlying or relating to such statements.

Although we believe that the expectations reflected in the forward-looking statements contained herein are reasonable, such expectations or any of the forward-looking statements may prove to be incorrect and actual results could differ materially from those projected or assumed in the forward-looking statements. Our future financial condition and results of operations, as well as any forward-looking statements, are subject to inherent risks and uncertainties, including, but not limited to, the risk factors set forth in Part I, Item 1A “Risk Factors” below and for the reasons described elsewhere in this Annual Report on Form 10-K. All forward-looking statements and reasons why results may differ included in this report are made as of the date hereof and we do not intend to update any forward-looking statements except as required by law or applicable regulations.

- the initiation, timing, progress and results of our research and development programs, preclinical studies, clinical trials and Investigational New Drug, or IND, application, Investigational Medicinal Product Dossier, or IMPD, Clinical Trial Application, or CTA, New Drug Application, or NDA, or other regulatory submissions;
- our dependence on current and future collaborators for developing, obtaining regulatory approval for and commercializing therapeutic candidates in the collaboration;
- our receipt and timing of any milestone payments or royalties under any current or future research collaboration and license agreements or arrangements;
- our ability to identify and develop therapeutic candidates for treatment of additional disease indications;
- our or a current or future collaborator’s ability to obtain and maintain regulatory approval of any of our therapeutic candidates;
- the rate and degree of market acceptance of any approved therapeutic candidates;
- the commercialization of any approved therapeutic candidates;
- our ability to establish and maintain collaborations and retain commercial rights for our therapeutic candidates in the collaborations;
- the implementation of our business model and strategic plans for our business, technologies and therapeutic candidates;
- our estimates of our expenses, ongoing losses, future revenue and capital requirements, including our expectations relating to the use of proceeds from our private placement offering, and our needs for additional financing;
- our ability to obtain additional funds for our operations;

- our ability to obtain and maintain intellectual property protection for our technologies and therapeutic candidates and our ability to operate our business without infringing the intellectual property rights of others;
- our reliance on third parties to conduct our preclinical studies and clinical trials;
- our reliance on third party supply and manufacturing partners to supply the materials and components for, and manufacture, our research and development, preclinical and clinical trial supplies;
- our ability to attract and retain qualified key management and technical personnel;
- our expectations regarding the time during which we will be an emerging growth company under the Jumpstart Our Business Startups Act of 2012, or the JOBS Act;
- our financial performance;
- the impact of government regulation and developments relating to our competitors or our industry; and
- other risks and uncertainties, including those listed in Part I, Item 1A of this Annual Report on Form 10-K under the caption “Risk Factors.”

These statements relate to future events or our future operational or financial performance, and involve known and unknown risks, uncertainties and other factors that may cause our actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by these forward-looking statements. Factors that may cause actual results to differ materially from current expectations include, among other things, those listed in Part I, Item 1A of this Annual Report on Form 10-K under the section titled “Risk Factors” and elsewhere in this Annual Report on Form 10-K.

Any forward-looking statement in this Annual Report on Form 10-K reflects our current view with respect to future events and is subject to these and other risks, uncertainties and assumptions relating to our business, results of operations, industry and future growth. Given these uncertainties, you should not place undue reliance on these forward-looking statements. No forward-looking statement is a guarantee of future performance. You should read this Annual Report on Form 10-K and the documents that we reference herein and have filed with the SEC as exhibits thereto completely and with the understanding that our actual future results may be materially different from any future results expressed or implied by these forward-looking statements. Except as required by law, we assume no, and specifically decline any, obligation to update or revise these forward-looking statements for any reason, even if new information becomes available in the future.

This Annual Report on Form 10-K also contains or may contain estimates, projections and other information concerning our industry, our business and the markets for certain therapeutics, including data regarding the estimated size of those markets, their projected growth rates and the incidence of certain medical conditions. Information that is based on estimates, forecasts, projections or similar methodologies is inherently subject to uncertainties and actual events or circumstances may differ materially from events and circumstances reflected in this information. Unless otherwise expressly stated, we obtained these industry, business, market and other data from reports, research surveys, studies and similar data prepared by third parties, industry, medical and general publications, government data and similar sources. In some cases, we do not expressly refer to the sources from which these data are derived.

Except where the context otherwise requires, in this Annual Report on Form 10-K, the “Company,” “Exicure,” “we,” “us” and “our” refers to Exicure, Inc., a Delaware corporation, and, where appropriate, its subsidiaries.

TRADEMARKS

All trademarks, service marks and trade names appearing in this Annual Report on Form 10-K are the property of their respective holders. Use or display by us of other parties' trademarks, trade dress, or products in this prospectus is not intended to, and does not, imply a relationship with, or endorsements or sponsorship of, us by the trademark or trade dress owners.

PART I

All references in this Annual Report on Form 10-K to “Exicure OpCo” herein refer to Exicure, Inc. (formerly AuraSense Therapeutics, LLC), a privately held Delaware corporation, which changed its name to “Exicure Operating Company”. Unless otherwise stated or the context otherwise indicates, references to “Exicure,” the “Company,” “we,” “our,” “us,” or similar terms refer to Exicure, Inc. and our wholly-owned subsidiary, Exicure Operating Company. Exicure Operating Company holds all material assets and conducts all business activities and operations of the Company.

Item 1. Business.

Overview

We are a clinical-stage biotechnology company developing gene regulatory and immuno-oncology therapeutics based on our proprietary Spherical Nucleic Acid, or SNA, technology. SNAs are nanoscale constructs consisting of densely packed synthetic nucleic acid sequences that are radially arranged in three dimensions. We believe the design of our SNAs gives rise to distinct chemical and biological properties that may provide advantages over other nucleic acid therapeutics and enable therapeutic activity outside of the liver. Since our SNAs have shown in a Phase 1 clinical trial and in preclinical studies that they can cross certain biological barriers when administered locally, we believe that they have the therapeutic potential to target diseases not typically addressed with other nucleic acid therapeutics. We have demonstrated the ability to cross certain biological barriers in a Phase 1 clinical trial of our lead therapeutic candidate, AST-005, and in preclinical studies of two other therapeutic candidates, XCUR17 and AST-008, both of which we are advancing to the clinic.

AST-005 is an SNA targeting tumor necrosis factor, or TNF, for the treatment of mild to moderate psoriasis that is intended to be administered locally in a gel to psoriatic lesions. In a completed Phase 1 clinical trial, AST-005, when topically administered to the skin of patients with mild to moderate psoriasis, resulted in no drug associated adverse events, and demonstrated a reduction of TNF mRNA. The TNF mRNA reduction elicited by the highest strength of AST-005 gel was statistically significant when compared to the effects of the vehicle. While we did not observe an antipsoriatic effect in our Phase 1 clinical trial, we believe this is due to the short duration of the treatment. The results of a clinical trial with etanercept, a systemic TNF inhibitor, indicate that at least four weeks of therapy is required before antipsoriatic efficacy can be observed.

On December 2, 2016, we entered into a research collaboration, option and license agreement with Purdue Pharma L.P., or Purdue, referred to as the Purdue Collaboration. Purdue has the option to obtain from us the full worldwide development and commercial rights to AST-005, an option to obtain three additional collaboration targets and a further option to obtain from us the full worldwide development and commercial rights to any therapeutic candidates developed targeting the three additional collaboration targets. Additionally, Purdue has rights of first offer to some potential collaboration targets. These rights of first offer are subject to limitations in time and scope. In connection with the Purdue Collaboration, we received a non-refundable development fee of \$10.0 million. In addition, we are eligible to receive up to \$776.5 million upon successful completion of certain research, regulatory and commercial sales milestones. We cannot assure you that these milestones will be achieved as they are subject to highly significant risks and uncertainties, many of which are outside of our control. In the event a therapeutic candidate subject to the collaboration results in commercial sales, we are eligible to receive royalties ranging from the low single digits to a maximum of 10% on future net sales of such commercialized therapeutic candidates. Pursuant to the Purdue Collaboration, Purdue is conducting a Phase 1b clinical trial in psoriasis patients in Germany to evaluate the effect of higher concentrations of AST-005 gel on TNF mRNA and downstream mRNA expression. Patient dosing is complete and no serious adverse events have been reported. We expect to have the topline results of the clinical trial in early 2018.

Our second therapeutic candidate, XCUR17, is an SNA that targets the mRNA that encodes interleukin 17 receptor alpha, or IL-17RA, a protein that is considered essential in the initiation and maintenance of psoriasis. Although the availability of inhibitors of TNF revolutionized the systemic treatment of severe psoriasis, studies of disease pathogenesis have shifted attention to the IL-17 pathway, in which IL-17RA is a key driver of psoriasis. Our strategy is to reduce the levels of IL-17RA in the skin by topically applying XCUR17. In preclinical studies, XCUR17 inhibited IL-17RA in the keratinocytes of the skin. We filed a CTA for a Phase 1 clinical trial of XCUR17 in patients with psoriasis in Germany in the third quarter of 2017. Our CTA was approved in February 2018 and we expect the first patient in our Phase 1 clinical trial to be dosed in early 2018. We expect this clinical trial to be completed in mid-2018.

Our third therapeutic candidate, AST-008, is an SNA consisting of toll-like receptor 9, or TLR9, agonists designed for immuno-oncology applications. TLR9 agonists bind to and activate TLR9 receptors. We believe AST-008 may be used for immuno-oncology applications as a monotherapy or in combination with checkpoint inhibitors. Checkpoint inhibitors are therapeutics that prevent tumors from evading destruction by the immune system. We have observed that administration of AST-008 as a monotherapy can have anti-tumor activity in colon cancer, breast cancer, lymphoma and melanoma mouse models. We have also observed that, in preclinical studies in a variety of tumor models, AST-008 applied in combination with certain checkpoint inhibitors exhibited anti-tumor responses and survival rates that were greater than those demonstrated by checkpoint inhibitors alone. Importantly, in an anti-PD-1 antibody-resistant breast cancer mouse model, administration of AST-008 with certain anti-PD-1, or programmed death 1, antibodies restored the anti-tumor activity of these antibodies. We have also demonstrated that AST-008 was active when administered subcutaneously, intratumorally or intravenously, in both prevention and established mouse tumor models. The administration of AST-008 also produced localized as well as abscopal anti-tumor activity in mouse cancer models. Additionally, administration of AST-008 in combination with certain checkpoint inhibitors conferred adaptive immunity in breast and colon cancer mouse models. We filed a CTA for a Phase 1 clinical trial of AST-008 in the United Kingdom in the second quarter of 2017. In the third quarter of 2017, we received an authorization from the MHRA, the competent health authority of the United Kingdom, to conduct a Phase 1 clinical trial with AST-008. We began subject dosing in our Phase 1 clinical trial for AST-008 in the fourth quarter of 2017. We expect this trial to be completed in mid-2018. We ultimately plan to clinically advance AST-008 in combination with checkpoint inhibitors.

Given the extensive potential therapeutic applications for our SNA platform, we believe it is important to enter into selective partnerships to broaden the indications we can pursue and accelerate the development of new programs. To that end, on December 2, 2016, we entered into the Purdue Collaboration. We believe this collaboration exemplifies our strategy of establishing alliances with leaders with a proven track record in the development and global commercialization of treatments for patients with chronic conditions.

We believe that we have a strong intellectual property, or IP, position in the field of SNA therapeutics. As of December 31, 2017, our patent portfolio consisted of over 55 issued patents and allowed patent applications and over 135 pending patent applications. We have licensed IP from Northwestern University and have also independently filed patents to protect our IP. Our license from Northwestern University is for exclusive worldwide rights to the use of SNA technology for therapeutic applications. Any patents arising from AST-005, XCUR17 or AST-008 applications would expire by 2035, 2037, and 2034 or 2035, respectively.

Our Strategy

We intend to build a leading nucleic acid therapeutics company based on our proprietary SNA technology. The key elements of our strategy are:

- **Advance therapeutics incorporating our SNA technology for the treatment of skin diseases.** We filed a CTA for a Phase 1 clinical trial of XCUR17 in patients with psoriasis in Germany in the third quarter of 2017. We expect the first patient in our Phase 1 clinical trial to be dosed in early 2018. We expect this clinical trial to be completed in mid-2018.

- **Advance AST-008 through clinical development for immuno-oncology applications.** We have conducted preclinical studies of AST-008 in immuno-oncology applications including bladder, breast and colorectal cancer, lymphoma and melanoma. We believe AST-008 is applicable in two cancer treatment strategies: as a monotherapy or in combination with checkpoint inhibitors. We began our Phase 1 clinical trial for AST-008 in the United Kingdom in the fourth quarter of 2017. We expect this trial to be completed in mid-2018. We ultimately plan to clinically advance AST-008 in combination with checkpoint inhibitors. We believe AST-008 may be an attractive partnership candidate and we may explore that possibility after our Phase 1 clinical trial results are available.
- **Use our proprietary SNA technology to develop additional therapeutic candidates.** One of the key strengths of our proprietary SNAs is that they have the potential to enter a number of different cells and organs. We expect that our gene regulatory SNAs may have potential therapeutic applications in organs beyond the liver, such as the brain, eye, gastrointestinal tract, lung and skin. We believe the most promising therapeutic targets for SNAs are antibody targets with confirmed therapeutic benefit. We envision taking advantage of these properties by inhibiting these targets with local application of SNAs. We believe that this approach combines the benefits of specifically inhibiting validated targets without the potential safety issues associated with systemic therapy.
- **Support Purdue in its clinical development of AST-005.** In October 2016, we completed a Phase 1 clinical trial for the treatment of mild to moderate psoriasis that suggested that AST-005, delivered topically, is potentially capable of gene regulation in the skin. We believe these results preliminarily demonstrate the potential therapeutic application of SNA as a platform for local gene regulation. AST-005 is the subject of the Purdue Collaboration. Pursuant to the Purdue Collaboration, Purdue is conducting a Phase 1b clinical trial in psoriasis patients in Germany to evaluate the effect of higher concentrations of AST-005 gel on TNF mRNA and downstream mRNA expression. Patient dosing is complete and no serious adverse events have been reported. We expect to have the topline results of the clinical trial in early 2018.
- **Enter into additional partnerships to accelerate development and commercialization of our SNA therapeutic candidates.** Our proprietary SNA technology allows for the potential therapeutic application of nucleic acids in multiple tissues and organs, providing the opportunity to partner with pharmaceutical companies that have development or commercial expertise in a particular therapeutic area of interest where it would be uneconomical or impractical for us to develop SNA therapeutics independently. In addition, in the immuno-oncology field, in preclinical studies we have demonstrated the ability of our immuno-oncology SNAs to work in combination with certain checkpoint inhibitors, creating further potential opportunities to partner our SNAs with companies developing or marketing checkpoint inhibitors.
- **Build, enhance and protect our proprietary SNA intellectual property.** We believe the three-dimensional structure of our SNAs provides novel technological and commercial opportunities. We have licensed IP from Northwestern University and have also filed patents independently to protect our IP. Our license from Northwestern University is for exclusive worldwide rights to the use of SNA technology for therapeutic applications. We will continue to protect our IP and innovations arising from our research and development efforts, and prudently in-license technologies where appropriate for protection of our therapeutic pipeline and the broader SNA technology. Any patents arising from AST-005, XCUR17 or AST-008 applications would expire by 2035, 2037, and 2034 or 2035, respectively.

Introduction to Nucleic Acid Therapeutics

Overview of nucleic acids as a therapeutic modality

Historically, therapeutic development has been focused on small molecules and biologics, or protein-based therapeutics, including antibodies. Development of small molecule therapeutics often involves screening thousands of compounds, sometimes without a known protein structure or active site to which the small molecule can bind and affect its disease-related function. Protein-based therapeutics are also subject to limitations. For example, the choice

of targets that antibodies can address is typically limited to extracellular protein targets. However, the majority of protein targets are located inside the cell, making them undruggable by antibodies.

Nucleic acid therapeutics represent a treatment approach differing in many important ways from small molecules and biologics. Nucleic acid therapeutics are based on the well-established scientific understanding that DNA in the nucleus of cells is converted into an intermediate molecule, called messenger RNA, or mRNA, that serves as the template for making proteins. Therapeutic gene regulation is the use of nucleic acid therapeutics to modulate the production of target proteins by changing the amount of mRNA that is converted to protein, thereby providing an approach to treating diseases at their genetic origin. Our SNAs are a type of nucleic acid therapeutic.

We believe the development timeline for nucleic acid therapeutic candidates will be shorter than that of small molecules and antibodies. Nucleic acid therapeutics can be directed against most mRNA, including the mRNA of proteins that cannot be targeted by small molecules or antibodies. Due to the detailed knowledge of mRNA sequences in humans, nucleic acid therapeutics can be engineered to be specific to a region of an mRNA sequence while interacting minimally with all other mRNA sequences. Moreover, due to the well-defined length and composition of mRNA sequences, a relatively small set of rationally designed therapeutic candidates, usually hundreds, can be synthesized and tested for activity against an mRNA target. This is in contrast to the small molecule drug development process that requires a much larger number of candidates to be screened.

Challenges in developing nucleic acid therapeutics

Significant progress has been made in the development of nucleic acid therapeutics. As of the fourth quarter of 2017, four nucleic acid therapeutics were being marketed and many were in various stages of clinical development. However, we believe there are ongoing technical challenges in the nucleic acid therapeutics field. Nucleic acids are molecules that, when administered without proper formulation, encounter a number of barriers to their bioavailability, biodistribution, and desired biological activity. These challenges have often been met by chemically modifying the oligonucleotide and by encapsulating or complexing it with a lipid or polymer carrier. Despite these advances in the delivery of oligonucleotides, the biodistribution of these molecules remains a challenge since oligonucleotides typically accumulate in the liver after subcutaneous or intravenous administration, thereby limiting their primary application to diseases of the liver. In contrast, the results of our Phase 1 clinical trial of AST-005 demonstrated the potential therapeutic application of our gene regulatory SNAs to modulate target mRNA expression after topical application to psoriatic lesions. Further, in an array of experiments, we have demonstrated that SNAs, administered locally without encapsulation or complexation, enter cells and organs. We believe the local administration of our gene regulatory SNAs will potentially enable safe and efficacious therapeutic applications to organs beyond the liver.

Overview of immuno-oncology as a therapeutic modality

In healthy individuals, the immune system fights off pathogens, such as bacteria and viruses. The immune system should also recognize cancer cells as foreign and eliminate them. However, cancers present a challenge because they have developed strategies to resist detection and clearance by the immune system. Immuno-oncology approaches help the patient's immune system identify a cancer as foreign and stimulate a tumor-clearing immune response. One of the greatest benefits of the immuno-oncology approach is the continuous, durable anti-tumor response that can be achieved long after discontinuation of treatment.

Current immuno-oncology therapeutic approaches generally fall into three broad categories. First, there are approaches that stimulate the immune system to detect and eliminate tumors. Examples include cytokines and toll-like receptor, or TLR, agonists. Second, some therapeutics make a cancer more readily visible to the immune system. These therapeutics include checkpoint inhibitors, such as those that target CTLA4, or cytotoxic T-lymphocyte-associated protein 4, PD-1, and PD-L1, or programmed death-ligand 1. Third, there are adoptive cell transfer therapies, including dendritic cell vaccines and chimeric antigen receptor T-cells, or CAR-Ts, that direct the immune system to target a specific type of cancer.

The knowledge of the TLR activation pathway is central to the understanding of how the immune system is stimulated to target cancer. TLRs are membrane- and endosome-bound receptors found on a number of cell types, including specialized immune cells. TLRs recognize specific molecular patterns ordinarily presented by pathogens. When cells recognize pathogens, they produce and release protein signals called cytokines that mobilize the immune system to fight invading pathogens. In addition, they activate antigen presenting cell and helper T-cells, which then coordinate the longer-term pathogen specific adaptive immune response, and as a result, confer long-term immunity to the host.

Checkpoint proteins, such as CTLA4 and PD-1, are expressed on the surface of T-cells and inhibit the function of activated T-cells. Cancers are difficult to treat because they have developed mechanisms to take advantage of these checkpoint proteins thereby evading detection and clearance by the immune system. Inhibiting these checkpoint proteins, especially PD-1 and PD-L1, has proven to be a highly effective anti-cancer therapy in some patients. Nevertheless, checkpoint inhibitors targeting the PD-1 pathway have limited clinical efficacy as monotherapy, with response rates of 20% or less in many common types of cancers, including breast and colon cancers. Emerging evidence suggests that checkpoint inhibitors are effective primarily in patients whose tumors already have pre-existent CD8 T-cell infiltrate, i.e. immune system is already capable of recognizing the tumors. We believe the challenge in the field is to increase the efficacy of checkpoint inhibitors in a broader cancer patient population by converting tumors that are non-T-cell inflamed to T-cell inflamed.

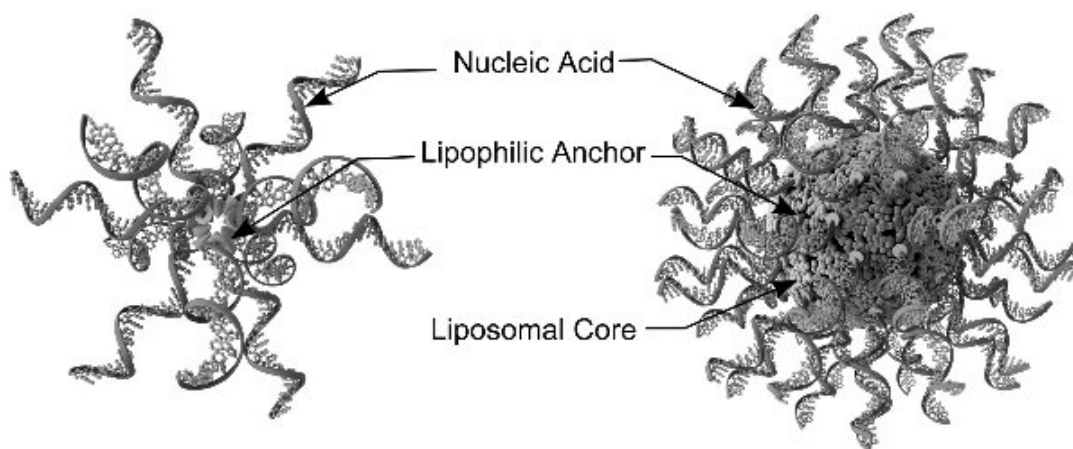
Preclinical data suggest our immuno-oncology SNAs delivered in combination with certain checkpoint inhibitors generate a greater anti-tumor activity than such checkpoint inhibitors alone. In mouse tumor models, administration of AST-008 with anti-PD-1 antibodies suppresses regulatory T-cells, or Tregs, and myeloid-derived suppressor cells, or MDSCs, and increases the levels of CD8 effector T-cells. We believe these important results suggest that the combination of immuno-oncology SNAs and checkpoint inhibitors could potentially treat a larger proportion of cancer patients than checkpoint inhibitors alone.

Our Proprietary Technology: Spherical Nucleic Acids

Our therapeutic discovery and development efforts rely on our proprietary SNA technology. SNAs are nanoscale constructs consisting of densely packed synthetic nucleic acid molecules that are radially arranged in three dimensions. We refer to these synthetic nucleic acid molecules in our SNAs as oligonucleotides and the radial orientation of the oligonucleotides without lipid or polymer encapsulation as our “inside out” or “3-D” approach. Our SNAs, unlike many other nucleic acid therapeutics, do not require lipid or polymer encapsulation or complexation in order to be delivered. Encapsulation is the process of confining the nucleic acids inside the cavities of larger structures, typically liposomes, whereas complexation is the process of creating an assembly of nucleic acids bound together with other molecules, typically lipids or polymers.

This arrangement of oligonucleotides allows our proprietary SNAs to enter cells through class A scavenger receptors. Class A scavenger receptors are commonly found on the surface of cells throughout the body, which we believe provides a ubiquitous mechanism of cellular entry for the local administration of our SNA therapeutic candidates. This mechanism of cellular entry is different from many other nucleic acid therapeutics that typically bind to receptors found only in the liver.

The broad cellular and tissue penetration properties of SNAs enable two distinct therapeutic approaches. Gene regulatory SNAs can be designed to modulate the production of target proteins for a potential therapeutic benefit without triggering an unintended immune response. Immuno-oncology SNAs can be designed to potentially elicit an anti-tumor immune response. Accordingly, we are developing both gene regulatory SNAs for diseases beyond the liver and immuno-oncology SNAs for solid and hematological cancers.



All of our SNAs contain oligonucleotides that are densely packed and radially oriented.

We believe the key advantages of our proprietary SNAs include:

- **SNAs cross certain biological barriers to deliver nucleic acid therapeutics.** Local delivery of nucleic acid therapeutics through biological barriers, such as the skin, has been a significant technical challenge. In our successful Phase 1 clinical trial of AST-005, we showed that SNAs can be delivered without the use of needles, and that our SNAs are capable of reducing the expression of the target TNF gene in lesional patient skin after topical application. Further, in preclinical studies, we have demonstrated delivery and activity of our SNAs in the eye, lung, and gastrointestinal tract. Considered together, we believe that these results indicate that the SNA platform has therapeutic potential for gene regulation in the skin.
- **Gene regulatory SNAs are potentially well tolerated.** The Phase 1 clinical trial of AST-005 resulted in no drug associated adverse events when AST-005 was applied topically to the skin of patients with mild to moderate psoriasis. There are three key elements to our safety strategy. First, by administering gene regulatory SNAs locally, we expect to avoid systemic exposure thereby decreasing safety risk. Second, because SNAs enter cells and tissues without lipid or polymer encapsulation or complexation, we expect to avoid the toxicity risks associated with these delivery systems. Finally, due to the nuclease resistance attributable to the architecture of the SNA, we use fewer chemical modifications than are customary in nucleic acid therapeutic development.
- **SNAs can be administered locally into a number of different cell and tissue types.** SNAs enter cells through class A scavenger receptors, which are present on the surface of many cell types. We believe that by accessing this mechanism, our SNAs could have therapeutic applications in organs beyond the liver, such as the brain, eye, gastrointestinal tract, lung, and skin. In preclinical studies, more than 50 cell lines and primary cells have been shown to internalize SNAs.
- **Immuno-oncology SNAs may produce a powerful immune response against tumors.** In preclinical studies, SNAs localized to endosomes and stimulated the immune system via TLRs. We have also observed in preclinical studies that SNAs can generate a cancer-specific adaptive immune response. In addition, in preclinical studies in a variety of cancer models, SNAs, in combination with certain checkpoint inhibitors, exhibited a greater anti-tumor response and increased survival than did such checkpoint inhibitors alone. Moreover, when administered as a monotherapy, AST-008 exhibited anti-tumor activity in mouse cancer models.

- **SNAs have shown greater resistance to nuclease degradation.** Nucleases are proteins that degrade oligonucleotides. In preclinical studies, SNAs have been shown to have an increased nuclease resistance compared to linear oligonucleotides. We believe this is a result of our 3-D approach, and as a consequence, we believe that smaller amounts of SNAs may be required to achieve therapeutic efficacy compared to linear oligonucleotides.
- **SNAs can be manufactured at commercial scale.** Based on our manufacturing work to date, we believe SNAs can be made in a low cost, high-throughput, scalable, and reproducible manner using cGMPs.

We plan to develop SNA-based therapeutics utilizing two distinct approaches. First, we will use SNA constructs containing oligonucleotides for gene regulation applications in target organs. Our first development programs have been focused on the skin because of a combination of unmet medical need and low barriers to achieving therapeutic and mechanistic proof of concepts. As we progress, we will explore the use of SNAs in other local applications, such as the brain, lung, eye and gastrointestinal tract. Second, we will seek to design SNAs for immuno-oncology applications. We believe the properties of our proprietary SNAs will allow us to develop therapeutic candidates in both fields.

Gene regulatory SNAs

Introduction to gene regulation

Gene regulation is the process of modulating target protein levels within cells. This could be a powerful approach for developing targeted therapies for diseases with known genetic origins. This approach may be for therapeutic targets that are identified as “undruggable” with small molecules or antibodies.

Gene regulation can be achieved with a number of approaches, three of which, siRNA-, miRNA-, and antisense-based therapeutics, have been the focus of commercial development. Small interfering RNAs, or siRNAs, are double-stranded RNA-like oligonucleotides that harness RNA interference, or RNAi, a potent and natural biological mechanism. When delivered into cells, siRNAs can lead to target mRNA degradation and a decrease in protein expression. miRNAs are naturally occurring small RNA molecules that modulate protein expression. Antisense therapeutics are short single-stranded oligonucleotides that bind to target mRNA and thus prevent its translation into protein.

Gene regulatory SNA advantages for therapeutic applications

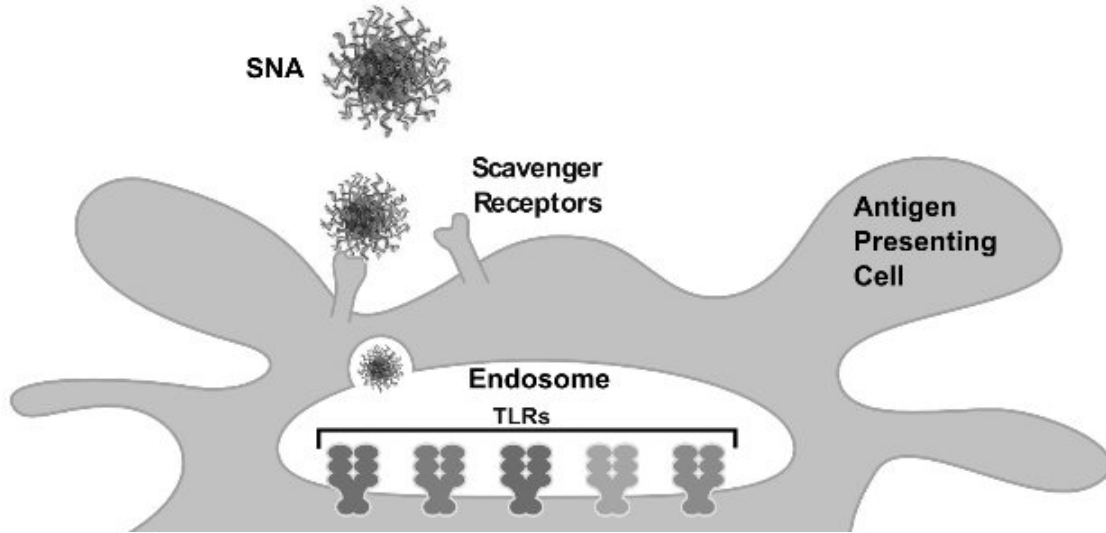
We believe our gene regulatory SNAs provide the attractive features of nucleic acid therapeutics while potentially overcoming their limitations. In preclinical studies we demonstrated that gene regulatory SNAs can enter cells to a much greater extent than linear oligonucleotides and we believe do so with minimal toxicity. Our gene regulatory SNAs are designed to enter cells through class A scavenger receptors. These class A receptors are commonly found on the surface of cells throughout the body thereby providing a mechanism of cellular entry that can be accessed through the local administration of SNA therapeutics. This mechanism of cellular entry is different from many nucleic acid therapeutics which typically bind to receptors found only in the liver. We believe our gene regulatory SNAs are not limited to diseases of the liver. We have shown that certain gene regulatory SNAs cross the stratum corneum and deliver nucleic acid therapeutics to the epidermal and dermal layers of the skin ex vivo. We believe the ability of our gene regulatory SNAs to penetrate through biological barriers will open up new opportunities for the use of nucleic acid therapeutics in local applications. We believe that our gene regulatory SNAs may also have therapeutic applications in organs such as the brain, eye, gastrointestinal tract, liver, lung, and skin.

Immuno-oncology SNAs

We believe our immuno-oncology SNAs are potent and specific activators of TLRs. It has been demonstrated that oligonucleotides containing specific nucleotide sequences bind to TLRs and induce a robust immune response. The challenge in the immuno-oncology field has been to expose these oligonucleotides to the cells of the immune system in such a way as to optimally bind the TLRs and launch the activation pathway. Based on the results of our

preclinical studies, we believe our immuno-oncology SNAs enter cells of the immune system, bind to a variety of TLRs, and generate a robust immune response.

SNAs localize to endosomes of immune cells, engage multiple TLRs, and activate the immune system.



Note: Image not to scale

Immuno-oncology SNA advantages for therapeutic applications

We believe that SNAs are well suited for immuno-oncology applications because of four key properties:




- Results of our preclinical studies indicate that SNAs are capable of being internalized into and concentrated in the endosomes of the cells where TLRs are located. Our immuno-oncology SNAs bind to and signal through TLRs to induce innate and adaptive immune responses.
- SNAs present their TLR agonists in a 3-D presentation, which we believe allows SNAs to engage TLRs more efficiently. We have designed and demonstrated SNAs which activate multiple classes of TLRs in cultured mouse macrophages and human B cells, as well as in a lymphoma mouse model.
- SNAs can potentially induce a broad immune response. We believe that such a broad immune response could include the production of cytokines that induce a potent adaptive immune response, which in turn, may confer long-term immunity.
- In preclinical studies, immuno-oncology SNAs enhance the activity of certain checkpoint inhibitors. For example, SNAs administered in combination with anti-PD-1 antibodies have restored the anti-tumor activity of those antibodies in anti-PD-1 antibody resistant breast and colorectal cancer, and in lymphoma and melanoma mouse models. Moreover, no palpable tumors grew in the mouse breast cancer model after a second injection of tumor cells, which we believe indicates the occurrence of an adaptive immune response against that tumor.

We believe that these properties collectively make our proprietary SNAs an attractive therapeutic approach for immuno-oncology applications.

Our Research and Development Programs

Our research and development programs include the development of three SNA therapeutic candidates to address unmet medical needs in the treatment of mild to moderate psoriasis and solid tumors as well as early stage research activities in neurology, ophthalmology, respiratory and gastrointestinal applications, and the development of SNAs that target IL-4RA. These early stage research activities are described in more detail in the sections entitled “—Early development programs” and “—SNA targeting IL-4RA for atopic dermatitis.” Research and development expense for the years ended December 31, 2017 and 2016 was \$14.1 million and \$13.7 million, respectively.

The table below sets forth the stage of development of our current SNA therapeutic candidates:

	Therapeutic Candidate/ Target	Indication	Development Stage				Milestones
			Preclinical Development	Phase 1	Phase 2	Phase 3	
	AST-005 targeting TNF ⁽¹⁾	Mild to moderate psoriasis	████████████████████			<ul style="list-style-type: none"> • Phase 1 complete • Phase 1b subject dosing complete 	
	XCUR17 targeting IL-17RA	Mild to moderate psoriasis	████████████████			<ul style="list-style-type: none"> • Phase 1 CTA submission 3Q 2017 • Phase 1 completion mid-2018 	
	AST-008 (TLR9 agonist)	Solid tumors	████████████████			<ul style="list-style-type: none"> • Phase 1 subject dosing underway • Phase 1 completion mid-2018 	

TNF = Tumor Necrosis Factor; IL-17RA = Interleukin 17 Receptor Alpha; TLR9 = Toll-like Receptor 9

(1) AST-005 is the subject of the Purdue Collaboration described below in “—Purdue Collaboration.”

Regulatory documents are prepared and submitted to the appropriate health authority to enable clinical trials in any given jurisdiction. In the United States, this document is called an IND application, while in other jurisdictions, this document is often called an IMPD, which is submitted as part of a CTA. The content and scope of an IND and a CTA are similar.

AST-005 — topically applied SNAs for psoriasis

Overview

AST-005 is a therapeutic candidate for the treatment of mild to moderate psoriasis, which is often defined as psoriasis that affects less than 10% body surface area and is generally not treated with systemic antibody therapy. AST-005 is an SNA containing TNF antisense oligonucleotides and is intended to be applied in a gel to psoriatic lesions. The clinical success of systemically delivered anti-TNF antibodies has validated TNF as a clinically relevant therapeutic target for psoriasis. We believe that the local inhibition of TNF with AST-005 may result in targeted therapeutic activity in patients with mild to moderate psoriasis, where, given their systemic risks, treatment with anti-TNF antibodies falls outside of the current American Academy of Dermatology guidelines.

In our Phase 1 clinical trial, AST-005 resulted in no drug associated adverse events, and AST-005 reduced the production of TNF mRNA in psoriatic skin after topical application. We believe these results demonstrate the potential therapeutic application of AST-005 in the tissue of interest, and that SNAs are potentially capable of regulating gene expression in human skin. On December 2, 2016, we entered into the Purdue Collaboration for further development of AST-005 in mild to moderate psoriasis and in other indications. Pursuant to the Purdue Collaboration, Purdue is conducting a Phase 1b clinical trial in psoriasis patients in Germany to evaluate the effect of higher concentrations of AST-005 gel on TNF mRNA and downstream mRNA expression. Patient dosing is complete and no serious adverse events have been reported. We expect to have the topline results of the clinical trial in early 2018.

Psoriasis market and current treatments

According to a 2016 Global Report on Psoriasis issued by the World Health Organization, the prevalence of psoriasis in countries ranges between 0.09% and 11.43%, making psoriasis a serious global problem with at least 100 million individuals affected worldwide. According to LeadDiscovery, in 2009, over 4.5 million prescriptions were written for patients with psoriasis in the U.S., with approximately 3.9 million of these prescriptions written for topical therapies.

Patients suffering from severe psoriasis can benefit from antibody therapeutics, such as etanercept or adalimumab. These antibodies target TNF, a cytokine that plays a central role in the inflammation underlying psoriasis. When injected, the antibodies bind to TNF, diminishing TNF's ability to act as an inflammatory signal. Patients with limited disease, or mild to moderate psoriasis, can be treated with topical or oral anti-inflammatory therapeutic agents. These patients are generally not treated with systemic anti-TNF antibodies due to adverse health risks. According to the American Academy of Dermatology, patients with limited skin disease should not automatically be treated with systemic treatments if they do not improve, because treatment with systemic therapy may carry more risk than the disease itself.

Accordingly, topically applied agents, such as corticosteroids, are widely used to treat mild to moderate psoriasis. Unlike antibodies that target a specific pathway to treat psoriasis, topical therapies generally have a non-specific mechanism of action, which may cause skin thinning, skin irritation, and other side effects. Moreover, many of these therapies become less effective at treating the disease over time as patients become refractory to treatment. Findings from National Psoriasis Foundation surveys conducted between 2003 and 2011 indicate that 52.3% of patients with psoriasis were dissatisfied with their treatment.

We believe there is an unmet medical need in mild to moderate psoriasis for a locally administered therapeutic that combines the specificity of antibodies with the convenience of topical corticosteroids without the side effects of either class of therapeutics. To date, the skin has proven to be a barrier to the penetration of many potential therapies. Some approaches for delivering oligonucleotides directly into the skin require injections, which may be uncomfortable and painful.

Our approach

AST-005 is intended to be administered locally as a topically applied gel to psoriatic lesions. We developed AST-005 to enter into cells of the epidermis and dermis and modulate the expression of TNF.

Clinical success of systemically delivered anti-TNF antibodies has validated TNF as a clinically relevant target for psoriasis. TNF is an important trigger and mediator of inflammatory responses. Excessive TNF production in the skin causes keratinocyte and T-cell proliferation as well as immune cell infiltration, which results in the formation of psoriatic lesions.

Preclinical development of AST-005

We gathered experimental evidence of the biological activity of AST-005 in both healthy and psoriatic human skin samples prior to undertaking a Phase 1 clinical trial. As a consequence, we believe we had a deeper understanding of how AST-005 would perform during clinical trials than would be ordinarily possible with traditional therapeutic development. Data from our preclinical studies demonstrated that AST-005 penetrates into, and modulates the production of TNF in, both healthy and psoriatic human skin after topical application. We believe we had preliminarily demonstrated the intended therapeutic mechanism of action of AST-005 in the tissue of interest in advance of a Phase 1 clinical trial. We intend to use this model when developing other gene regulatory SNA compounds.

We also examined AST-005 in a mouse model of psoriasis known as the imiquimod model. AST-005 was applied topically in an ointment. Histological and biomarker results showed that AST-005 prevents the development

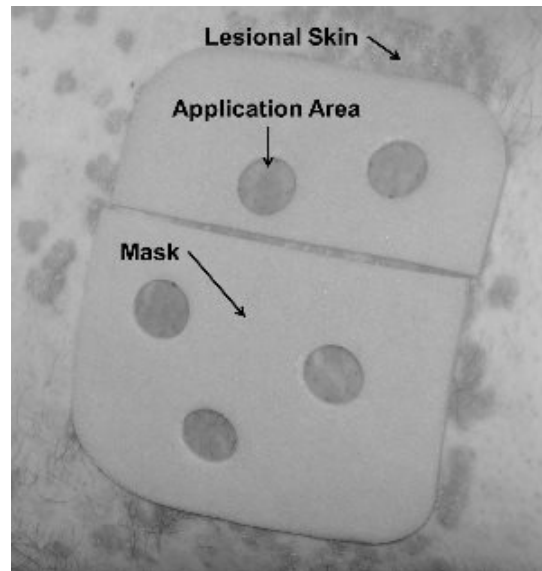
of psoriatic phenotype in mouse models of the disease. A biomarker is a substance whose measurement is indicative of a disease state.

Finally, we performed studies which demonstrate that our SNAs cause minimal off-target changes in gene expression in human skin cells and in mouse tissue. Such experiments demonstrated that SNA treatment leads to fewer genetic misregulations as compared to linear oligonucleotides against the same target delivered with a commercially available lipid encapsulation-based oligonucleotide delivery system. A misregulated gene is expressed at an inappropriately high or low level.

Phase 1 clinical development for AST-005

We conducted a Phase 1 clinical trial to assess the safety, antipsoriatic efficacy and pharmacodynamic effect of AST-005 in 15 mild to moderate psoriasis patients in Germany. The primary endpoint of the clinical trial was the change in psoriatic infiltrate thickness compared to the start of the study, which is a method of measuring antipsoriatic effects. Secondary endpoints included evaluation of antipsoriatic efficacy by a clinical score, safety and tolerability assessments, and target mRNA reduction. The clinical trial design allowed for inpatient comparisons of AST-005 to a placebo and a currently approved therapeutic. A mask containing five holes, or test fields, was placed on the patients' psoriatic lesions, enabling the application of different agents within one lesion. The test fields were treated with one of three strengths of a gel containing AST-005, a matched control gel without AST-005 and an approved therapeutic administered 10 times over a 12-day treatment period. Safety assessments included a complete physical examination with special focus on the skin, vital signs, and laboratory assessments. At the end of the clinical trial, full biopsy punches were taken of the AST-005 gel and vehicle gel treated areas for measurement of TNF mRNA expression.

The Phase 1 clinical trial design utilized a mask that allowed for the evaluation of multiple strengths of AST-005, a placebo, and a currently approved therapeutic within one psoriatic lesion.

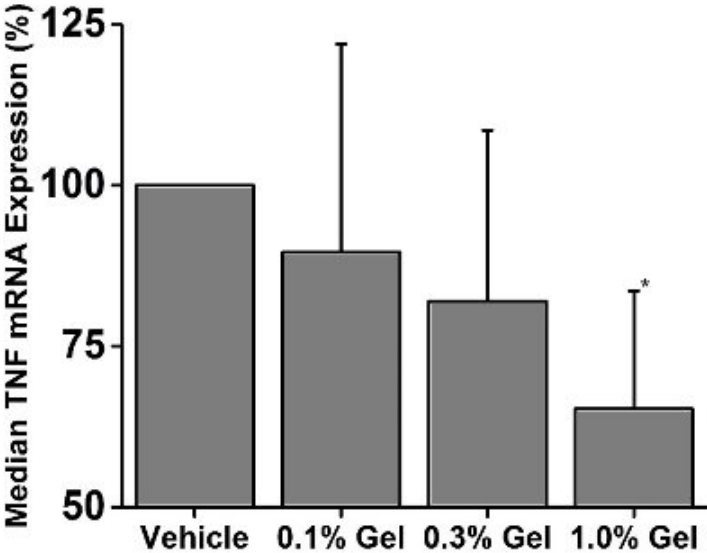


We believe our clinical trial design is consistent with other topical studies that have been accepted by the FDA, and the European Medicines Agency, or the EMA.

The results of the clinical trial showed no adverse events related to treatment with AST-005. In addition, AST-005 application reduced the expression of TNF mRNA in a dose dependent manner in the psoriatic skin of the patients. The TNF mRNA reduction elicited by the highest strength of AST-005 gel was statistically significant when

compared to the effects of the vehicle. These results demonstrate that topically applied SNAs are potentially capable of reducing gene expression in the skin of psoriasis patients, and we believe that these results demonstrate the potential therapeutic application of our gene regulatory SNA platform. While the results of the clinical trial did not show antipsoriatic efficacy, we believe antipsoriatic efficacy was not to be expected based on the length of treatment in this clinical trial. The results of a clinical trial with etanercept, a systemic TNF inhibitor, indicate that four weeks of therapy is required before antipsoriatic efficacy can be observed.

*A gel containing AST-005 reduced the target TNF mRNA expression in the lesional psoriatic skin of patients in a dose dependent manner after topical application in a Phase 1 clinical trial. The knockdown achieved by the high strength of gel was statistically significant compared to the vehicle treated skin. * p < 0.05*



On December 2, 2016, we entered into the Purdue Collaboration for further development of AST-005 in mild to moderate psoriasis and in other indications. Together with Purdue, we will pursue continued development of AST-005 in psoriasis and potentially in other indications. Pursuant to the Purdue Collaboration, Purdue is conducting a Phase 1b clinical trial in psoriasis patients in Germany to evaluate the effect of higher concentrations of AST-005 gel on TNF mRNA and downstream mRNA expression. Patient dosing is complete and no serious adverse events have been reported. We expect to have the topline results of the clinical trial in early 2018.

XCUR17 — a topically applied anti-IL-17RA SNA

Overview

XCUR17, our second therapeutic candidate, targets the mRNA that encodes IL-17RA, a protein that is considered essential in the initiation and maintenance of psoriasis. Although the availability of inhibitors of TNF revolutionized the systemic treatment of severe psoriasis, studies of disease pathogenesis have shifted attention to the IL-17 pathway, in which IL-17RA is a key driver of psoriasis. IL-17 binding to IL-17RA on keratinocytes stimulates and perpetuates the inflammation cascade of psoriasis. IL-17RA-mediated inflammation can be inhibited by disrupting the protein’s function. Brodalumab, an anti-IL-17RA monoclonal antibody, was approved by the FDA as an effective treatment for chronic moderate to severe plaque psoriasis. Our strategy is to reduce the levels of IL-17RA in the skin by topically applying XCUR17. In preclinical studies, XCUR17 showed inhibition of IL-17RA expression in the keratinocytes of the skin. We filed a CTA for a Phase 1 clinical trial of XCUR17 in patients with psoriasis in Germany in the third quarter of 2017. Our CTA was approved in February 2018 and we expect the first

patient in our Phase 1 clinical trial to be dosed in early 2018. We expect this clinical trial to be completed in mid-2018.

Our approach

The clinical success of a systemically delivered anti-IL-17RA antibody has validated that target as a clinically relevant target for psoriasis. The IL-17 pathway is important for initiating and sustaining inflammatory responses. IL-17RA stimulation in the skin causes keratinocyte and T-cell proliferation as well as immune cell infiltration, which results in the formation of psoriatic lesions.

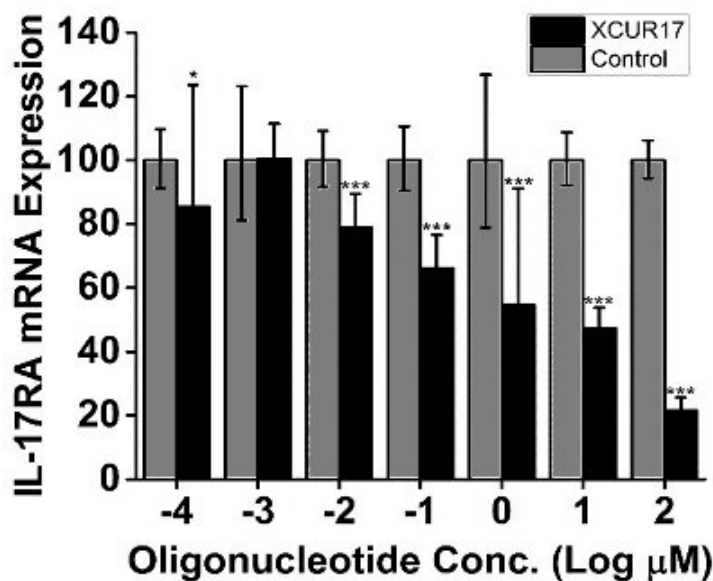
We are developing XCUR17, an SNA containing IL-17RA antisense oligonucleotides. XCUR17 is intended to be applied locally as a topically applied gel to psoriatic lesions. We expect XCUR17 to enter into cells of the epidermis, especially keratinocytes, and modulate the production of IL-17RA.

Preclinical development of XCUR17

Similar to the AST-005 preclinical development, we have gathered experimental evidence of the biological activity of XCUR17 in healthy human skin samples prior to undertaking a Phase 1 clinical trial. As a consequence, we believe we have a deeper understanding of how XCUR17 will perform during clinical trials than would be ordinarily possible with traditional therapeutic development.

XCUR17 exhibits cellular uptake and skin penetration properties. Specifically, XCUR17 enters into keratinocytes *in vitro* and enters into healthy human skin *ex vivo* after topical application. In addition, it also down-regulates the expression of IL-17RA mRNA and protein in keratinocytes *in vitro*. Further, XCUR17 gel down-regulates IL-17RA mRNA in healthy human skin *ex vivo*.

Topical application of XCUR17 in a prototype gel to healthy human skin ex vivo results in a dose-dependent decrease in IL-17RA mRNA expression. * $p < 0.05$; *** $p < 0.001$ vs the controls



Planned Phase 1 clinical development for XCUR17

We filed a CTA to conduct a Phase 1 clinical trial of XCUR17 in patients with psoriasis in Germany in the third quarter of 2017. Our CTA was approved in February 2018 and we expect the first patient in our Phase 1 clinical trial to be dosed in early 2018. We expect this clinical trial to be completed in mid-2018. The primary endpoints of the clinical trial will be safety and tolerability, and the secondary endpoints will include the measurement of IL-17RA mRNA and protein levels from lesional skin biopsies, lesional skin histology and other assessments of mRNA targets in the psoriasis network.

The clinical trial design allows for inpatient comparisons of XCUR17 to a placebo and a currently approved therapeutic. A mask containing 5 holes will be placed on the patient's skin, enabling the application of three different strengths of a gel containing XCUR17 as well as a placebo and a currently approved therapeutic within one psoriatic lesion. The drug will be applied daily for 26 days in up to 25 patients. Over the course of the clinical trial, the safety and tolerability of XCUR17 will be monitored. In addition, the severity of psoriasis in the treated areas will be assessed. At the end of the clinical trial, biopsy samples from XCUR17- and vehicle-treated areas will be taken and interrogated for IL-17RA and downstream mRNA modulation to demonstrate that XCUR17 engages the target of interest and has an effect on inflammation in the skin. We believe our clinical trial design is consistent with the clinical trial design for other topically applied therapeutic candidates that have been accepted by the FDA and EMA.

Additional gene regulation programs

We believe that additional gene regulation programs are enabled by the successful results of our Phase 1 clinical trial with AST-005 and the results from preclinical testing of XCUR17. We are also evaluating the use of AST-005 in other indications where anti-TNF therapeutics have been successful and where we believe we have a strategic advantage. In addition, we believe that the initial clinical results of our Phase 1 clinical trial of AST-005 may have important implications for the application of our proprietary SNA technology across a broad range of organs and diseases. First, there were no adverse events related to treatment with AST-005 in the Phase 1 clinical trial and we also observed initial pharmacodynamic activity in the Phase 1 clinical trial. We believe that there are other skin diseases for which we can design therapeutically relevant SNAs. Other targets of interest include IL-17RA, which

we are addressing with XCUR17, and interleukin 4 receptor alpha, or IL-4RA, and other targets at various levels of preclinical development. We also believe that the initial clinical trial results of AST-005 suggest that our SNAs will have potential therapeutic applications in other organs and diseases for which local administration would be appropriate such as the brain, eye, gastrointestinal tract, liver, and lung.

AST-008 — an SNA for immuno-oncology

Overview

Our third therapeutic candidate, AST-008, an SNA consisting of a TLR9 agonist, is being developed for the treatment of cancer. We believe AST-008 may be used for immuno-oncology applications as a monotherapy or in combination with checkpoint inhibitors. We have observed that administration of AST-008 as a monotherapy can have anti-tumor activity in colon cancer, breast cancer, lymphoma and melanoma mouse models. We have also observed that, in preclinical studies in a variety of tumor models, AST-008 applied in combination with certain checkpoint inhibitors exhibited anti-tumor responses and survival rates that were greater than those demonstrated by checkpoint inhibitors alone. Importantly, in an anti-PD-1 antibody-resistant breast cancer mouse model, administration of AST-008 with certain anti-PD-1, or programmed death 1, antibodies restored the anti-tumor activity of these antibodies. We have also demonstrated that AST-008 is active when administered subcutaneously, intratumorally or intravenously, in both prevention and established mouse tumor models. The administration of AST-008 also produced localized as well as abscopal anti-tumor activity in mouse cancer models. Additionally, administration of AST-008 in combination with certain checkpoint inhibitors confers adaptive immunity in breast and colon cancer mouse models. We began subject dosing in our clinical trial for AST-008 in the fourth quarter of 2017. We expect this trial to be completed in mid-2018. We ultimately plan to clinically advance AST-008 in combination with checkpoint inhibitors.

Our approach

Our preclinical data with AST-008 illustrate many of the important attributes of our proprietary SNA technology. Our immuno-oncology SNAs bind to class A scavenger receptors and are localized on the endosomes of immune cells. These same endosomes contain TLRs and are responsible for inducing an innate immune response. SNAs present their TLR agonists externally, in a 3-D configuration, which allows SNAs to bind to TLRs efficiently. We have designed and prepared SNAs which activate multiple classes of TLRs. Our preclinical data show that SNAs induce a broad immune response. We believe that such broad immune response includes the production of cytokines that induce a potent adaptive immune response, which in turn, may confer long-term immunity. In preclinical studies, local administration of AST-008 elicits systemic pro-inflammatory cytokine response. In mouse tumor models, administration of AST-008 with anti-PD-1 antibodies suppresses regulatory T-cells, or Tregs, and myeloid-derived suppressor cells, or MDSCs, and increases the levels of CD8 effector T-cells.

AST-008 in combination with checkpoint inhibitors

We have demonstrated that the combination of AST-008 with certain anti-PD-1 antibodies enhances therapeutic activity in a number of animal models, including breast and colorectal cancers, as well as lymphoma and melanoma.

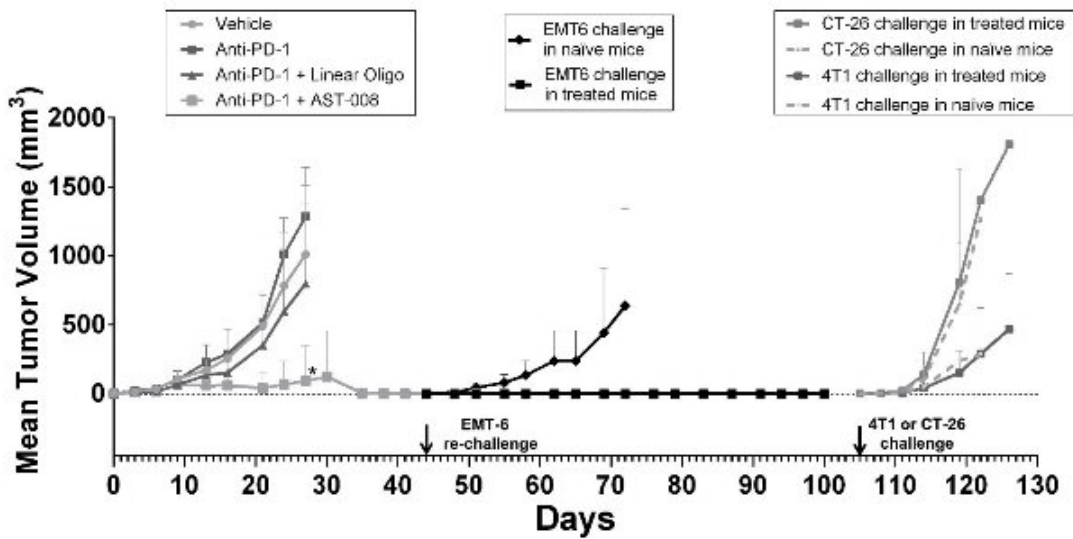
Breast cancer mouse model. We have demonstrated that administration of AST-008 with a selected anti-PD-1 antibody shows a durable anti-tumor response in an anti-PD-1 antibody insensitive mouse breast cancer model. This study was carried out with four groups, each consisting of eight mice per group. The four groups were vehicle treatment, antibody treatment alone, linear oligonucleotide plus antibody treatment, and AST-008 plus antibody treatment. Both the AST-008 and the linear oligonucleotide comparator treatments consisted of subcutaneous administration on days 3, 6, 9, 12, and 15 after tumor implantation at a dose of 0.8 mg/kg per injection. In the three groups where mice received anti-PD-1 antibody therapy, drug administration was performed intraperitoneally on days 3, 8 and 13 at a dose of 10 mg/kg per injection. The mice were monitored for mortality and their tumor volumes were periodically measured. The mice treated with the combination of AST-008 and the anti-PD-1 antibody had average tumor volume reductions of greater than 90% compared to anti-PD-1 antibody treatment alone. In addition, treatment with AST-008 resulted in an 88% average decrease in tumor volume compared to mice treated

with linear oligonucleotides at the same dose. At the conclusion of the initial phase of the experiment, seven out of eight mice in the group treated with the combination of AST-008 and the anti-PD-1 antibody had no palpable tumors. In contrast, no mice treated with linear oligonucleotides and the anti-PD-1 antibody survived.

In the next phase of this study, we re-challenged the seven surviving mice from the combination group that was treated with AST-008 and anti-PD-1 with the same breast cancer tumor type. A new group of six mice that had never received any therapy, referred to here as naïve mice, was also inoculated with the same breast cancer tumor type for comparison. The tumor growth and survival were monitored in both groups of mice without further treatment with the AST-008 and anti-PD-1 antibody combination. No palpable tumors were observed in the surviving mice from the combination group through day 105 of the study, whereas naïve mice showed tumor growth. Finally, on day 105 of the study, the mice from the combination group that had survived two rounds of tumor implantation were injected with different tumor types. The mouse colon cancer tumors grew in the animals that had survived two challenges with breast cancer cells. Taken together, we believe these data demonstrate an adaptive immune response and a systemic anti-cancer vaccination against the treated tumor type. We believe these data also demonstrate that AST-008 has the potential to synergize with checkpoint inhibitors for immuno-oncology applications.

Importantly, AST-008 in combination with selected anti-PD-1 antibodies shows significantly greater activity compared to the linear oligonucleotides of the same sequence and concentration. We believe this demonstrates the potential advantage of our proprietary SNA design compared to linear oligonucleotides for effecting a tumor clearing response.

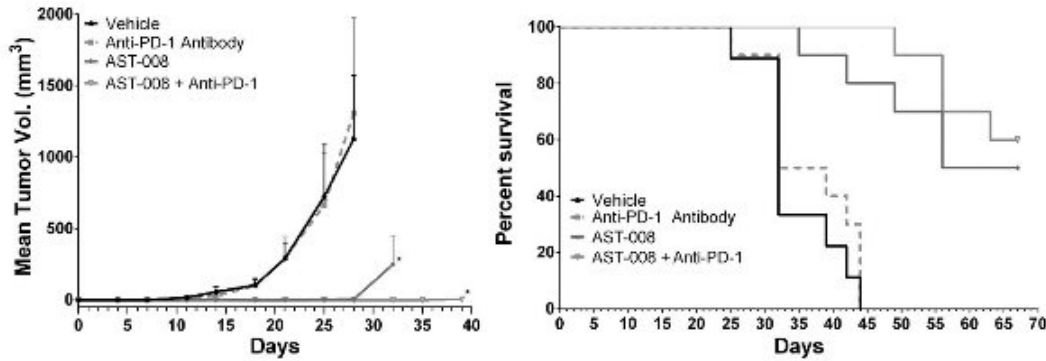
*AST-008 in combination with a certain anti-PD-1 antibody in breast cancer mouse model resistant to anti-PD-1 treatment. Surviving mice from the experiment treated with anti-PD-1 and AST-008 survived when re-injected with the same EMT6 breast cancer cells, but did not survive when injected with unrelated CT-26 or 4T1 cancer cells. * $p < 0.0001$ versus vehicle treated group.*



Melanoma mouse model. We have demonstrated the synergy of AST-008 with a selected anti-PD-1 antibody in a mouse melanoma model where the antibody is not effective on its own. This is representative of most advanced melanoma patients who receive anti-PD-1 antibodies because the majority of patients do not respond to the therapy. This study was executed with 10 mice per group, and there were four treatment groups. The animals were treated with vehicle, an anti-PD-1 antibody alone, AST-008 alone, or a combination of the antibody and AST-008. AST-008 was administered subcutaneously on days 3, 6, 9, 12, and 15 after tumor implantation at a dose of 0.8 mg/kg/injection. The anti-PD-1 antibody was injected intraperitoneally on days 5, 10 and 15 at a dose of 10 mg/kg/

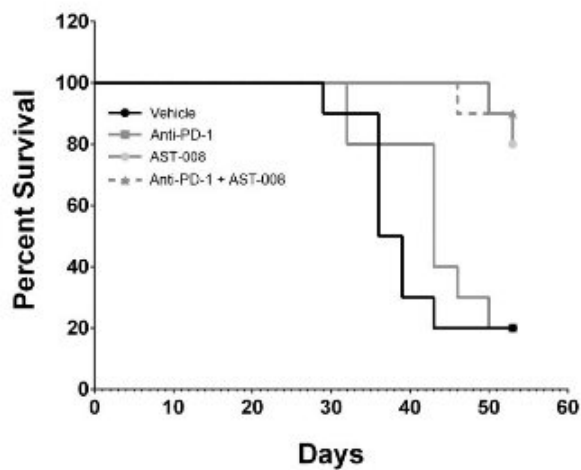
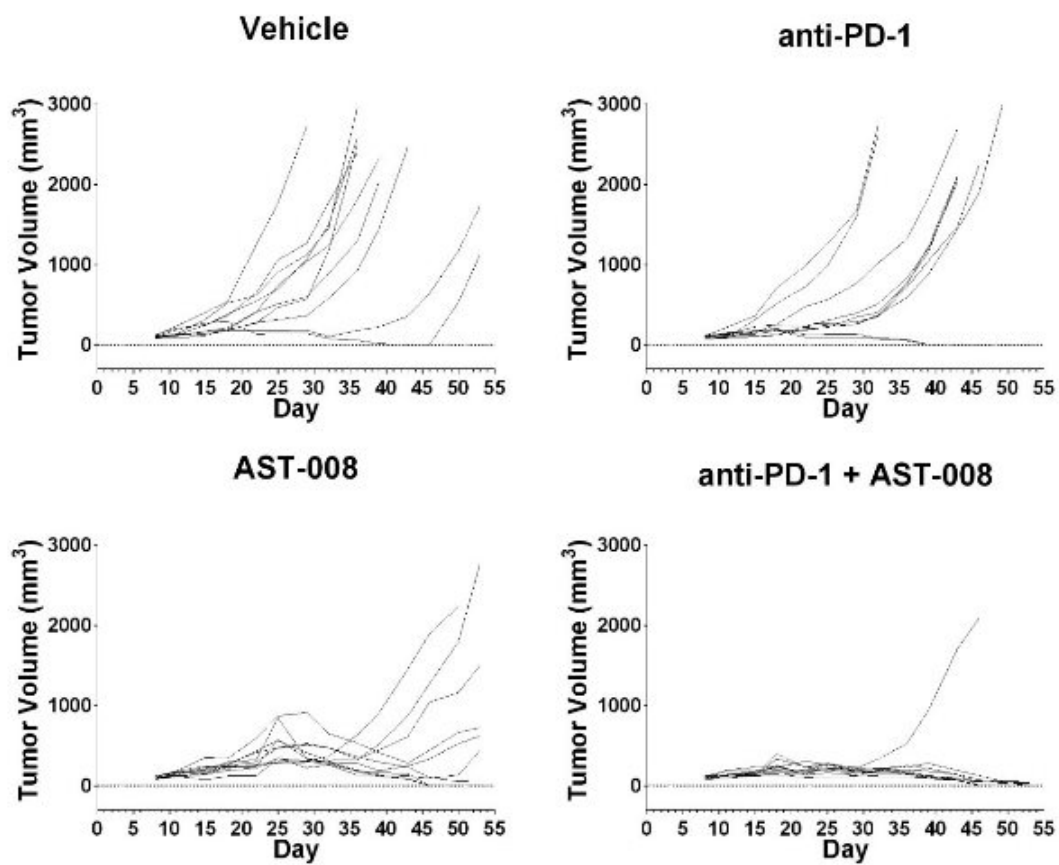
injection. AST-008 treatment resulted in a large decrease in tumor volume and an increase in survival versus the mice treated with vehicle or antibody alone. Importantly, mice treated with both AST-008 and the anti-PD-1 antibody had no measurable tumor volume, in contrast to animals treated with the anti-PD-1 antibody alone, where no meaningful tumor volume change or survival was observed compared to the vehicle treated group. Moreover, median survival for the anti-PD-1 treatment group was 36 days whereas median survival for the combination group was greater than 67 days, at least an 86% increase. These results suggest that AST-008 treatment may be able to potentiate anti-PD-1 antibody therapy when the antibody is ineffective on its own.

*The combination of AST-008 with an anti-PD-1 antibody shows improved tumor volume reduction and increased median survival in a mouse model of melanoma compared to anti-PD-1 antibody alone. * $p < 0.0001$ vs vehicle treated group.*



Lymphoma mouse model. In a third demonstration of how AST-008 treatment can synergize with checkpoint inhibitor antibodies, we combined our SNA with an anti-PD-1 antibody in a lymphoma mouse model. This study used 10 mice per group, and the study had four groups. At the start of the study, A20 mouse lymphoma tumor cells were implanted in mice on day 0. Mice received vehicle, AST-008 alone, the anti-PD-1 antibody alone, or a combination of AST-008 and the antibody. AST-008 was injected directly into the tumor at a dose of 2.4 mg/kg, while the antibody was dosed intraperitoneally at 5 mg/kg. Therapy began on day 8 of the study when average tumor volume was 100mm³. Both agents were dosed once a week for a total of four doses. Over the course of the study, the mice were monitored for mortality and tumor volume was measured twice a week until study termination.

AST-008 monotherapy greatly decreased the tumor volume growth rate and increased the proportion of animals surviving to the end of the study to 80%, compared to both the vehicle and anti-PD-1 antibody groups, where survival was only 20%. Importantly, in the AST-008 and anti-PD-1 antibody combination group, the tumor completely regressed in nine out of 10 animals, and 90% of the mice in the group survived to the end of the study.



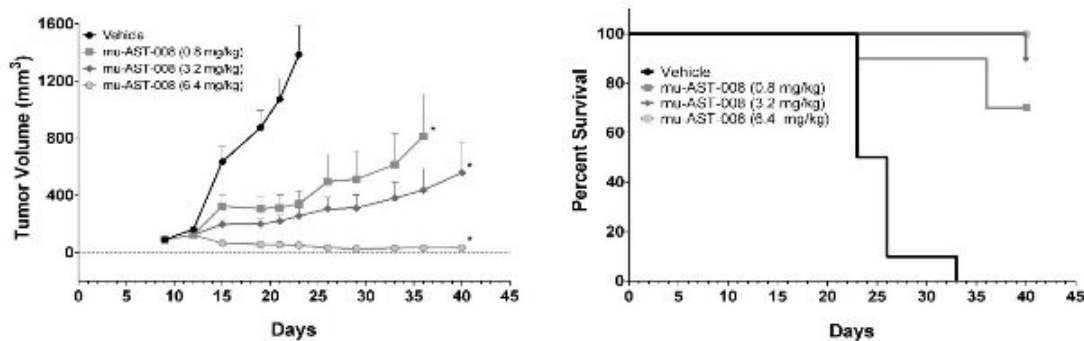
AST-008 as a monotherapy for cancer.

We believe AST-008 potentially can be used as a monotherapy to treat cancer. We have examined AST-008 in a colon cancer mouse model, as well as in a melanoma model.

Mouse colon cancer model. Mice were implanted with colon cancer tumors. Once the tumor volume reached approximately 100 mm³, the mice were treated with vehicle or varying doses of the mouse analogue of AST-008, referred to as mu-AST-008. The mu-AST-008 was administered by intratumoral injection every three days, starting on the ninth day after tumor implantation, for a total of five doses. The dose levels were 0.8, 3.2, or 6.4 mg/kg/injection. The mice were monitored for mortality, and tumor volume measurements were obtained twice weekly until day 40 of the experiment.

The mice treated with mu-AST-008 had a dose dependent increase in survival and decrease of tumor burden compared to mice receiving the vehicle. A complete clearance of the tumors was observed in animals receiving the 6.4 mg/kg/injection dose of mu-AST-008. In addition, no mice in the group receiving the high dose of mu-AST-008 had died at day 40 of the study, while all of the vehicle-treated animals died by day 33.

*Intratumoral treatment with the mouse analogue of AST-008, referred to as mu-AST-008, reduces tumor volume and increases survival in a colon cancer mouse model in a dose dependent manner. * = $p < 0.0001$ versus vehicle on day 23.*



We believe the results of this study demonstrate that AST-008 has potential as a monotherapy for cancer.

Clinical development plan for AST-008

We began subject dosing in the Phase 1 clinical trial for AST-008 in the fourth quarter of 2017. The Phase 1 clinical trial is the first-in-human clinical trial of AST-008 and will evaluate the safety, tolerability, pharmacokinetics, and pharmacodynamics of single and multiple doses of AST-008 by subcutaneous administration in healthy volunteers. The clinical trial is planned to be a randomized, single ascending dose, or SAD, and randomized, double-blind multiple ascending dose, or MAD, trial. Subjects will be recruited in five or more SAD cohorts. After the fourth SAD cohort, the first of three or more MAD cohorts will begin recruiting. We plan to dose a total at least 44 healthy subjects during this Phase 1 clinical trial. We expect this trial to be completed in mid-2018.

SNA targeting IL-4RA for atopic dermatitis

Overview

We are developing SNAs that target IL-4RA mRNA for the treatment of atopic dermatitis. The signaling of the cytokines IL-4 and IL-13 is believed to play a role in the pathogenesis of atopic dermatitis. Both of those cytokines require binding to the IL-4RA protein to produce inflammatory signaling.

Atopic dermatitis is a chronic rash characterized by inflammation and itching. The lifetime prevalence of atopic dermatitis is 10-20% in children and 1-3% in adults. Its prevalence has increased two- to threefold during the past three decades in industrialized countries.

Current Treatments

Current mild to moderate atopic dermatitis treatments aim to reduce inflammation and itchiness. Combinations of antihistamines, topical corticosteroids and topical immunomodulators are the current standard of care. Corticosteroid therapy use requires caution, however, because prolonged use can cause skin atrophy and tachyphylaxis. The FDA has warned of lymphoma and other cancers associated with prolonged use of topical immunomodulators. Antihistamines do not treat the disease, but are only useful to dull the urge to scratch to relieve itching.

Recently, a clinical trial of dupilumab, a fully human monoclonal antibody that is directed against the shared alpha subunit of the IL-4 receptor and that blocks signaling from both IL-4 and IL-13, showed efficacy in moderate to severe atopic dermatitis. Dupilumab is now marketed in the United States for the treatment of moderate to severe atopic dermatitis.

Our Approach

We believe that an anti-IL-4RA SNA applied topically to the skin will reduce the levels of IL-4RA mRNA, and in turn IL-4RA protein, in the skin thereby preventing the inflammatory signaling through both IL-4 and IL-13. Late stage clinical trials with dupilumab have confirmed that inhibiting the function of IL-4RA leads to successful treatment of atopic dermatitis. We believe our approach of modulating IL-4RA specifically and locally will result in an improved safety profile versus topical antihistamines, corticosteroids and immunomodulators, as well as systemically administered antibodies.

Early development programs

In addition to our named pipeline programs, a variety of early stage research efforts are ongoing in areas we believe will best leverage the properties of the SNA. Potential applications of the SNA include those in neurology, ophthalmology, respiratory, and the gastrointestinal tract.

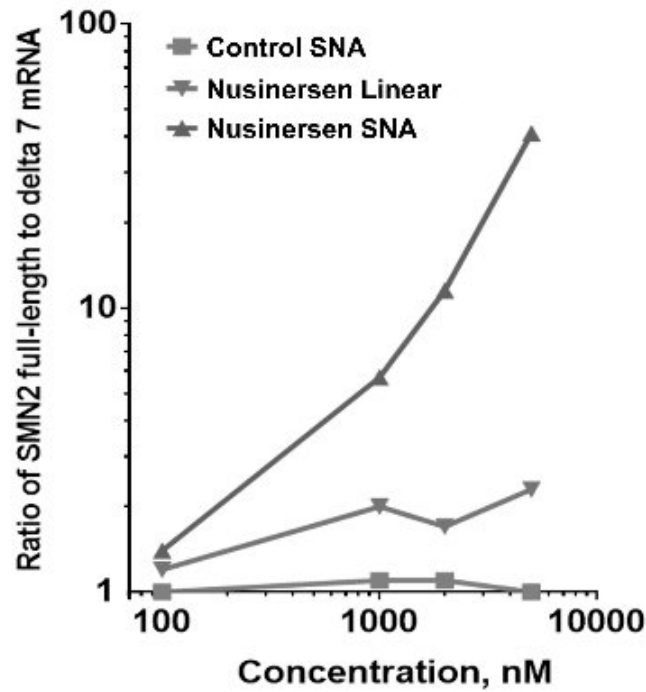
Neurology

Despite delivery challenges, nucleic-acid based therapy has been successfully developed to treat a central nervous system, or CNS, disorder. Nusinersen, by Ionis Pharmaceuticals and Biogen Inc., was approved in late 2016 for the treatment of spinal muscular atrophy, or SMA, by the FDA. SMA is a genetic disorder characterized by progressive muscle wasting and loss of muscle function due to motor neuron dysfunction. SMA is characterized by reduced amount of survival of motor neuron 1, or SMN1, protein. The severity of the disease depends on the amount of a related protein, SMN2, where lesser quantities of SMN2 are correlated to more severe disease. SMN2 is similar to SMN1, but has a mutation that leads to production of truncated protein, which is normally rapidly degraded. Nusinersen is designed to mitigate the effects of this mutation by directing the production of a more stable variant of SMN2, increasing the level of SMN2 protein, and thus improving motor function. In clinical trials, SMA patients treated with nusinersen achieved and sustained meaningful improvement in motor function and survival compared to untreated patients.

To evaluate the superiority of the SNA over linear oligonucleotides in directing the production of the more stable variant of the SMN2 protein, we compared the effects of nusinersen in linear format to nusinersen in the SNA format in cells derived from SMA patients. The data demonstrate that treatment with the SNA format of nusinersen results in greater levels of the more stable full-length variant of the SMN2 mRNA and an attendant decrease in the less stable delta 7 variant of SMN2 mRNA. Importantly, the ratio of the full length to delta 7 variants is greater with the SNA format compared to the linear version of nusinersen. At the highest tested concentration, the ratio of the

quantity of full length mRNA to quantity of the delta 7 mRNA was over 41 for nusinersen in SNA format compared to 2.3 for nusinersen in the linear format.

Nusinersen in the SNA format significantly increases the levels of stable variant of SMN2 compared to the linear format as measured by changes in mRNA levels in cells derived from SMA patients.



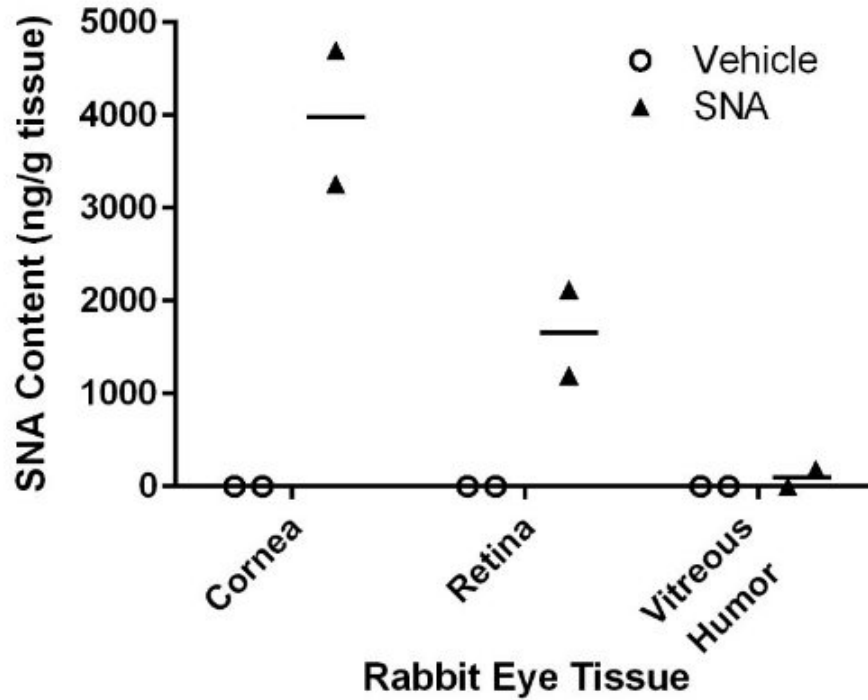
We believe these results suggest that nucleic acid therapeutics based on SNA may have superior pharmacodynamic properties compared to those in the linear format, some of which are already approved by the FDA. The results also suggest that our SNA technology may have applications in a broad range of genetic disorders.

Ophthalmology

Ophthalmic therapies, such as antibodies, peptides or aptamers, are typically injected into the eye to reach their target tissues and achieve therapeutic effects. We believe that the penetration properties of the SNA may result in the delivery of therapeutically relevant concentrations of oligonucleotides to certain tissues in the eye after topical administration in the form of eyedrops.

To assess penetration into the eye, Dutch belted rabbits were given either eyedrops containing no SNAs, referred to as vehicle, or an SNA in a formulation targeting an ocular gene of interest. The eyedrops were administered to the animals 18 times over the course of five days. On the fifth day, the rabbit eyes were analyzed for SNA content. The results indicate that SNAs were detected in tissues at the surface of the eye, where the application occurred, but also in the retina and vitreous humor, indicating that the SNA had penetrated into the eye.

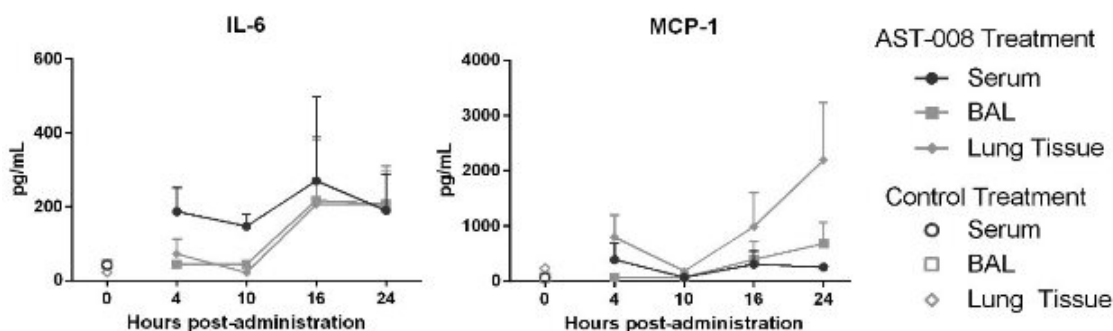
The distribution of SNAs in rabbit eyes when administered as topical drops demonstrates that SNAs penetrate the eye



We believe these results are a promising step in demonstrating that SNAs may be used to treat ophthalmic diseases with eyedrops, an alternative to injections requiring medical personnel.

Respiratory

Altering the immunological state of the lung has promising therapeutic implications for the treatment of allergic diseases, such as asthma. In a preliminary assessment, we demonstrated an alteration of the immunological state both locally in the lung and systemically in mice after the inhalation of SNAs. An intranasal dose of PBS or nebulized formulation of AST-008 was administered to mice at 7.5 mg/kg to assess the pharmacodynamic effects of SNA delivery to the lungs. Four mice per group were used. At 4, 10, 16, or 24 hours following administration, serum was collected from the animals and bronchoalveolar lavage, or BAL, was performed to produce fluid from the lung surface. Finally, lung tissue was also collected from the animals. The fluids and tissue were subjected to cytokine concentration analysis. The results show that nebulized SNAs can produce a cytokine response in the lung tissue and BAL fluid, as well as systemically, as measured in the mouse serum. We believe these results have implications for the potential treatment of allergic diseases of the lung.



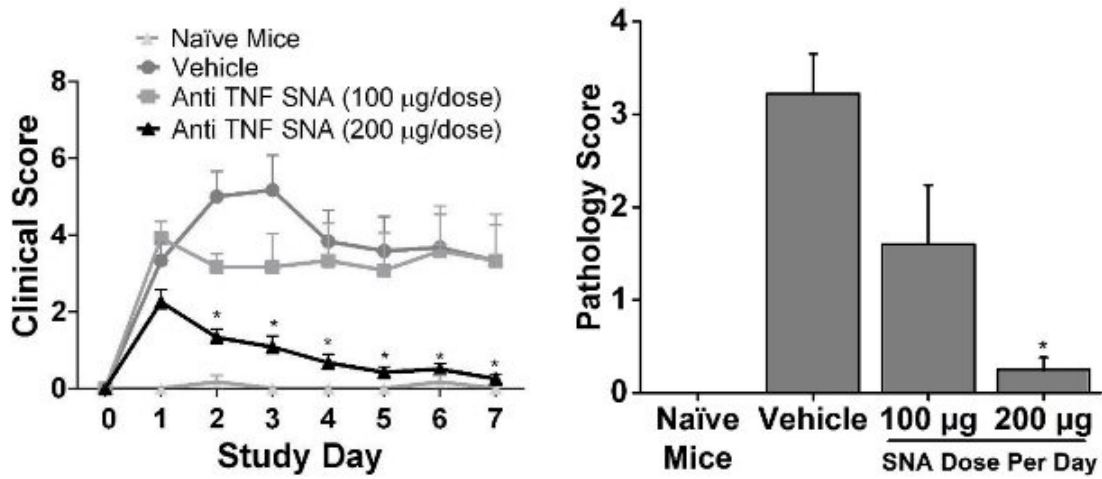
Gastrointestinal

A variety of gastrointestinal disorders, including ulcerative colitis and Crohn's disease, collectively referred to as irritable bowel disease, or IBD, are inadequately treated with existing therapies such as immunosuppressive steroids and anti-TNF antibodies.

We believe that orally applied SNAs may provide the opportunity to treat diseases such as IBD by taking advantage of the local tissue penetration of the SNA technology. Accordingly, the effect of oral SNA treatment was assessed in an induced IBD mouse model. After the induction of colitis, the mice were treated with anti-TNF SNAs on day 1, 2, 3 and 4, for a total four doses, at 100 or 200 $\mu\text{g}/\text{dose}/\text{mouse}$ by oral gavage. Control mice were treated with vehicle only. The mice were monitored for mortality and scored clinically for seven days.

Clinical scores for the mice during the course of the study were assigned by considering the body weight, stool consistency, bleeding and any abnormalities observed in fur coat and abdomen. Gross pathology scores were assigned on the last day of study from the colons removed from the animals after euthanization. Gross pathology scores ranging from 0 to 5, indicating no abnormalities and multiple ulcers, respectively, were assigned based on the severity of the inflammation and ulceration in the colon.

The results showed improvement in clinical score and gross pathology for animals treated with 200 $\mu\text{g}/\text{dose}$ of anti-TNF SNAs compared to those treated with vehicle only. Overall, the results suggest that oral administration of SNA had a positive effect on disease symptoms as reflected by lower clinical and pathology scores.



Novel TLR9 agonists

We are developing novel TLR9 agonist SNAs that produce cytokine profiles distinct from AST-008 in an effort to broaden our armamentarium of options for treatment of cancer, respiratory and autoimmune diseases.

Purdue Collaboration

Pursuant to the Purdue Collaboration we entered into with Purdue on December 2, 2016, Purdue has the option to obtain from us the full worldwide development and commercial rights to AST-005, an option to obtain three additional collaboration targets and a further option to obtain from us the full worldwide development and commercial rights to any therapeutic candidates developed targeting the three additional collaboration targets. Additionally, Purdue has rights of first offer to some potential collaboration targets. These rights of first offer are subject to limitations in time and scope. In connection with the Purdue Collaboration, we received a non-refundable development fee of \$10.0 million. In addition, we are eligible to receive up to \$776.5 million upon successful completion of certain research, regulatory and commercial sales milestones. The research milestones are payable upon target identification and IND-enabling pre-clinical development, per program, with an aggregate total of up to \$16.5 million. The regulatory milestones are payable upon the initiation or completion of clinical trials, and regulatory approval in the United States and outside the United States, per program, with an aggregate total of up to \$410.0 million. The commercial sales milestones are payable upon achievement of specified aggregate product sales thresholds and total up to \$350.0 million. There can be no assurance these milestones will be achieved as they are subject to highly significant risks and uncertainties, many of which are outside of our control. In the event a therapeutic candidate subject to the collaboration results in commercial sales, we are eligible to receive royalties ranging from the low single digits to a maximum of 10% on future net sales of such commercialized therapeutic candidates.

Purdue is entitled to terminate the Purdue Collaboration by providing the Company with advance written notice. The agreement also provides termination provisions for material breaches of contract provisions that are customary for agreements of this type.

By working with Purdue, we believe we will be able to discover and develop the next generation of nucleic acid therapies that have the potential to substantially advance the field of targeted therapies. We believe this collaboration

exemplifies our strategy of establishing alliances with leaders with a proven track record in the development and global commercialization of treatments for patients with chronic conditions.

Our Intellectual Property

Proprietary Protection

Our commercial success depends in part on our ability to obtain and maintain proprietary protection for our therapeutic candidates, manufacturing and process discoveries and other know-how, to operate without infringing the proprietary rights of others, and to prevent others from infringing on our proprietary rights. We have been building and continue to build our intellectual property portfolio relating to our AST-005, XCUR17 and AST-008 therapeutic candidates and our SNA technology platform. Our policy is to seek to protect our proprietary position by, among other methods, filing and licensing U.S. and certain foreign patent applications related to our proprietary technology, inventions and improvements that are important to the development and implementation of our business. We also intend to rely on trade secrets, know-how, and technological innovation to develop and maintain our proprietary position. We cannot be sure that patents will be granted with respect to any of our owned or licensed pending patent applications or with respect to any patent applications filed or licensed by us in the future, nor can we be sure that any of our existing owned or licensed patents or any patents that may be granted or licensed to us in the future will be commercially useful in protecting our technology.

Patent Rights

Our patent portfolio includes pending patent applications and issued patents in the United States and in foreign countries. As of December 31, 2017, our patent portfolio consisted of over 55 issued patents and allowed patent applications and over 135 pending patent applications. Our general practice is to seek patent protection in major markets worldwide, including the U.S., Canada, China, Japan, Australia, certain members of the European Union, among others. All of the issued patents and allowed patent applications are licensed from Northwestern University, or NU. Among the pending patent applications, we license 55 from NU, we exclusively own 73, and we jointly own 8 with Northwestern University.

Our license from Northwestern University is for royalty bearing worldwide exclusive rights to the use of SNAs for therapeutic applications. Pursuant to the license, we are allowed to manufacture, use, offer for sale, sell and import products covered by the licensed patent rights.

Our AST-005 patent portfolio includes one pending U.S. patent application and corresponding applications in 28 foreign jurisdictions. The pending applications are composition of matter and method of use type applications and include claims to an oligonucleotide that is 18 nucleotides in length, and methods of use for treating dermal and other disorders. Any patents that may issue from these applications would expire by 2035. The expiration dates do not take into consideration any potential patent term adjustment that may be applied by the U.S. Patent Office upon issuance of the patent, any terminal disclaimers that may be filed in the future or any regulatory extensions that may be obtained.

Our AST-008 patent portfolio includes 24 pending U.S. nonprovisional and foreign patent applications. Foreign jurisdictions where we are seeking patent protection for our AST-008 patent portfolio include Canada, China, Japan, Australia, the European Union, India, South Korea and Mexico. Each of these applications is a composition of matter and method of use type application. The claims of these applications are directed to certain nanoscale constructs, liposomal particles, and multivalent nanostructures, and their methods of use for treating cancer and other disorders. Any patents that may issue from these applications would expire by 2034 or 2035. The expiration dates do not take into consideration any potential patent term adjustment that may be applied by the U.S. Patent Office upon issuance of the patent, any terminal disclaimers that may be filed in the future or any regulatory extensions that may be obtained.

Our XCUR17 patent portfolio includes one pending international patent application filed under the Patent Cooperation Treaty, or PCT. The pending PCT application is a composition of matter and method of use type

application and includes claims to one or more oligonucleotides that are 18 nucleotides in length, and methods of use for treating dermal and other disorders. We have the option of pursuing patent protection for this pending PCT application in the U.S. and elsewhere. Any patents that may issue from this application would expire by 2037. The expiration date does not take into consideration any potential patent term adjustment that may be applied by the U.S. Patent Office upon issuance of the patent, any terminal disclaimers that may be filed in the future or any regulatory extensions that may be obtained.

Upon receiving FDA approval for AST-005, XCUR17 or AST-008, we intend to list applicable patents in the FDA's Orange Book.

Patent life determination depends on the date of filing of the application and other factors as promulgated under the patent laws. In most countries, including the United States, the patent term is generally 20 years from the earliest claimed filing date of a non-provisional patent application in the applicable country.

Trade Secret and Other Protection

In addition to patented intellectual property, we also rely on trade secrets and proprietary know-how to protect our technology, especially when we do not believe that patent protection is appropriate or can be obtained. It is our policy to require our employees and consultants, outside scientific collaborators, sponsored researchers and other advisors who receive confidential information from us to execute confidentiality agreements upon the commencement of employment or consulting relationships. These agreements provide that all confidential information developed or made known to these individuals during the course of the individual's relationship with the company is to be kept confidential and is not to be disclosed to third parties except in specific circumstances. The agreements provide that all inventions conceived by an employee shall be the property of our Company. There can be no assurance, however, that these agreements will provide meaningful protection or adequate remedies for our trade secrets in the event of unauthorized use or disclosure of such information.

Other Intellectual Property Rights

We seek trademark protection in the United States when appropriate. We have filed for trademark protection for the following marks: LIFE HAPPENS IN 3D, LIFE IN 3D, and EXICURE. We currently have one registered trademark, EXICURE.

From time to time, we may find it necessary or prudent to obtain licenses from third party intellectual property holders.

Northwestern University License Agreements

In September 2009, Northwestern University and AuraSense LLC, or ASLLC, one of our significant stockholders, entered into a license agreement under which Northwestern University granted ASLLC an exclusive, worldwide license under certain Northwestern University patents and patent applications to exploit products and processes in the field of the use of nanoparticles, nanotechnology, microtechnology or nanomaterial-based constructs as or accompanying therapeutics or theradiagnostics and in or for intracellular diagnostic applications and intracellular research. On December 12, 2011, ASLLC assigned to us all of its worldwide rights and interests under the Northwestern University-ASLLC license in the field of the use of nanoparticles, nanotechnology, microtechnology or nanomaterial-based constructs as therapeutics or accompanying therapeutics as a means of delivery, but expressly excluding diagnostics (the "assigned field"). In accordance with the terms and conditions of this assignment, we assumed all liabilities and obligations of ASLLC to Northwestern University as set forth in its license agreement in the assigned field and in August 2015 we entered into a restated license agreement with Northwestern University. In February 2016, we obtained exclusive license as to Northwestern University's rights in certain SNA technology we jointly own with Northwestern University. Our license to Northwestern University's rights is limited to the assigned field, however we have no such limitation as to our own rights in this jointly owned technology. In June 2016, we entered into an exclusive license with Northwestern University to obtain worldwide rights to certain inhibitors of glucosylceramide synthase and their use in wound healing in diabetes. Our rights and

obligations in these 2016 agreements are substantially the same as in the restated license agreement from August 2015. For purposes of the assigned field, therapeutic uses means the use of products and processes that are covered by the patents and patent applications licensed from Northwestern University for the purpose of providing a therapy or course of medical treatment to address a medical condition or disease. The Northwestern University license agreements provide to us the exclusive, worldwide right to make, have made, use, modify, sell, offer for sale and import any product or process that is covered by any claim in the licensed Northwestern University patents and patent applications. We have the right to sublicense these rights to third parties. The Northwestern University license agreements require us to use commercially reasonable efforts, consistent with demand in the marketplace, regulatory procedures and industry conditions and development timelines, to research, develop, market and manufacture the licensed products.

Our rights under the Northwestern University license agreements are subject to a variety of material limitations. First, the license specifically excludes use of the licensed patent rights to perform qualitative or quantitative *in vitro* analysis, testing, or measurement as well as detection of a variety of combinations of biodiagnostics field subsets and targets. Second, the license specifically prohibits us from using the licensed patent rights with regard to diagnostics, including without limitation, theradiagnostics. Third, though the license is otherwise exclusive in the assigned field, Northwestern University retains the right to use the licensed patent rights for research, teaching, and other educational purposes, including the right to distribute and publish materials related to the licensed patent rights. Fourth, the license is subject to the rights of the U.S. government under any and all applicable laws including substantially manufacturing all licensed products in the U.S. unless such requirement is waived by the U.S. government. Fifth, other than in certain circumstances, the Northwestern University license agreements are non-transferable without the consent of Northwestern University. Under the terms of the Northwestern University license agreements, depending on the circumstances, either we or Northwestern University can sue to enforce the patent rights against third party infringers.

In order to secure the assignment of the Northwestern University-ASLLC license in the field, we assumed the obligation to pay Northwestern University an annual license fee, which may be credited against any royalties based on sales of licensed products that are due to Northwestern University in the same year, and to reimburse Northwestern University for expenses associated with the prosecution and maintenance of the licensed patent rights. In addition, we assumed the obligation to pay Northwestern University royalties at a low single-digit percentage of any net revenue generated by our sale or transfer of any licensed product. In the event we grant a sublicense under the licensed patent rights, we also assumed the obligation to pay Northwestern University, on a quarterly basis, the greater of a mid-teen percentage of all sublicensee royalties or a low single-digit percent of any net revenue generated by a sublicensee's sale or transfer of any licensed product. As of December 31, 2017, we have paid to Northwestern University an aggregate of \$3.4 million in consideration of each of the obligations described above.

We may terminate our license agreements with Northwestern University at any time by providing 90 days written notice to Northwestern University. Northwestern University may terminate the agreements or, alternatively, convert our exclusive rights to non-exclusive rights if we fail to comply with certain prescribed timelines for research, development, marketing and manufacturing milestones for the licensed products. Northwestern University may also terminate the agreements if we sue, or do not terminate all agreements with a sublicensee who sues Northwestern University, in a matter not arising from the agreements themselves. Either party may terminate the agreements in the event of a material breach by the other that remains uncured for a period of 30 days after the non-breaching party provides notice to the breaching party. The agreements will automatically terminate if we reach specified thresholds of financial distress. In the event of termination, all rights immediately revert to Northwestern University. The agreements will automatically expire upon the expiration of the last to expire patent rights. In the event of expiration, the license automatically becomes a non-exclusive, irrevocable, fully-paid license to use or sublicense the use of know-how to make and sell products in each country where the license had previously been in effect.

Our technology licenses and assignments

Our strategy around protection of our proprietary technology, including any innovations and improvements, is to obtain worldwide patent coverage with a focus on jurisdictions that represent significant global pharmaceutical

markets. Generally, patents have a term of twenty years from the earliest priority date, assuming that all maintenance fees are paid, no portion of the patent has been terminally disclaimed and the patent has not been invalidated. In certain jurisdictions, and in certain circumstances, patent terms can be extended or shortened. We are pursuing worldwide patent protection for at least novel molecules, compositions of matter, pharmaceutical formulations, methods of use, including treatment of disease, methods of manufacture and other novel uses for the inventive molecules originating from our research and development efforts. We continuously assess whether it is strategically more favorable to maintain confidentiality for the “know-how” regarding a novel invention rather than pursue patent protection. For each patent application that is filed we strategically tailor our claims in accordance with the existing patent landscape around a particular technology.

There can be no assurance that an issued patent will remain valid and enforceable in a court of law through the entire patent term. Should the validity of a patent be challenged, the legal process associated with defending the patent can be costly and time consuming. Issued patents can be subject to oppositions, interferences and other third party challenges that can result in the revocation of the patent or limit patent claims such that patent coverage lacks sufficient breadth to protect subject matter that is commercially relevant. Competitors may be able to circumvent our patents. Development and commercialization of pharmaceutical products can be subject to substantial delays and it is possible that at the time of commercialization any patent covering the product has expired or will be in force for only a short period of time following commercialization. We cannot predict with any certainty if any third party U.S. or foreign patent rights, or other proprietary rights, will be deemed infringed by the use of our technology. Nor can we predict with certainty which, if any, of these rights will or may be asserted against us by third parties. Should we need to defend ourselves and our partners against any such claims, substantial costs may be incurred. Furthermore, parties making such claims may be able to obtain injunctive or other equitable relief, which could effectively block our ability to develop or commercialize some or all of our products in the U.S. and abroad, and could result in the award of substantial damages. In the event of a claim of infringement, we or our partners may be required to obtain one or more licenses from a third party. There can be no assurance that we can obtain a license on a reasonable basis should we deem it necessary to obtain rights to an alternative technology that meets our needs. The failure to obtain a license may have a material adverse effect on our business, results of operations and financial condition.

We also rely on trade secret protection for our confidential and proprietary information. No assurance can be given that we can meaningfully protect our trade secrets on a continuing basis. Others may independently develop substantially equivalent confidential and proprietary information or otherwise gain access to our trade secrets.

It is our policy to require our employees and consultants, outside scientific collaborators, sponsored researchers and other advisors who receive confidential information from us to execute confidentiality agreements upon the commencement of employment or consulting relationships. These agreements provide that all confidential information developed or made known to these individuals during the course of the individual’s relationship with the company is to be kept confidential and is not to be disclosed to third parties except in specific circumstances. The agreements provide that all inventions conceived by an employee shall be the property of the company. There can be no assurance, however, that these agreements will provide meaningful protection or adequate remedies for our trade secrets in the event of unauthorized use or disclosure of such information.

Our success will depend in part on our ability to obtain and maintain patent protection, preserve trade secrets, prevent third parties from infringing upon our proprietary rights and operate without infringing upon the proprietary rights of others, both in the U.S. and other territories worldwide.

Manufacturing and Supply

We do not currently own or operate manufacturing facilities for the production of preclinical, clinical or commercial quantities of any of our therapeutic candidates. We currently contract with only one therapeutic substance and three drug product manufacturers for the supply of SNAs and we expect to continue to do so to meet the preclinical and any clinical requirements of our therapeutic candidates. We do not have a long-term agreement with these third parties.

We have agreements for the supply of such therapeutic materials with manufacturers or suppliers that we believe have sufficient capacity to meet our demands. In addition, we believe that adequate alternative sources for such supplies exist. However, there is a risk that, if supplies are interrupted, it would materially harm our business. We typically order raw materials and services on a purchase order basis and do not enter into long-term dedicated capacity or minimum supply arrangements.

Manufacturing is subject to extensive regulations that impose various procedural and documentation requirements, which govern record keeping, manufacturing processes and controls, personnel, quality control and quality assurance, among others. Our contract manufacturing organizations manufacture our therapeutic candidates subject to cGMP conditions. cGMPs are regulatory requirements for the production of therapeutics that will be used in humans.

Competition

We believe that our scientific knowledge and expertise in SNA-based therapies provide us with competitive advantages over the various companies and other entities that are attempting to develop oligonucleotide based-therapeutics. However, we face competition at the technology and therapeutic indication levels from both large and small biotechnology companies, academic institutions, government agencies and public and private research institutions. Many of our competitors have significantly greater financial resources and expertise in research and development, manufacturing, preclinical testing, conducting clinical trials, obtaining regulatory approvals and marketing approved products than we do. These competitors also compete with us in recruiting and retaining qualified scientific and management personnel and establishing clinical trial sites and patient registration for clinical trials, as well as in acquiring technologies complementary to, or necessary for, our programs.

Our success will be based in part upon our ability to identify, develop and manage a portfolio of therapeutics that are safer and more effective than competing products in the treatment of our targeted patients. Our commercial opportunity could be reduced or eliminated if our competitors develop and commercialize products that are safer, more effective, have fewer side effects, are more convenient or are less expensive than any therapeutics we may develop.

Competition in oligonucleotide-based therapeutics

There is intense and rapidly evolving competition in the biotechnology, pharmaceutical and oligonucleotide therapeutics fields. We believe that while our SNA technology, its associated intellectual property and our scientific and technical know-how gives us a competitive advantage in this space, competition from many sources remains. Our competition includes larger and better funded pharmaceutical, biotechnological and oligonucleotide therapeutic firms. Moreover, we not only compete with other firms, but also with current and future therapeutics.

We are aware of several companies that are developing oligonucleotide delivery platforms and oligonucleotide based therapeutics. These competitors include Ionis Pharmaceuticals, Inc., Alnylam Pharmaceuticals, Inc., Dicerna Pharmaceuticals, Inc., Arbutus Biopharma Corp., Wave Life Sciences Ltd., Dynavax Technologies Corp., Idera Pharmaceuticals, Inc., Mologen AG, and Checkmate Pharmaceuticals, Inc. These and other competitors compete with us in recruiting scientific and managerial talent, and for the finite funding available from biotechnology and pharmaceutical companies.

Our success will partially depend on our ability to develop and protect therapeutics that are safer and more effective than competing products. Our commercial opportunity and success will be reduced or eliminated if competing products are safer, more effective, or less expensive than the therapeutics we develop.

If our lead therapeutic candidates are approved for the indications for which we undertake clinical trials, they will compete with therapies that are either in development or currently marketed, such as the following:

Competition in psoriasis

There are currently a number of therapeutics on the market for the treatment of psoriasis. Over the counter medications such as salicylic acid and zinc pyrithione are used for treating mild to moderate psoriatic lesions. Prescription medications such as corticosteroids, calcipotriene, retinoids are available and can be applied topically. Oral therapeutics like cyclosporine and methotrexate are also used. Finally, injectable antibody-based therapies are used to decrease TNF-driven inflammation and thus reduce the symptoms of the disorder in the case of severe psoriasis.

Competition in immuno-oncology

There are a number of competitive products to SNAs for immuno-oncology on the market and in development. Ipilimumab and nivolumab from Bristol-Myers Squibb Company, atezolizumab from the Roche Group, as well as pembrolizumab from Merck & Co., Inc., are now marketed for the treatment of advanced melanoma or other cancers, and these and other therapeutic products are in development for other immuno-oncology applications. In addition, adoptive cell therapies such as CAR-T cells are showing great promise for the treatment of B-cell malignancies in clinical trials.

Government Regulation and Product Approval

Governmental authorities in the U.S., at the federal, state and local level, and other countries extensively regulate, among other things, the research, development, testing, manufacture, labeling, packaging, promotion, storage, advertising, distribution, marketing, sales, and export and import of products such as those we are developing. Our therapeutic candidates must be approved by the FDA through the NDA process before they may be legally marketed in the U.S. and will be subject to similar requirements in other countries prior to marketing in those countries. The process of obtaining regulatory approvals and the subsequent compliance with applicable federal, state, local and foreign statutes and regulations require the expenditure of substantial time and financial resources.

U.S. government regulation

NDA approval processes . In the U.S., the FDA regulates drugs under the Federal Food, Drug, and Cosmetic Act of 1938, or the FDCA, and implementing regulations. If we fail to comply with applicable FDA or other requirements at any time during the product development or approval process, or after approval, we may become subject to administrative or judicial sanctions, any of which could have a material adverse effect on us. These sanctions could include:

- refusal to approve pending applications;
- license suspension or revocation;
- withdrawal of an approval;
- imposition of a clinical hold;
- warning or untitled letters;
- seizures or administrative detention of product;
- product recalls;
- total or partial suspension of production or distribution; or
- injunctions, fines, disgorgement, or civil or criminal penalties.

The process required by the FDA before a therapeutic candidate may be marketed in the U.S. generally involves the following:

- completion of nonclinical laboratory tests, animal studies and formulation studies conducted according to Good Laboratory Practices, or GLPs, and other applicable regulations;
- submission to the FDA of an IND, which must become effective before human clinical trials may begin;
- performance of adequate and well-controlled human clinical trials according to Good Clinical Practices, or GCPs, to establish the safety and efficacy of the therapeutic candidate for its intended use;
- submission to the FDA of an NDA;
- satisfactory completion of an FDA inspection of the manufacturing facility or facilities at which the therapeutic candidate is produced to assess readiness for commercial manufacturing and conformance to the manufacturing-related elements of the application, to conduct a data integrity audit, and to assess compliance with cGMPs to assure that the facilities, methods and controls are adequate to preserve the therapeutic candidate's identity, strength, quality and purity; and
- FDA review and approval of the NDA.

The testing and approval process requires substantial time, effort, and financial resources, and we cannot be certain any approvals for our therapeutic candidates will be granted on a timely basis, if at all.

Once a therapeutic candidate is identified for development, it enters the preclinical or nonclinical testing stage. Nonclinical tests include laboratory evaluations of product chemistry, toxicity, formulation and stability, as well as animal studies. An IND sponsor must submit the results of the nonclinical tests, together with manufacturing information and analytical data, to the FDA as part of the IND. Some nonclinical testing may continue even after the IND is submitted. In addition to including the results of the nonclinical studies, the IND will also include a protocol detailing, among other things, the objectives of the clinical trial, the parameters to be used in monitoring safety and the effectiveness criteria to be evaluated if the first phase lends itself to an efficacy determination. Currently, the IND automatically becomes effective 30 days after receipt by the FDA, unless the FDA, within the 30-day time period, raises concerns or questions about the conduct of the clinical trial, including concerns that human research subjects will be exposed to unreasonable health risks. In such a case, the IND sponsor and the FDA must resolve any outstanding concerns before the clinical trial can begin. Submission of an IND may result in the FDA not allowing the clinical trials to commence or not allowing the clinical trials to commence on the terms originally specified in the IND. A separate submission to an existing IND must also be made for each successive clinical trial conducted during drug development, and the FDA must grant permission, either explicitly or implicitly by not objecting, before each clinical trial can begin.

All clinical trials must be conducted under the supervision of one or more qualified investigators in accordance with GCPs. They must be conducted under protocols detailing the objectives of the trial, dosing procedures, research subject selection and exclusion criteria and the safety and effectiveness criteria to be evaluated. Each protocol, and any subsequent material amendment to the protocol, must be submitted to the FDA as part of the IND, and progress reports detailing the status of the clinical trials must be submitted to the FDA annually. Sponsors also must report to the FDA serious and unexpected adverse reactions in a timely manner, any clinically important increase in the rate of a serious suspected adverse reaction over that listed in the protocol or investigation brochure or any findings from other studies or animal or *in vitro* testing that suggest a significant risk in humans exposed to the therapeutic. An IRB at each institution participating in the clinical trial must review and approve the protocol before a clinical trial commences at that institution and must also approve the information regarding the trial and the consent form that must be provided to each research subject or the subject's legal representative, monitor the trial until completed and otherwise comply with IRB regulations. There are also requirements governing the reporting of ongoing clinical trials and completed clinical trials results to public registries.

Human clinical trials are typically conducted in three sequential phases that may overlap or be combined.

- Phase 1-The therapeutic candidate is initially introduced into healthy human subjects and tested for safety, dosage tolerance, absorption, metabolism, distribution and elimination. In the case of some therapeutic candidates for severe or life-threatening diseases, such as cancer, especially when the therapeutic candidate may be inherently too toxic to ethically administer to healthy volunteers, the initial human testing is often conducted in patients.
- Phase 2-Clinical trials are performed on a limited patient population intended to identify possible adverse effects and safety risks, to preliminarily evaluate the efficacy of the product for specific targeted diseases and to determine dosage tolerance and optimal dosage.
- Phase 3-Clinical trials are undertaken to further evaluate dosage, clinical efficacy and safety in an expanded patient population at geographically dispersed clinical trial sites. These studies are intended to establish the overall risk-benefit ratio of the product and provide an adequate basis for product labeling.

Human clinical trials are inherently uncertain and Phase 1, Phase 2 and Phase 3 testing may not be successfully completed. The FDA or the sponsor may suspend a clinical trial at any time for a variety of reasons, including a finding that the clinical trial is not being conducted in accordance with FDA requirements or a finding that the research subjects or patients are being exposed to an unacceptable health risk. Similarly, an IRB can suspend or terminate approval of a clinical trial at its institution if the clinical trial is not being conducted in accordance with the IRB's requirements or if the therapeutic candidate has been associated with unexpected serious harm to patients. Additionally, some clinical trials are overseen by an independent group of qualified experts organized by the clinical trial sponsor, known as an Independent Data Monitoring Committee, or IDMC. The IDMC receives special access to the data during the clinical trial and may halt the clinical trial if it determines that there is an unacceptable safety risk for subjects or on other grounds, such as no demonstration of efficacy.

A drug being studied in clinical trials may be made available to individual patients, in certain circumstances. Pursuant to the 21st Century Cures Act, or Cures Act, which was signed into law in December 2016, the manufacturer of an investigational drug for a serious disease or condition is required to make available, such as by posting on its website, its policy on evaluating and responding to requests for individual patient access to such investigational drug.

During the development of a new therapeutic candidate, sponsors are given opportunities to meet with the FDA at certain points; specifically, prior to the submission of an IND, at the end of Phase 2 and before an NDA is submitted. Meetings at other times may be requested. These meetings can provide an opportunity for the sponsor to share information about the data gathered to date and for the FDA to provide advice on the next phase of development. Sponsors typically use the meeting at the end of Phase 2 to discuss their Phase 2 clinical results and present their plans for the pivotal Phase 3 clinical trial that they believe will support the approval of the new therapeutic.

Concurrent with clinical trials, sponsors usually complete additional animal safety studies and also develop additional information about the chemistry and physical characteristics of the therapeutic candidate and finalize a process for manufacturing commercial quantities of the therapeutic candidate in accordance with cGMP requirements. The manufacturing process must be capable of consistently producing quality batches of the therapeutic candidate and the manufacturer must develop methods for testing the quality, purity and potency of the therapeutic candidate. Additionally, appropriate packaging must be selected and tested and stability studies must be conducted to demonstrate that the therapeutic candidate does not undergo unacceptable deterioration over its proposed shelf-life.

The results of product development, nonclinical studies and clinical trials, along with descriptions of the manufacturing process, analytical tests and other control mechanisms, proposed labeling and other relevant information are submitted to the FDA as part of an NDA requesting approval to market the product. Under the Prescription Drug User Fee Act, or PDUFA, as amended, each NDA must be accompanied by a significant user fee.

The FDA adjusts the PDUFA user fees on an annual basis. PDUFA also imposes an annual product fee for products and an annual establishment fee on facilities used to manufacture prescription drug products. Fee waivers or reductions are available in certain circumstances, such as where a waiver is necessary to protect the public health, where the fee would present a significant barrier to innovation, or where the applicant is a small business submitting its first human therapeutic application for review. Within 60 days following submission of the application, the FDA reviews all NDAs submitted to ensure that they are sufficiently complete for substantive review before it accepts them for filing. It may request additional information rather than accept an NDA for filing. In this event, the NDA must be resubmitted with the additional information. The resubmitted application also is subject to review before the FDA accepts it for filing. Congress reauthorized the various user fees in the FDA Reauthorization Act of 2017 (FDARA) to facilitate the FDA's product review and oversight.

Once the submission is accepted for filing, the FDA begins an in-depth substantive review in accordance with certain performance goals. NDAs receive either standard or priority review. A therapeutic representing a significant improvement in treatment, prevention or diagnosis of disease may receive priority review. Most such applications for standard review product candidates are reviewed within ten months of the date the FDA files the NDA; most applications for priority review product candidates are reviewed within six months of the date the FDA files the NDA. The FDA reviews an NDA to determine, among other things, whether a product is safe and effective for its intended use and whether its manufacturing is cGMP-compliant. The FDA may refer the NDA to an advisory committee for review and recommendation as to whether the application should be approved and under what conditions. The FDA is not bound by the recommendation 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. Additionally, before approving an NDA, the FDA will typically inspect one or more clinical sites to assure that the clinical trials were conducted in compliance with IND trial requirements and GCP requirements. To assure cGMP and GCP compliance, an applicant must incur significant expenditures of time, money and effort in the areas of training, record keeping, production and quality control.

During the product approval process, the FDA also will determine whether a Risk Evaluation and Mitigation Strategy, or REMS, plan is necessary to assure the safe use of the product. If the FDA concludes a REMS plan is needed, the sponsor of the NDA must submit a proposed REMS plan. The FDA will not approve an NDA without a REMS plan, if required. The FDA has authority to require a REMS plan under the Food and Drug Administration Amendments Act of 2007, or FDAAA, when necessary to ensure that the benefits of a therapeutic outweigh the risks. In determining whether a REMS plan is necessary, the FDA must consider the size of the population likely to use the therapeutic, the seriousness of the disease or condition to be treated, the expected benefit of the therapeutic, the duration of treatment, the seriousness of known or potential adverse events, and whether the therapeutic is a new molecular entity. A REMS plan may be required to include various elements to assure safe use, such as a medication guide or patient package insert, a communication plan to educate health care providers of the risks, limitations on who may prescribe or dispense the therapeutic, or other measures that the FDA deems necessary to assure the safe use of the therapeutic. In addition, the REMS plan must include a timetable to assess the strategy at 18 months, three years, and seven years after the strategy's approval.

The FDA may also require a REMS plan for a therapeutic that is already on the market if it determines, based on new safety information, that a REMS plan is necessary to ensure that the product's benefits outweigh its risks. The requirement for a REMS can materially affect the potential market and profitability of the product.

Notwithstanding the submission of relevant data and information, the FDA may ultimately decide that the NDA does not satisfy its regulatory criteria for approval and deny approval. Data obtained from clinical trials are not always conclusive and the FDA may interpret data differently than we interpret the same data. If the agency decides not to approve the NDA in its present form, the FDA will issue a complete response letter that describes all of the specific deficiencies in the NDA identified by the FDA. The deficiencies identified may be minor, for example, requiring labeling changes, or major, for example, requiring additional clinical trials. Additionally, the complete

response letter may include recommended actions that the applicant might take to place the application in a condition for approval. If a complete response letter is issued, the applicant may either resubmit the NDA, addressing all of the deficiencies identified in the letter, or withdraw the application. Even if the NDA is resubmitted, FDA may again decide that the resubmitted NDA does not satisfy the criteria for approval.

Even if a product receives regulatory approval, the approval may be significantly limited to specific indications and dosages or the indications for use may otherwise be limited, which could restrict the commercial value of the product. Further, the FDA may require that certain contraindications, warnings or precautions be included in the product labeling. The FDA may impose restrictions and conditions on product distribution, prescribing, or dispensing in the form of a risk management plan, or otherwise limit the scope of any approval. In addition, the FDA may require post-marketing clinical trials, sometimes referred to as “Phase 4” clinical trials, designed to further assess a product’s safety and effectiveness, and testing and surveillance programs to monitor the safety of approved products that have been commercialized.

Companion Diagnostics. The FDA has issued a final guidance document addressing the agency’s policy in relation to in vitro companion diagnostic tests. The guidance explains that for some therapeutics, the use of a companion diagnostic test is essential for the safe and effective use of the product, such as when the use of a product is limited to a specific patient subpopulation that can be identified by using the test. According to the guidance, the FDA generally will not approve such a product if the companion diagnostic is not also approved or cleared for the appropriate indication, and accordingly the therapeutic product and the companion diagnostic should be developed and approved or cleared contemporaneously. However, the FDA may decide that it is appropriate to approve such a product without an approved or cleared in vitro companion diagnostic device when the therapeutic is intended to treat a serious or life-threatening condition for which no satisfactory alternative treatment exists and the FDA determines that the benefits from the use of a product with an unapproved or uncleared in vitro companion diagnostic device are so pronounced as to outweigh the risks from the lack of an approved or cleared in vitro companion diagnostic device. The FDA encourages sponsors considering developing a therapeutic product that requires a companion diagnostic to request a meeting with both relevant device and therapeutic product review divisions to ensure that the product development plan will produce sufficient data to establish the safety and effectiveness of both the therapeutic product and the companion diagnostic. Because the FDA’s policy on companion diagnostics is set forth only in guidance, this policy is subject to change and is not legally binding.

Most companion diagnostics are subject to the premarket approval application (PMA) process for medical devices, which, generally must be undertaken contemporaneously to the NDA process for the corresponding therapeutic candidate, and which may itself take several years to do. The PMA process may include preclinical studies and adequate and well-controlled clinical trials to assure the FDA of the safety and effectiveness of the companion diagnostic, reproducibility of the diagnostic results, and compliance with FDA requirements for medical device design, testing, control, manufacturing, documentation, and labeling. PMAs are also subject to a substantial application fee. PMA approval is not guaranteed, can be more limited than that we seek, or can include post-approval conditions and restrictions. Additionally, an approved medical device remains subject to audits and significant regulatory requirements for manufacturing, registration, quality assurance, labeling, packaging, shipping, and importing.

Expedited review and approval. The FDA has various programs, including Fast Track, priority review, accelerated approval and breakthrough therapy, which are intended to expedite or simplify the process for reviewing therapeutic candidates, or provide for the approval of a therapeutic candidate on the basis of a surrogate endpoint. Even if a therapeutic candidate qualifies for one or more of these programs, the FDA may later decide that the therapeutic candidate no longer meets the conditions for qualification or that the time period for FDA review or approval will be lengthened. Generally, therapeutic candidates that are eligible for these programs are those for serious or life-threatening conditions, those with the potential to address unmet medical needs and those that offer meaningful benefits over existing treatments. For example, Fast Track is a process designed to facilitate the development and expedite the review of therapeutic candidates to treat serious or life-threatening diseases or conditions and fill unmet medical needs. Priority review is designed to give a therapeutic candidate that treats a serious condition and, if approved, would provide a significant improvement in safety or effectiveness, an initial review within eight months as compared to a standard review time of twelve months.

Although Fast Track and priority review do not affect the standards for approval, the FDA will attempt to facilitate early and frequent meetings with a sponsor of a Fast Track designated therapeutic candidate and expedite review of the application for a therapeutic candidate designated for priority review. Accelerated approval, which is described in Subpart H of 21 CFR Part 314, provides for an earlier approval for a new therapeutic candidate that is intended to treat a serious or life-threatening disease or condition, generally provides a meaningful advantage over available therapies and demonstrates an effect on a surrogate endpoint that is reasonably likely to predict clinical benefit or on a clinical endpoint that can be measured earlier than irreversible morbidity or mortality, or IMM, that is reasonably likely to predict an effect on IMM or other clinical benefit. A surrogate endpoint is a laboratory measurement or physical sign used as an indirect or substitute measurement representing a clinically meaningful outcome. As a condition of approval, the FDA may require that a sponsor of a therapeutic candidate receiving accelerated approval perform post-marketing clinical trials to verify and describe the predicted effect on irreversible morbidity or mortality or other clinical endpoint, and the product may be subject to accelerated withdrawal procedures.

In the Food and Drug Administration Safety and Innovation Act, or FDASIA, which was signed into law in July 2012, the U.S. Congress encouraged the FDA to utilize innovative and flexible approaches to the assessment of therapeutic candidates under accelerated approval. The law required the FDA to issue related guidance and also promulgate confirming regulatory changes. In May 2014, the FDA published a final Guidance for Industry titled “Expedited Programs for Serious Conditions—Drugs and Biologics,” which provides guidance on FDA programs that are intended to facilitate and expedite development and review of new therapeutic candidates as well as threshold criteria generally applicable to concluding that a therapeutic candidate is a candidate for these expedited development and review programs.

In addition to the Fast Track, accelerated approval and priority review programs discussed above, the FDA also provided guidance on a new program for Breakthrough Therapy Designation, established by FDASIA to subject a new category of drugs to accelerated approval. A sponsor may seek FDA designation of a therapeutic candidate as a “breakthrough therapy” if the therapeutic is intended, alone or in combination with one or more other therapeutics, to treat a serious or life-threatening disease or condition, and preliminary clinical evidence indicates that the therapeutic may demonstrate substantial improvement over existing therapies on one or more clinically significant endpoints, such as substantial treatment effects observed early in clinical development. A request for Breakthrough Therapy designation should be submitted concurrently with, or as an amendment to, an IND, but ideally no later than the end of the Phase 2 meeting.

Similar to FDASIA, the Cures Act, which was signed into law in December 2016, includes numerous provisions intended to accelerate the development of new products regulated by the FDA. As an example, the Cures Act provides that the FDA may allow the sponsor of an NDA for a genetically targeted drug or variant protein targeted drug to rely upon data and information previously developed by the same sponsor (or another sponsor that has provided the sponsor with a contractual right of reference to such data and information) and submitted by the sponsor in support of one or more previously approved applications submitted to the FDA for a drug that incorporates or utilizes the same or similar genetically targeted technology or the same variant protein targeted drug.

Patent term restoration and marketing exclusivity. Depending upon the timing, duration and specifics of FDA approval of the use of our therapeutic candidates, some of our U.S. patents may be eligible for limited patent term extension under the Drug Price Competition and Patent Term Restoration Act of 1984, referred to as the Hatch-Waxman Act. The Hatch-Waxman Act permits a patent restoration term of up to five years as compensation for patent term lost during product development and the FDA regulatory review process. However, patent term restoration cannot extend the remaining term of a patent beyond a total of 14 years from the therapeutic candidate’s approval date. The patent term restoration period is generally one half of the time between the effective date of an IND and the submission date of an NDA, plus the time between the submission date of an NDA and the approval of that application, except that the review period is reduced by any time during which the applicant failed to exercise due diligence. Only one patent applicable to an approved therapeutic candidate is eligible for the extension and the application for extension must be made prior to expiration of the patent. The U.S. Patent and Trademark Office, in consultation with the FDA, reviews and approves the application for any patent term extension or restoration. In the future, we intend to apply for restorations of patent term for some of our currently owned or licensed patents to add

patent life beyond their current expiration date, depending on the expected length of clinical trials and other factors involved in the submission of the relevant NDA.

Market exclusivity provisions under the FDCA also can delay the submission or the approval of certain applications. The FDCA provides a five-year period of non-patent marketing exclusivity within the U.S. to the first applicant to gain approval of an NDA for a new chemical entity. A therapeutic candidate is a new chemical entity if the FDA has not previously approved any other new therapeutic candidate containing the same active moiety, which is the molecule or ion responsible for the action of the therapeutic candidate substance. During the exclusivity period, the FDA may not accept for review an abbreviated new drug application, or ANDA, or a 505(b)(2) NDA submitted by another company for another version of such therapeutic candidate where the applicant does not own or have a legal right of reference to all the data required for approval. However, an application may be submitted after four years if it contains a certification of patent invalidity or non-infringement. The FDCA also provides three years of marketing exclusivity for an NDA, 505(b)(2) NDA or supplement to an approved NDA if new clinical investigations, other than bioavailability studies, that were conducted or sponsored by the applicant are deemed by the FDA to be essential to the approval of the application, for example, for new indications, dosages or strengths of an existing therapeutic candidate. This three-year exclusivity covers only the conditions associated with the new clinical investigations and does not prohibit the FDA from approving ANDAs for therapeutic candidates containing the original active agent. Five-year and three-year exclusivity will not delay the submission or approval of a full NDA. However, an applicant submitting a full NDA would be required to conduct or obtain a right of reference to all of the preclinical studies and adequate and well-controlled clinical trials necessary to demonstrate safety and effectiveness.

Disclosure of Clinical Trial Information : Sponsors of clinical trials of FDA-regulated products are required to register and disclose certain clinical trial information. Information related to the product, patient population, phase of investigation, trial sites and investigators, and other aspects of the clinical trial is then made public as part of the registration. Sponsors are also obligated to disclose the results of their clinical trials within one year of completion, although disclosure of the results of these trials can be delayed in certain circumstances for up to two additional years. Competitors may use this publicly available information to gain knowledge regarding the progress of development programs.

Orphan drug designation. Under the Orphan Drug Act, the FDA may grant orphan drug designation to therapeutic candidates intended to treat a rare disease or condition, which is generally a disease or condition that affects fewer than 200,000 individuals in the U.S., or more than 200,000 individuals in the U.S. and for which there is no reasonable expectation that the cost of developing and making available in the U.S. a therapeutic candidate for this type of disease or condition will be recovered from sales in the U.S. for that therapeutic candidate. Orphan drug designation must be requested before submitting a marketing application for the therapeutic for that particular disease or condition. After the FDA grants orphan drug designation, the identity of the therapeutic agent and its potential orphan use are disclosed publicly by the FDA. Orphan drug designation does not convey any advantage in or shorten the duration of the regulatory review and approval process. The FDA may revoke orphan drug designation, and if it does, it will publicize the drug is no longer designated as an orphan drug.

If a therapeutic candidate with orphan drug designation subsequently receives the first FDA approval for the disease for which it has such designation, the therapeutic candidate is entitled to orphan product exclusivity, which means that the FDA may not approve any other applications to market the same therapeutic candidate for the same indication, except in very limited circumstances, for seven years. Orphan drug exclusivity, however, could also block the approval of one of our therapeutic candidates for seven years if a competitor obtains approval of the same therapeutic candidate as defined by the FDA or if our therapeutic candidate is determined to be contained within the competitor's therapeutic candidate for the same indication or disease.

Pediatric exclusivity and pediatric use. Under the Best Pharmaceuticals for Children Act, or BPCA, certain therapeutic candidates may obtain an additional six months of exclusivity if the sponsor submits information requested in writing by the FDA, referred to as a Written Request, relating to the use of the active moiety of the therapeutic candidate in children. The FDA may not issue a Written Request for studies on unapproved or approved

indications where it determines that information relating to the use of a therapeutic candidate in a pediatric population, or part of the pediatric population, may not produce health benefits in that population.

In addition, the Pediatric Research Equity Act, or PREA, requires a sponsor to conduct pediatric studies for most therapeutic candidates and biologics, for a new active ingredient, new indication, new dosage form, new dosing regimen or new route of administration. Under PREA, original NDAs, BLAs and supplements thereto must contain a pediatric assessment unless the sponsor has received a deferral or waiver. The required assessment must assess the safety and effectiveness of the therapeutic candidate for the claimed indications in all relevant pediatric subpopulations and support dosing and administration for each pediatric subpopulation for which the therapeutic candidate is safe and effective. The sponsor or the FDA may request a deferral of pediatric studies for some or all of the pediatric subpopulations. A deferral may be granted for several reasons, including a finding that the drug or biologic is ready for approval for use in adults before pediatric studies are complete or that additional safety or effectiveness data needs to be collected before the pediatric studies begin. The FDA must send a noncompliance letter to any sponsor that fails to submit the required assessment, keep a deferral current or fails to submit a request for approval of a pediatric formulation. The FDA also must post the PREA noncompliance letter and sponsor's response.

As part of the FDASIA, the U.S. Congress made a few revisions to BPCA and PREA, which were slated to expire on September 30, 2012, and made both laws permanent.

Post-approval requirements. Once an approval is granted, the FDA may withdraw the approval if compliance with regulatory requirements is not maintained or if problems occur after the therapeutic candidate reaches the market. Later discovery of previously unknown problems with a therapeutic candidate may result in restrictions on the therapeutic candidate or even complete withdrawal of the therapeutic candidate from the market. After approval, some types of changes to the approved therapeutic candidate, such as adding new indications, manufacturing changes and additional labeling claims, are subject to further FDA review and approval. In addition, the FDA may under some circumstances require testing and surveillance programs to monitor the effect of approved therapeutic candidates that have been commercialized, and the FDA under some circumstances has the power to prevent or limit further marketing of a therapeutic candidate based on the results of these post-marketing programs.

Any therapeutic candidates manufactured or distributed by us or our collaborators pursuant to FDA approvals are subject to continuing regulation by the FDA, including, among other things:

- record-keeping requirements;
- reporting of adverse experiences associated with the therapeutic candidate;
- providing the FDA with updated safety and efficacy information;
- therapeutic sampling and distribution requirements;
- notifying the FDA and gaining its approval of specified manufacturing or labeling changes; and
- complying with FDA promotion and advertising requirements, which include, among other things, standards for direct-to-consumer advertising, restrictions on promoting products for uses or in patient populations that are not described in the product's approved labeling, limitations on industry-sponsored scientific and educational activities and requirements for promotional activities involving the internet.

Therapeutic manufacturers, their subcontractors, and other entities involved in the manufacture and distribution of approved therapeutic candidates are required to register their establishments with the FDA and certain state agencies and are subject to periodic unannounced inspections by the FDA and some state agencies for compliance with cGMPs, including data integrity requirements, and other laws. The FDA periodically inspects manufacturing facilities to assess compliance with ongoing regulatory requirements, including cGMPs, which impose extensive procedural, substantive and record-keeping requirements upon us and any third-party manufacturers that we may

decide to use if our therapeutic candidates are approved. In addition, changes to the manufacturing process are strictly regulated, and, depending on the significance of the change, may require FDA approval before being implemented. FDA regulations would also require investigation and correction of any deviations from cGMPs and impose reporting and documentation requirements upon us and the third-party manufacturers. Accordingly, manufacturers must continue to expend time, money and effort in the area of production and quality control to maintain compliance with cGMPs and other aspects of regulatory compliance. Failure to comply with the statutory and regulatory requirements can subject a manufacturer to possible legal or regulatory actions, such as warning letters, suspension of manufacturing, seizures of products, injunctive actions or other civil penalties. We cannot be certain we or our present or future third-party manufacturers or suppliers will be able to comply with the cGMP regulations and other ongoing FDA regulatory requirements. If we or our present or future third-party manufacturers or suppliers are not able to comply with these requirements, the FDA may halt our clinical trials or require us to recall a product from distribution.

In addition, therapeutic manufacturers in the United States must comply with applicable provisions of the Drug Supply Chain Security Act and provide and receive product tracing information, maintain appropriate licenses, ensure they only work with other properly licensed entities, and have procedures in place to identify and properly handle suspect and illegitimate product.

New Legislation and Regulations . From time to time, legislation is drafted, introduced and passed in the U.S. Congress that could significantly change the statutory provisions governing the testing, approval, manufacturing and marketing of products regulated by the FDA. In addition to new legislation, FDA regulations and policies are often revised or interpreted by the agency in ways that may significantly affect our business and our products. It is impossible to predict whether further legislative changes will be enacted or whether FDA regulations, guidance, policies or interpretations will be changed or what the effect of such changes, if any, may be.

Foreign Clinical Studies to Support an IND, or NDA: We are conducting several trials in Germany. The FDA will accept as support for an IND, or NDA a well-designed, well-conducted, non-IND foreign clinical trial. Regulatory applications based solely on foreign clinical data meeting these criteria may be approved if the foreign data are applicable to the U.S. population and U.S. medical practice, the trials have been performed by clinical investigators of recognized competence, in accordance with GCP, and the data may be considered valid without the need for an on-site inspection by FDA or, if FDA considers such an inspection to be necessary, FDA is able to validate the data through an on-site inspection or other appropriate means. Failure of an application to meet any of these criteria may result in the application not being approvable based on the foreign data alone. A sponsor or applicant who wishes to rely on a non-IND foreign clinical trial to support an IND must submit the following supporting information to the FDA to demonstrate that the trial conformed to GCP:

- the investigator's qualifications;
- a description of the research facilities;
- a detailed summary of the protocol and trial results and, if requested, case records or additional background data;
- a description of the drug substance and drug product, including the components, formulation, specifications, and, if available, the bioavailability of the product candidate;
- information showing that the trial is adequate and well controlled;
- the name and address of the independent ethics committee that reviewed the trial and a statement that the independent ethics committee meets the required definition;
- a summary of the independent ethics committee's decision to approve or modify and approve the trial, or to provide a favorable opinion;

- a description of how informed consent was obtained;
- a description of what incentives, if any, were provided to subjects to participate;
- a description of how the sponsor monitored the trial and ensured that the trial was consistent with the protocol;
- a description of how investigators were trained to comply with GCP and to conduct the trial in accordance with the trial protocol; and
- a statement on whether written commitments by investigators to comply with GCP and the protocol

Regulation outside of the U.S.

In addition to regulations in the U.S., we will be subject to regulations of other countries governing any clinical trials and commercial sales and distribution of our therapeutic candidates. Whether or not we obtain FDA approval for a product, we must obtain approval by the comparable regulatory authorities of countries outside of the U.S. before we can commence clinical trials in such countries and approval of the regulators of such countries or economic areas, such as the European Union, or EU, before we may market products in those countries or areas. The approval process and requirements governing the conduct of clinical trials, product licensing, pricing and reimbursement vary greatly from place to place, and the time may be longer or shorter than that required for FDA approval.

The currently applicable Clinical Trials Directive 2001/20/EC and Commission Directive 2005/28/EC on GCP setting out the system for the approval of clinical trials in the European Union have been implemented through national legislation in the EU Member States. Under this system, an applicant must obtain approval from the national competent authorities in all EU Member States in which the clinical trials are to be conducted. Furthermore, the applicant may only start a clinical trial at a specific study site once approved by the competent ethics committee.

In 2014, a new Clinical Trials Regulation 536/2014, replacing the current Clinical Trials Directive, was adopted. The new Regulation will become directly applicable in all EU Member States (without national implementation) once the EU Portal and Database are fully functional. The Regulation was expected to apply by October 2018. However, due to technical difficulties with the development of the IT systems, it is currently expected that the new Regulation will come into application during 2019. The new Regulation seeks to simplify and streamline the approval of clinical trials in the EU. For example, the sponsor shall submit a single application for approval of a clinical trial via the EU Portal. As part of the application process, the sponsor shall propose a reporting Member State, who will coordinate the validation and evaluation of the application. The reporting Member State shall consult and coordinate with the other concerned Member States. If an application is rejected, it can be amended and resubmitted through the EU Portal. If an approval is issued, the sponsor can start the clinical trial in all concerned Member States. However, a concerned Member State can in limited circumstances declare an “opt-out” from an approval. In such a case, the clinical trial cannot be conducted in that Member State. The Regulation also aims to streamline and simplify the rules on safety reporting, and introduces enhanced transparency requirements such as mandatory submission of a summary of the clinical trial results to the EU Database.

In the EU, a company may submit a marketing authorization application either: (i) at the national level with the national competent authorities in one EU Member State, or the national procedure; (ii) via mutual recognition of a national authorization in other EU Member States, or the mutual recognition procedure; (iii) at the national level in several EU Member States, or the decentralized procedure; or (iv) at centralized level with the European Medicines Agency, or EMA, referred to as the centralized procedure. The national procedure allows sponsor to choose the EU Member State in which he wishes to first submit an application. The mutual recognition procedure allows a marketing authorization granted in one EU Member State via the national procedure to be recognized in other EU Member States. The decentralized procedure allows a medicine that has not yet been authorized in the EU to be authorized in several EU Member States. The centralized procedure, whereby a medicine receives marketing authorization in all EU Member States, is compulsory for certain medicines, including products derived from

biotechnology, orphan medicinal products, medicinal products for human use which contain an active substance authorized in the EU after May 20, 2004 and which are intended for the treatment of AIDS, cancer, neurodegenerative disorders or diabetes and is optional for other types of medicines if the applicant can show eligibility.

As in the U.S., we may apply for designation of a therapeutic candidate as an orphan drug for the treatment of a specific indication in the EU before the application for marketing authorization is made. Orphan drugs in the EU enjoy economic and marketing benefits, including up to ten (10) years of market exclusivity for the approved indication. During such period, marketing applications for a “similar medicinal product” will not be accepted, unless certain exceptions apply. In the EU, a “similar medicinal product” is a medicinal product containing a similar active substance or substances as contained in a currently authorized orphan medicinal product, and which is intended for the same therapeutic indication.

Healthcare Reform

In March 2010, Congress passed the ACA, a sweeping law intended to broaden access to health insurance, reduce or constrain the growth of health spending, enhance remedies against fraud and abuse, add new transparency requirements for the healthcare and health insurance industries, impose new taxes and fees on the health industry, and impose additional policy reforms. The ACA contains a number of provisions, including those governing enrollment in federal healthcare programs, reimbursement changes, and fraud and abuse, impacting existing government healthcare programs and resulting in the development of new programs, including Medicare payment for performance initiatives, and improvements to the physician quality reporting system and feedback program. Other aspects of the ACA include, but are not limited to:

- Increases in pharmaceutical manufacturer rebate liability under the Medicaid Drug Rebate Program due to an increase in the minimum basic Medicaid rebate on most branded prescription drugs, and the application of Medicaid rebate liability to drugs used in risk-based Medicaid managed care plans.
- Expansion of the 340B Drug Pricing Program to require discounts for “covered outpatient drugs” sold to certain children’s hospitals, critical access hospitals, freestanding cancer hospitals, rural referral centers, and sole community hospital.
- Requirements on pharmaceutical companies to offer discounts on brand-name drugs to patients who fall within the Medicare Part D coverage gap, commonly referred to as the “Donut Hole.” In February 2018, Congress passed the Bipartisan Budget Act of 2018, which, beginning in 2019, increased the discount to be paid by pharmaceutical companies from 50% to 70% of a brand-name drug’s negotiated price and added biosimilars to the coverage gap discount program.
- Requirements on pharmaceutical companies to pay an annual non-tax-deductible fee to the federal government based on each company’s market share of prior year total sales of branded drugs to certain federal healthcare programs, such as Medicare, Medicaid, Department of Veterans Affairs, and Department of Defense.
- Establishment of the Patient-Centered Outcomes Research Institute to identify priorities in, and conduct comparative clinical effectiveness research, along with funding for such research. The research conducted by the Patient-Centered Outcomes Research Institute may affect the market for certain pharmaceutical products.
- Establishment the Center for Medicare and Medicaid Innovation within the Centers for Medicare and Medicaid Services, or CMS, to test innovative payment and service delivery models to lower Medicare and Medicaid spending, potentially including prescription drug spending. Funding has been allocated to support the mission of the Center for Medicare and Medicaid Innovation from 2011 to 2019.

From time to time, legislation is drafted, introduced, and passed in Congress that could significantly change the statutory provisions governing the sale, marketing, coverage, and reimbursement of products regulated by CMS or other government agencies. In addition to new legislation, CMS regulations and policies are often revised or interpreted by the agency in ways significantly affecting our business and our products.

In particular, we expect that the new administration and the U.S. Congress will seek to modify, repeal, or otherwise invalidate all, or certain provisions of, the U.S. healthcare reform legislation. Since taking office, President Trump has continued to support the repeal of all or portions of the ACA. President Trump has also issued an executive order in which he stated it is his administration's policy to seek the prompt repeal of the ACA and directed executive departments and federal agencies to waive, defer, grant exemptions from, or delay the implementation of the provisions of the ACA to the maximum extent permitted by law. Congress has also enacted legislation that repeals certain portions of the ACA, including the Tax Cuts and Jobs Act, passed in December 2017, which included a provision that eliminates the penalty under the ACA's individual mandate effective January 1, 2019, as well as the Bipartisan Budget Act of 2018, passed in February 2018, which, among other things, repealed the Independent Payment Advisory Board that was established by the ACA and was intended to reduce the rate of growth in Medicare spending. There is still uncertainty with respect to the impact President Trump's administration and the U.S. Congress may have, if any, and any changes will likely take time to unfold. Such reforms could have an adverse effect on anticipated revenues from therapeutic candidates we may successfully develop and for which we may obtain regulatory approval and may affect our overall financial condition and ability to develop therapeutic candidates. However, we cannot predict the ultimate content, timing, or effect of any healthcare reform legislation or the impact of potential legislation on us.

Furthermore, political, economic, and regulatory influences frequently subject the healthcare industry in the U.S. to fundamental change. For example, initiatives to reduce the federal budget and debt and to reform healthcare coverage are increasing cost-containment efforts. We anticipate federal agencies, Congress, state legislatures, and the private sector will continue to review and assess alternative healthcare benefits, controls on healthcare spending, and other fundamental changes to the healthcare delivery system. Any proposed or actual changes could limit coverage for or the amounts federal and state governments will pay for health care products and services, which could also result in reduced demand for our products or additional pricing pressures, and limit or eliminate our spending on development projects and affect our ultimate profitability.

Third-Party Payor Coverage and Reimbursement

Significant uncertainty exists as to the coverage and reimbursement status of any products for which we may obtain regulatory approval. In the U.S., sales of any products for which we may receive regulatory marketing approval will depend, in part, on the availability of coverage and reimbursement from third-party payors. Third-party payors include government authorities such as Medicare, Medicaid, TRICARE, and the Veterans Administration, managed care providers, private health insurers, and other organizations.

The Medicaid Drug Rebate Program, which is part of the federal Medicaid program (a program for financially needy patients, among others), requires pharmaceutical manufacturers to enter into and have in effect a national rebate agreement with the Secretary of the Department of Health and Human Services as a condition for receiving federal reimbursement for the manufacturer's outpatient drugs furnished to Medicaid patients.

In order for a pharmaceutical product to (i) receive federal reimbursement under Medicaid and Medicare Part B (the part of the federal Medicare program covering outpatient items and services for the aged and disabled) or (ii) be sold directly to U.S. government agencies, the manufacturer must extend discounts to entities eligible to participate in the 340B drug pricing program, which is a federal program that requires manufacturers to provide discounts to certain statutorily defined safety-net providers. The required 340B discount on a given product is calculated based on certain Medicaid Drug Rebate Program metrics the manufacturer is required to report to CMS. The failure to report or the misreporting of such pricing metrics could result in significant civil monetary penalties and fines, including up to \$181,071 (adjusted for inflation) for each item of false or omitted information and \$18,107 (adjusted for inflation) per day per labeler code for each day the submission of such pricing information is late beyond the due date.

The Medicare Prescription Drug, Improvement, and Modernization Act of 2003, or MMA, imposed requirements for the distribution and pricing of prescription drugs for Medicare beneficiaries. Under Part D, Medicare beneficiaries may enroll in prescription drug plans offered by private entities, which will provide coverage of outpatient prescription drugs. Part D plans include both stand-alone prescription drug benefit plans and prescription drug coverage as a supplement to Medicare Advantage plans. Unlike Medicare Part A and B, Part D coverage is not standardized. Part D prescription drug plan sponsors are not required to pay for all covered Part D drugs, and each drug plan can develop its own drug formulary that identifies which drugs it will cover and at what tier or level. However, Part D prescription drug formularies must include drugs within each therapeutic category and class of covered Part D drugs, though not necessarily all the drugs in each category or class. Any formulary used by a Part D prescription drug plan must be developed and reviewed by a pharmacy and therapeutic committee. Government payment for some of the costs of prescription drugs may increase demand for our products for which we receive marketing approval. However, any negotiated prices for our products covered by a Part D prescription drug plan will likely be lower than the prices we might otherwise obtain. Moreover, while the MMA applies only to drug benefits for Medicare beneficiaries, private payors often follow Medicare coverage policy and payment limitations in setting their own payment rates. Any reduction in payment that results from the MMA may result in a similar reduction in payments from non-governmental payors.

The process for determining whether a payor will provide coverage for a product is typically separate from the process for setting the reimbursement rate a payor will pay for the product. Third-party payors may limit coverage to specific products on an approved list or formulary, which may not include all FDA-approved products for a particular indication. Also, third-party payors may refuse to include a particular branded product on their formularies or otherwise restrict patient access to a branded drug when a less costly generic equivalent or other alternative is available. Furthermore, a payor's decision to provide coverage for a product does not imply an adequate reimbursement rate will be available. 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.

Third-party payors are increasingly challenging the price and examining the medical necessity and cost-effectiveness of medical products and services. Additionally, the containment of healthcare costs has become a priority of federal and state governments, and the prices of therapeutics have been a focus in this effort. The U.S. government, state legislatures, and foreign governments have shown significant interest in implementing cost-containment programs, including price controls, restrictions on reimbursement, and requirements for substitution of generic products. Adoption of price controls and cost-containment measures, and adoption of more restrictive policies in jurisdictions with existing controls and measures, could further limit our net revenue and results. Our drug candidates may not be considered medically necessary or cost-effective. If third-party payors do not consider a product to be cost-effective compared to other available therapies, they may not cover an approved product as a benefit under their plans or, if they do, the level of payment may not be sufficient to allow us to sell our products at a profit.

Further, the American Recovery and Reinvestment Act of 2009 provides funding for the federal government to compare the effectiveness of different treatments for the same illness. The plan for the research was published in 2012 by the Department of Health and Human Services, the Agency for Healthcare Research and Quality, or AHRQ, and the National Institutes for Health, and periodic reports on the status of the research and related expenditures will be made to the U.S. Congress. In addition, the ACA requires, among other things, that AHRQ broadly disseminate findings from federally funded comparative clinical effectiveness research. Although the results of the comparative effectiveness studies are not intended to mandate coverage policies for public or private payors, it is not clear what effect, if any, the research will have on the sales of our therapeutic candidates if any such therapeutic, or the condition that it is intended to treat, is the subject of a study. It is also possible that comparative effectiveness research demonstrating benefits in a competitor's product could adversely affect the sales of our therapeutic candidates.

In addition, other legislative changes have been proposed and adopted in the United States since the ACA was enacted. On August 2, 2011, the Budget Control Act of 2011 among other things, created measures for spending reductions by the U.S. Congress. A Joint Select Committee on Deficit Reduction, tasked with recommending a targeted deficit reduction of at least \$1.2 trillion for the years 2013 through 2021, was unable to reach required

goals, thereby triggering the legislation's automatic reduction to several government programs. This includes aggregate reductions to Medicare payments to providers of up to 2% per fiscal year, started in April 2013, and, due to subsequent legislative amendments have been subsequently extended through 2027. On January 2, 2013, President Obama signed into law the American Taxpayer Relief Act of 2012, or the ATRA, which among other things, also reduced Medicare payments to several providers, including hospitals, imaging centers and cancer treatment centers, and increased the statute of limitations period for the government to recover overpayments to providers from three to five years. Although the Bipartisan Budget Act of 2018, passed in February 2018, enacts a two-year federal spending agreement and raises the federal spending cap on non-defense spending for fiscal years 2018 and 2019, the Medicare program is frequently identified as a target for spending cuts. We expect that additional federal healthcare reform measures will be adopted in the future, any of which could limit the amounts that federal and state governments will pay for healthcare drugs and services, and in turn could significantly reduce the projected value of certain development projects and reduce our profitability.

Finally, in some foreign countries, the proposed pricing for a therapeutic candidate must be approved before it may be lawfully marketed. The requirements governing therapeutic pricing vary widely from country to country. For example, in the EU, pricing and reimbursement of pharmaceutical products are regulated at a national level under the individual EU Member States' social security systems; policies may vary also within EU member states. In some EU member states, pricing or reimbursement negotiations may be required both at the national level and at regional level. Some foreign countries provide options 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 country 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. There can be no assurance that any country that has price controls or reimbursement limitations for pharmaceutical products will allow favorable reimbursement and pricing arrangements for any of our therapeutic candidates. Even if approved for reimbursement, historically, therapeutic candidates launched in some foreign countries such as some countries in the EU do not follow price structures of the U.S. and prices generally tend to be significantly lower.

Other Healthcare Laws and Regulations

If we obtain regulatory approval of our products, we may be subject to various federal and state laws targeting fraud and abuse in the healthcare industry. These laws may impact, among other things, our proposed sales and marketing strategies. In addition, we may be subject to patient privacy regulation by both the federal government and the states in which we conduct our business. These laws include, without limitation, state and federal anti-kickback, fraud and abuse, false claims, privacy and security, and physician sunshine laws and regulations.

The federal Anti-Kickback Statute prohibits, among other things, any person from knowingly and willfully offering, soliciting, receiving or paying remuneration (a term interpreted broadly to include anything of value, including, for example, gifts, discounts and credits), 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, an item or reimbursable, in whole or in part, under a federal healthcare program, such as the Medicare and Medicaid programs. Violations of the federal Anti-Kickback Statute can result in significant civil monetary and criminal penalties, including \$74,792 (adjusted annually for inflation) per kickback for acts committed prior to February 9, 2018 or \$100,000 (adjusted annually for inflation) for acts committed after February 9, 2018, plus three times the amount of remuneration and a five year prison term for acts committed before February 9, 2018 or a ten year prison term for acts committed after February 9, 2018. Further, violation of the federal Anti-Kickback Statute can also form the basis for False Claims Act liability (discussed below). The Anti-Kickback Statute is subject to evolving interpretations. In the past, the government has enforced the Anti-Kickback Statute to reach large settlements with healthcare companies based on allegedly inappropriate consulting, discounting and other financial arrangements with physicians and others in a position to refer patients to receive items or services reimbursable by a federal healthcare program. A person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation. Many states have adopted laws similar to the federal Anti-Kickback Statute, some of which apply to the referral of patients for healthcare items or services reimbursed by any source, not only government programs.

Additionally, the civil False Claims Act prohibits knowingly presenting or causing the presentation of a false, fictitious or fraudulent claim for payment to the U.S. government. Actions under the False Claims Act may be brought by the Attorney General or as a qui tam action by a private individual in the name of the government. Violations of the False Claims Act can result in very significant monetary penalties, including \$11,181-\$22,363 (adjusted annually for inflation) for each false claim and treble the amount of the government's damages. The federal government continues to use the False Claims Act, and the accompanying threat of significant liability, in its investigations and prosecutions of pharmaceutical and biotechnology companies throughout the U.S. Such investigations and prosecutions frequently involve, for example, the alleged promotion of products for unapproved uses and other sales and marketing practices. The government has obtained multi-million and multi-billion dollar settlements under the False Claims Act in addition to individual criminal convictions under applicable criminal statutes. Given the significant size of actual and potential settlements, it is expected that the government will continue to devote substantial resources to investigating healthcare providers' and manufacturers' compliance with the False Claims Act and other applicable fraud and abuse laws.

The U.S. federal Health Insurance Portability and Accountability Act of 1996, or HIPAA, includes a fraud and abuse provision referred to as the HIPAA All-Payor Fraud Law, which imposes criminal and civil liability for executing a scheme to defraud any healthcare benefit program, or knowingly and willfully falsifying, concealing or covering up a material fact or making any materially false statement in connection with the delivery of or payment for healthcare benefits, items or services. Similar to the federal Anti-Kickback Statute, a person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation.

We may also be subject to data privacy and security regulation by both the federal government and the states in which we conduct our business. HIPAA, as amended by HITECH, and its implementing regulations, including the final omnibus rule published on January 25, 2013, imposes certain requirements relating to the privacy, security and transmission of individually identifiable health information. Among other things, HITECH makes HIPAA's privacy and security standards directly applicable to "business associates," defined as independent contractors or agents of covered entities that create, receive, maintain or transmit protected health information in connection with providing a service for or 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. Penalties include up to \$55,910 per violation (with a maximum fine of \$1,677,299 per per violation category per year) (adjusted for inflation) and ten years in prison.

We may also be subject to federal transparency laws, including the federal Physician Payment Sunshine Act, which was part of the ACA and requires manufacturers of certain drugs and biologics, among others, to track and disclose payments and other transfers of value they make to U.S. physicians and teaching hospitals, as well as physician ownership and investment interests in the manufacturer. This information is subsequently made publicly available in a searchable format on a CMS website. Failure to disclose required information may result in civil monetary penalties of up to an aggregate of \$165,786 per year (or up to an aggregate of \$1,105,241 per year for "knowing failures") (adjusted for inflation), for all payments, transfers of value or ownership or investment interests that are not timely, accurately and completely reported in an annual submission. Certain states also mandate implementation of compliance programs, impose restrictions on drug manufacturer marketing practices and/or require the tracking and reporting of gifts, compensation and other remuneration to physicians and/or other healthcare providers.

Finally, as noted above, analogous state laws and regulations, such as, state anti-kickback and false claims laws may apply to sales or marketing arrangements and claims involving healthcare items or services reimbursed by non-governmental third-party payors, including private insurers. 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 in addition to requiring drug manufacturers to report information related to payments to physicians and other healthcare providers or marketing expenditures. Similarly, many states also have laws governing the privacy and security of health information in certain circumstances, many of which differ from each other in significant ways and often are not preempted by HIPAA, thus complicating compliance efforts.

Environment

Our third party manufacturers are subject to inspections by the FDA for compliance with cGMP and other U.S. regulatory requirements, including U.S. federal, state and local regulations regarding environmental protection and hazardous and controlled substance controls, among others. Environmental laws and regulations are complex, change frequently and have tended to become more stringent over time. We have incurred, and may continue to incur, significant expenditures to ensure we are in compliance with these laws and regulations. We would be subject to significant penalties for failure to comply with these laws and regulations.

Sales and Marketing

Our current focus is on the development of our existing portfolio, the initiation and completion of clinical trials and, if and where appropriate, the registration of our therapeutic candidates. We currently do not have marketing, sales and distribution capabilities. If we receive marketing and commercialization approval for any of our therapeutic candidates, we intend to market the product through strategic alliances and distribution agreements with third parties. The ultimate implementation of our strategy for realizing the financial value of our therapeutic candidates is dependent on the results of clinical trials for our therapeutic candidates, the availability of funds and the ability to negotiate acceptable commercial terms with third parties.

Employees

As of December 31, 2017, we have 23 employees, all of whom are full-time and nine of whom have Ph.D. degrees. Of these employees, 16 are engaged in research and development activities and seven are engaged in finance, legal, human resources, business development and general management. We have no collective bargaining agreement with our employees and we have not experienced any work stoppages. We consider our relations with our employees to be good.

Corporate Information

We were originally incorporated in the State of Delaware on February 6, 2017 under the name “Max-1 Acquisition Corporation.” Prior to the Merger, Max-1 was a “shell” company registered under the Securities Exchange Act of 1934, as amended, or the Exchange Act, with no specific business plan or purpose until it began operating the business of Exicure OpCo through the Merger transaction on September 26, 2017. Exicure OpCo was originally formed as a limited liability company under the name AuraSense Therapeutics, LLC in the State of Delaware in June 2011 and was a clinical-stage biotechnology company developing gene regulatory and immuno-oncology therapeutics based on its proprietary SNA technology. AuraSense Therapeutics, LLC was subsequently converted into AuraSense Therapeutics, Inc., a Delaware corporation, on July 9, 2015, and changed its name on the same date to Exicure, Inc. Immediately after giving effect to the Merger and the initial closing of the Private Placement, the business of Exicure OpCo became our business. Our corporate headquarters are located at 8045 Lamont Avenue, Suite 410, Skokie, IL 60077, and our telephone number is (847) 673-1700.

Available Information

We maintain a website at www.exicuretx.com, to which we regularly post copies of our press releases as well as additional information about us. Our filings with the SEC will be available free of charge through the website as soon as reasonably practicable after being electronically filed with or furnished to the SEC. Information contained in our website is not a part of, nor incorporated by reference into this filing or our other filings with the SEC, and should not be relied upon. You can read our SEC filings, including this Annual Report on Form 10-K, over the Internet at the SEC’s website at <http://www.sec.gov>. You may also read and copy any document we file with the SEC at its public reference facilities at 100 F Street, N.E., Washington, D.C. 20549. You may also obtain copies of these documents at prescribed rates by writing to the Public Reference Section of the SEC at 100 F Street, N.E., Washington, D.C. 20549. Please call the SEC at 1-800-SEC-0330 for further information on the operation of the public reference facilities. You may also request a copy of these

filings, at no cost, by writing or telephoning us at: 8045 Lamon Avenue, Suite 410, Skokie, IL 60077, (847) 673-1700.

Item 1A. Risk Factors.

We are providing the following cautionary discussion of risk factors, uncertainties and assumptions that we believe are relevant to our business. These are factors that, individually or in the aggregate, we think could cause our actual results to differ materially from expected and historical results and our forward-looking statements. We note these factors for investors as permitted by Section 21E of the Exchange Act and Section 27A of the Securities Act. You should understand that it is not possible to predict or identify all such factors. Consequently, you should not consider this section to be a complete discussion of all potential risks or uncertainties that may substantially impact our business. Moreover, we operate in a competitive and rapidly changing environment. New factors emerge from time to time and it is not possible to predict the impact of all of these factors on our business, financial condition or results of operations.

Risks Related to Our Business

We are a clinical-stage biotechnology company with a history of losses. We expect to continue to incur significant losses for the foreseeable future and may never achieve or maintain profitability, which could result in a decline in the market value of our common stock.

We are a biotechnology company developing gene regulatory and immuno-oncology therapeutics based on our proprietary SNA technology. We have a limited operating history. Since our inception in June 2011, we have devoted our resources to the development of SNA technology. We have had significant operating losses since our inception. As of December 31, 2017 and as of December 31, 2016, we have generated an accumulated deficit of \$53.5 million and \$41.4 million, respectively. For the years ended December 31, 2017 and 2016, our net loss was \$12.0 million and \$16.9 million, respectively. Substantially all of our losses have resulted from expenses incurred in connection with our research programs and from general and administrative costs associated with our operations. Our technology and therapeutic candidates are in early stages of development, and we are subject to the risks of failure inherent in the development of therapeutic candidates based on novel technologies.

We have not generated, and do not expect to generate, any product revenue for the foreseeable future, and we expect to continue to incur significant operating losses for the foreseeable future due to the cost of research and development, preclinical studies, clinical trials, and the regulatory approval process for therapeutic candidates. The amount of future losses is uncertain. Our ability to achieve profitability, if ever, will depend on, among other things, us, or any current or future collaborators, successfully developing therapeutic candidates, obtaining regulatory approvals to market and commercialize therapeutic candidates, manufacturing any approved products on commercially reasonable terms, establishing a sales and marketing organization or suitable third party alternatives for any approved product and raising sufficient funds to finance business activities. If we, or any current or future collaborators, are unable to develop and commercialize one or more of our therapeutic candidates or if sales revenue from any therapeutic candidate that receives approval is insufficient, we will not achieve profitability, which could have a material adverse effect on our business, financial condition, results of operations and prospects.

Our approach to the discovery and development of innovative therapeutic treatments based on our technology is unproven and may not result in marketable products.

We plan to develop a pipeline of therapeutic candidates using our proprietary SNAs as therapeutic agents. We believe that therapeutic candidates identified with our therapeutic discovery technology may offer an improved therapeutic approach to small molecules and antibodies, as well as several advantages over linear oligonucleotide-based therapeutics. However, the scientific research that forms the basis of our efforts to develop therapeutic candidates based on our SNAs and the identification and optimization of SNAs is relatively new. Further, the scientific evidence to support the feasibility of developing therapeutic treatments based on SNAs is both preliminary and limited.

Therapeutic candidates based on SNA technology have not been extensively tested in humans, and a number of clinical trials conducted by other companies using oligonucleotide technologies have not been successful. We may discover that the SNAs do not possess certain properties required for therapeutic treatment to be effective, such as the ability to remain stable in the human body for the period of time required for the therapeutic candidate to reach the target tissue or the ability to cross the cell membrane and enter into cells within the target tissue for effective delivery. We currently have only limited data, and no conclusive evidence, to suggest that we can introduce these

necessary drug-like properties into SNAs. We may spend substantial funds attempting to introduce these properties and may never succeed in doing so. In addition, therapeutic candidates based on SNAs may demonstrate different chemical and pharmacological properties in patients than they do in laboratory studies. Even if therapeutic candidates have successful results in animal studies, they may not demonstrate the same chemical and pharmacological properties in humans and may interact with human biological systems in unforeseen, ineffective or harmful ways. As a result, we may never succeed in developing a marketable therapeutic, we may not become profitable and the value of our common stock will decline.

Further, the U.S. Food and Drug Administration, or the FDA, has limited experience with SNA-based therapeutics. No regulatory authority has granted approval to any person or entity, including us, to market and commercialize therapeutics using SNAs, which may increase the complexity, uncertainty and length of the regulatory approval process for our therapeutic candidates. We and any current or future collaborators may never receive approval to market and commercialize any therapeutic candidate. Even if we or a future collaborator obtain regulatory approval, the approval may be for disease indications or patient populations that are not as broad as we intended or desired or may require labeling that includes significant use or distribution restrictions or safety warnings. We or a future collaborator may be required to perform additional or unanticipated clinical trials to obtain approval or be subject to post-marketing testing requirements to maintain regulatory approval. If our SNA technology proves to be ineffective, unsafe or commercially unviable, our technology and pipeline would have little, if any, value, which could have a material adverse effect on our business, financial condition, results of operations and prospects.

Our therapeutic candidates are in early stages of development and may fail in development or suffer delays that materially and adversely affect their commercial viability.

We have no therapeutics on the market and all of our therapeutic candidates are in early stages of development. Our ability to achieve and sustain profitability depends on obtaining regulatory approvals, including an institutional review board, or IRB, approval to conduct clinical trials at particular sites for, and successfully commercializing, our therapeutic candidates, either alone or with third parties. Before obtaining regulatory approval for the commercial distribution of our therapeutic candidates, we or an existing or a future collaborator must conduct extensive preclinical studies and clinical trials to demonstrate the safety and efficacy in humans of our therapeutic candidates. Preclinical studies and clinical trials are expensive, difficult to design and implement, can take many years to complete and are uncertain as to outcome. The start or end of a clinical trial is often delayed or halted due to changing regulatory requirements, manufacturing challenges, required clinical trial administrative actions, slower than anticipated patient enrollment, changing standards of care, availability or prevalence of use of a comparative therapeutic or required prior therapy, clinical outcomes or financial constraints. For instance, delays or difficulties in patient enrollment or difficulties in retaining trial participants can result in increased costs, longer development times or termination of a clinical trial. Clinical trials of a new therapeutic candidate require the enrollment of a sufficient number of patients, including patients who are suffering from the disease the therapeutic candidate is intended to treat and who meet other eligibility criteria. Rates of patient enrollment are affected by many factors, including the size of the patient population, the eligibility criteria for the clinical trial, the age and condition of the patients, the stage and severity of disease, the nature of the protocol, the proximity of patients to clinical sites and the availability of effective treatments for the relevant disease.

A therapeutic candidate can unexpectedly fail at any stage of preclinical and clinical development. In our completed Phase 1 trial, AST-005 did not show an antipsoriatic effect. Although we believe this result was due to the short length of this clinical trial, there is no guarantee that AST-005 will show an antipsoriatic effect in future clinical trials of longer duration. The historical failure rate for therapeutic candidates is high due to scientific feasibility, safety, efficacy, changing standards of medical care and other variables. The results from preclinical studies or early clinical trials of a therapeutic candidate may not predict the results that will be obtained in later phase clinical trials of the therapeutic candidate. We, the FDA, an IRB, an independent ethics committee, or other applicable regulatory authorities may suspend clinical trials of a therapeutic candidate at any time for various reasons, including a finding that subjects participating in such trials are being exposed to unreasonable and significant risk of illness or injury. Similarly, an IRB or ethics committee may suspend a clinical trial at a particular trial site. We may not have the financial resources to continue development of, or to enter into collaborations for, a

therapeutic candidate if we experience any problems or other unforeseen events that delay or prevent regulatory approval of, or our ability to commercialize, therapeutic candidates, including:

- negative or inconclusive results from our clinical trials or the clinical trials of others for therapeutic candidates similar to ours, leading to a decision or requirement to conduct additional preclinical testing or clinical trials or abandon a program;
- therapeutic-related side effects experienced by participants in our clinical trials or by individuals using therapeutics similar to our therapeutic candidates;
- delays in submitting INDs or CTAs, or comparable foreign applications or delays or failure in obtaining the necessary approvals from regulators or IRBs to commence a clinical trial, or a suspension or termination of a clinical trial once commenced;
- conditions imposed by the FDA or comparable foreign authorities, such as the European Medicines Agency, or EMA, or European Union national competent authorities, regarding the scope or design of our clinical trials;
- delays in enrolling research subjects in clinical trials;
- high drop-out rates of research subjects;
- inadequate supply or quality of therapeutic candidate components or materials or other supplies necessary for the conduct of our clinical trials;
- greater than anticipated clinical trial costs;
- poor effectiveness of our therapeutic candidates during clinical trials;
- unfavorable FDA or other regulatory agency inspection and review of a clinical trial site;
- failure of our third party contractors or investigators to comply with regulatory requirements or otherwise meet their contractual obligations in a timely manner, or at all;
- delays and changes in regulatory requirements, policy and guidelines, including the imposition of additional regulatory oversight around clinical testing generally or with respect to our technology in particular, especially in light of the novelty of our therapeutic candidates; or
- varying interpretations of data by the FDA and similar foreign regulatory agencies; or
- refusal of the FDA to accept data from clinical trials conducted outside the United States, or acceptance of these data subject to certain conditions by the FDA.

Product development involves a lengthy and expensive process with an uncertain outcome, and results of earlier preclinical studies and clinical trials may not be predictive of future clinical trial results.

Clinical testing is expensive and generally takes many years to complete, and the outcome is inherently uncertain. Failure can occur at any time and at any stage during the clinical trial process. The results of preclinical studies and early clinical trials of our therapeutic candidates may not be predictive of the result of any subsequent clinical trials. Therapeutic candidates that have shown promising results in early stage clinical trials may still suffer significant setbacks in subsequent clinical trials. We will have to conduct trials in our proposed indications to verify the results obtained to date and to support any regulatory submissions for further clinical development. A number of companies in the biopharmaceutical industry have suffered significant setbacks in clinical trials due to lack of efficacy or adverse safety profiles despite promising results in earlier clinical trials. Moreover, clinical data is often

susceptible to varying interpretations and analyses. We do not know whether Phase 1, Phase 2, Phase 3, or other clinical trials we may conduct will demonstrate consistent or adequate efficacy and safety with respect to the proposed indication for use sufficient to receive regulatory approval or market our therapeutic candidates. If we experience delays in the completion of, or termination of, any clinical trial of our therapeutic candidates, the commercial prospects of our therapeutic candidates may be harmed, and our ability to generate product revenues from any of these therapeutic candidates will be delayed. In addition, any delays in completing clinical trials will increase our costs, slow down our therapeutic candidate development and approval process and jeopardize our ability to commence product sales and generate revenues. Any of these occurrences could materially and adversely affect our business, financial condition, results of operations or prospects.

We will need substantial additional funds to advance the development of our therapeutic candidates, and we cannot guarantee that we will have sufficient funds available in the future to develop and commercialize our current or future therapeutic candidates.

If our existing therapeutic candidates or our future therapeutic candidates enter and advance through preclinical studies and clinical trials, we will need substantial additional funds to expand our development, regulatory, manufacturing, marketing, and sales capabilities or contract with other organizations to provide these capabilities for us. We have used substantial funds to develop our therapeutic candidates and will require significant funds to conduct further research and development and preclinical studies and clinical trials of our therapeutic candidates, to seek regulatory approvals for our therapeutic candidates and to manufacture and market products, if any, that are approved for commercial sale. As of December 31, 2017 and December 31, 2016, we had \$25.8 million and \$19.6 million in cash and cash equivalents, respectively. Based on our current operating plan, we believe that our available cash and cash equivalents as of December 31, 2017 is sufficient to fund our current operating plans for the next twelve months as of the date of this report. Our future capital requirements and the period for which we expect our existing resources to support our operations may vary significantly from what we expect. Our monthly spending levels vary based on new and ongoing development and corporate activities. Since the length of time and activities associated with successful development of our therapeutic candidates is highly uncertain, we are unable to estimate the actual funds we will require for development and any approved marketing and commercialization activities. To execute our business plan, we will need, among other things:

- to obtain the human and financial resources necessary to develop, test, obtain regulatory approval for, manufacture and market our therapeutic candidates;
- to build and maintain a strong intellectual property portfolio and avoid infringing the intellectual property of third parties;
- to establish and maintain successful licenses, collaborations and alliances;
- to satisfy the requirements of clinical trial protocols, including patient enrollment;
- to establish and demonstrate the clinical efficacy and safety of our therapeutic candidates;
- to obtain regulatory approvals;
- to manage our spending as costs and expenses increase due to preclinical studies and clinical trials, regulatory approvals, and commercialization;
- to obtain additional capital to support and expand our operations; and
- to market our products to achieve acceptance and use by the medical community in general.

If we are unable to obtain funding on a timely basis or on acceptable terms, we may have to delay, reduce or terminate our research and development programs and preclinical studies or clinical trials, if any, limit strategic opportunities or undergo reductions in our workforce or other corporate restructuring activities. We also could be

required to seek funds through arrangements with collaborators or others that may require us to relinquish rights to some of our technology or therapeutic candidates that we would otherwise pursue on our own. We do not expect to realize revenue from product sales, milestone payments or royalties in the foreseeable future, if at all. Our revenue sources are, and will remain, extremely limited unless and until our therapeutic candidates are clinically tested, approved for commercialization and successfully marketed. To date, we have primarily financed our operations through the sale of equity securities, payments received in connection with our research collaboration, license, and option agreement with Purdue or as a primary contractor or as a subcontractor on government grants, and proceeds from our loan agreement with Hercules Technology Growth Capital, or Hercules. We will be required to seek additional funding in the future and intend to do so through either collaborations, public or private equity offerings or debt financings, credit or loan facilities or a combination of one or more of these funding sources. Our ability to raise additional funds will depend on financial, economic and other factors, many of which are beyond our control. Additional funds may not be available to us on acceptable terms or at all. If we raise additional funds by issuing equity securities, our stockholders will suffer dilution and the terms of any financing may adversely affect the rights of our stockholders. In addition, as a condition to providing additional funds to us, future investors may demand, and may be granted, rights superior to those of existing stockholders. Debt financing, if available, may involve restrictive covenants limiting our flexibility in conducting future business activities, and, in the event of insolvency, debt holders would be repaid before holders of equity securities received any distribution of corporate assets.

Our quarterly operating results may fluctuate significantly or may fall below the expectations of investors or securities analysts, each of which may cause our stock price to fluctuate or decline.

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

- variations in the level of expense related to our therapeutic candidates or future development programs;
- results of clinical trials, or the addition or termination of clinical trials or funding support by us, or a future collaborator or licensing partner;
- our execution of any collaboration, licensing or similar arrangement, and the timing of payments we may make or receive under such existing or future arrangements or the termination or modification of any such existing or future arrangements;
- any intellectual property infringement lawsuit or opposition, interference or cancellation proceeding in which we may become involved;
- additions and departures of key personnel;
- strategic decisions by us or our competitors, such as acquisitions, divestitures, spin-offs, joint ventures, strategic investments or changes in business strategy;
- whether or not any of our therapeutic candidates receives regulatory approval, market acceptance and demand for such therapeutic candidates;
- regulatory developments affecting our therapeutic candidates or those of our competitors; and
- changes in general market and economic conditions.

If our quarterly operating results fall below the expectations of investors or securities analysts, the price of our common stock could decline substantially. Furthermore, any quarterly fluctuations in our operating results may, in turn, cause the price of our stock to fluctuate substantially.

We are dependent on Purdue for the successful development of therapeutic candidates in our collaboration arrangement with Purdue.

On December 2, 2016, we entered into a research collaboration, option and license agreement with Purdue. As part of the agreement, Purdue has the option to obtain from us the full worldwide development and commercial rights to AST-005, an option to obtain three additional collaboration targets and a further option to obtain from us the full worldwide development and commercial rights to any therapeutic candidates developed targeting the three additional collaboration targets. Additionally, Purdue has rights of first offer to some potential collaboration targets. These rights of first offer are subject to limitations in time and scope. In connection with the Purdue Collaboration, we received a non-refundable development fee of \$10.0 million. In addition, we are eligible to receive up to \$776.5 million upon successful completion of certain research, regulatory and commercial sales milestones. There can be no assurance these milestones will be achieved as they are subject to highly significant risks and uncertainties, many of which are outside of our control. In the event a therapeutic candidate subject to the collaboration results in commercial sales, we are eligible to receive royalties ranging from the low single digits to a maximum of 10% on future net sales of such commercialized therapeutic candidates.

The success of our collaboration programs with Purdue depends largely upon the efforts of Purdue. Purdue has sole discretion in determining and directing the efforts and resources, including the ability to discontinue all efforts and resources, it applies to the development and, if approval is obtained, commercialization and marketing of the therapeutic candidates covered by the collaboration. Purdue may not be effective in obtaining approvals for the therapeutic candidates developed under the collaboration arrangement or marketing or arranging for necessary supply, manufacturing or distribution relationships for any approved products. Purdue may change its strategic focus or pursue alternative technologies in a manner that results in reduced, delayed or no revenue to us. Purdue has a variety of marketed products, and its own corporate objectives may not be consistent with our best interests. If Purdue fails to develop, obtain regulatory approval for or ultimately commercialize any therapeutic candidate under our collaboration or if Purdue terminates our collaboration, our business, financial condition, results of operations and prospects could be materially and adversely affected. In addition, any dispute or litigation proceedings we may have with Purdue in the future could delay development programs, create uncertainty as to ownership of intellectual property rights, distract management from other business activities and generate substantial expense.

If third parties on which we depend to conduct our preclinical studies and clinical trials do not perform as contractually required, fail to satisfy regulatory or legal requirements, or miss expected deadlines, our development program could be delayed with materially adverse effects on our business, financial condition, results of operations and prospects.

We rely on third party clinical investigators, contract research organizations, or CROs, clinical data management organizations and consultants to design, conduct, supervise and monitor preclinical studies and clinical trials for our therapeutic candidates. Because we rely on third parties and do not have the ability to conduct preclinical studies or clinical trials independently, we have less control over the timing, quality and other aspects of preclinical studies and clinical trials than we would if we conducted them on our own. These investigators, CROs and consultants are not our employees and we have limited control over the amount of time and resources that they dedicate to our programs. These third parties may have contractual relationships with other entities, some of which may be our competitors, which may draw time and resources away from our programs. The third parties with which we contract might not be diligent, careful or timely in conducting our preclinical studies or clinical trials, resulting in the preclinical studies or clinical trials being delayed or unsuccessful.

If we cannot contract with acceptable third parties on commercially reasonable terms, or at all, or if these third parties do not carry out their contractual duties, satisfy legal and regulatory requirements for the conduct of preclinical studies or clinical trials or meet expected deadlines, our clinical development programs could be delayed and otherwise adversely affected. In all events, we are responsible for ensuring that each of our preclinical studies and clinical trials is conducted in accordance with the general investigational plan and protocols for the trial. The FDA requires preclinical studies to be conducted in accordance with applicable Good Laboratory Practices, or GLPs, and clinical trials to be conducted in accordance with applicable FDA regulations and Good Clinical Practices, or GCPs, including requirements for conducting, recording and reporting the results of preclinical studies and clinical

trials to assure that data and reported results are credible and accurate and that the rights, integrity and confidentiality of clinical trial participants are protected. Our reliance on third parties that we do not control does not relieve us of these responsibilities and requirements. Any adverse development or delay in our preclinical studies or clinical trials could have a material adverse effect on our business, financial condition, results of operations and prospects.

Because we rely on third party manufacturing and supply partners, our supply of research and development, preclinical studies and clinical trial materials may become limited or interrupted or may not be of satisfactory quantity or quality.

We rely on third party partners to manufacture and supply the materials and components for our research and development, preclinical study and clinical trial supplies. We do not own manufacturing facilities or supply sources for such components and materials. Our manufacturing requirements include oligonucleotides and lipids. We procure our nonclinical toxicology and clinical development materials from a single source supplier on a purchase order basis. There can be no assurance that our supply of research and development, preclinical study and clinical trial therapeutic candidates and other materials will not be limited, interrupted, restricted in certain geographic regions or of satisfactory quality or continue to be available at acceptable prices. In particular, any replacement of our drug product manufacturers could require significant effort and expertise because there may be a limited number of qualified replacements.

The manufacturing process for a therapeutic candidate is subject to oversight by the FDA and foreign regulatory authorities. Suppliers and manufacturers must meet applicable manufacturing requirements and undergo rigorous facility and process validation tests required by regulatory authorities in order to comply with regulatory requirements, such as current Good Manufacturing Practices, or cGMPs. In the event that any of our suppliers or manufacturers fails to comply with such requirements or to perform its obligations to us in relation to quality, timing or otherwise, or if our supply of components or other materials becomes limited or interrupted for other reasons, we may be forced to manufacture the materials ourselves, for which we currently do not have the capabilities or resources, or enter into an agreement with another third party, which we may not be able to do on reasonable terms, if at all. In some cases, the technical skills or technology required to manufacture our therapeutic candidates may be unique or proprietary to the original manufacturer and we may have difficulty, or there may be contractual restrictions prohibiting us from, transferring such skills or technology to another third party and a feasible alternative may not exist. These factors would increase our reliance on such manufacturer or require us to obtain a license from such manufacturer in order to have another third party manufacture our therapeutic candidates. If we are required to change manufacturers for any reason, we will be required to verify that the new manufacturer maintains facilities and procedures that comply with quality standards and with all applicable regulations. The delays associated with the verification of a new manufacturer could negatively affect our ability to develop therapeutic candidates in a timely manner or within budget.

We expect to continue to rely on third party manufacturers if we receive regulatory approval for any therapeutic candidate. To the extent that we have existing, or enter into future, manufacturing arrangements with third parties, we will depend on these third parties to perform their obligations in a timely manner consistent with contractual and regulatory requirements, including those related to quality control and assurance. If we are unable to obtain or maintain third party manufacturing for therapeutic candidates, or to do so on commercially reasonable terms, we may not be able to develop and commercialize our therapeutic candidates successfully. Our or a third party's failure to execute on our manufacturing requirements and comply with cGMP could adversely affect our business in a number of ways, including:

- an inability to initiate or continue preclinical studies or clinical trials of our therapeutic candidates under development;
- delay in submitting regulatory applications, or receiving regulatory approvals, for therapeutic candidates;
- loss of the cooperation of a future collaborator;

- subjecting manufacturing facilities of our therapeutic candidates to additional inspections by regulatory authorities;
- requirements to cease distribution or to recall batches of our therapeutic candidates; and
- in the event of approval to market and commercialize a therapeutic candidate, an inability to meet commercial demands for our therapeutics.

We may not successfully engage in strategic transactions, including any collaborations we seek, which could adversely affect our ability to develop and commercialize therapeutic candidates, impact our cash position, increase our expense, and present significant distractions to our management.

From time to time, we may consider strategic transactions, such as collaborations, acquisitions of companies, asset purchases and out- or in-licensing of therapeutic candidates or technologies. In particular, we will evaluate and, if strategically attractive, seek to enter into collaborations, including with major biotechnology or pharmaceutical companies. The competition for collaborators is intense, and the negotiation process is time-consuming and complex. Any new collaboration may be on terms that are not optimal for us, and we may be unable to maintain any new collaboration if, for example, development or approval of a therapeutic candidate is delayed, sales of an approved therapeutic candidate do not meet expectations or the collaborator terminates the collaboration. Any such collaboration, or other strategic transaction, may require us to incur non-recurring or other charges, increase our near- and long-term expenditures and pose significant integration or implementation challenges or disrupt our management or business. These transactions would entail numerous operational and financial risks, including exposure to unknown liabilities, disruption of our business and diversion of our management's time and attention in order to manage a collaboration or develop acquired therapeutics, therapeutic candidates or technologies, incurrence of substantial debt or dilutive issuances of equity securities to pay transaction consideration or costs, higher than expected collaboration, acquisition or integration costs, write-downs of assets or goodwill or impairment charges, increased amortization expenses, difficulty and cost in facilitating the collaboration or combining the operations and personnel of any acquired business, impairment of relationships with key suppliers, manufacturers or customers of any acquired business due to changes in management and ownership and the inability to retain key employees of any acquired business. Accordingly, although there can be no assurance that we will undertake or successfully complete any transactions of the nature described above, any transactions that we do complete may be subject to the foregoing or other risks and may have a material adverse effect on our business, results of operations, financial condition and prospects. Conversely, any failure to enter into any collaboration or other strategic transaction that would be beneficial to us could delay the development and potential commercialization of our therapeutic candidates and have a negative impact on the competitiveness of any therapeutic candidate that reaches market.

We face competition from entities that have developed or may develop therapeutic candidates for our target disease indications, including companies developing novel treatments and technology platforms based on modalities and technology similar to ours. If these companies develop technologies, including delivery technologies, or therapeutic candidates more rapidly than we do or their technologies are more effective, our ability to develop and successfully commercialize therapeutic candidates may be adversely affected.

The development and commercialization of therapeutic candidates is highly competitive. We compete with a number of multinational pharmaceutical companies and specialized biotechnology companies, as well as technology being developed at universities and other research institutions. Our competitors have developed, are developing or will develop therapeutic candidates and processes competitive with our therapeutic candidates. Competitive therapeutic treatments include those that have already been approved and accepted by the medical community and any new treatments that enter the market. We believe that a significant number of therapeutics are currently under development, and may become commercially available in the future, for the treatment of conditions for which we may try to develop therapeutic candidates. There is intense and rapidly evolving competition in the biotechnology, pharmaceutical and oligonucleotide therapeutics fields. While we believe that our SNA technology, its associated intellectual property and our scientific and technical know-how give us a competitive advantage in this space, competition from many sources remains. Our competitors include larger and better funded pharmaceutical,

biotechnology and oligonucleotide therapeutics companies. Moreover, we also compete with current and future therapeutics developed at universities and other research institutions.

We are aware of several companies that are developing oligonucleotide delivery platforms and oligonucleotide-based therapeutics. These competitors include Ionis Pharmaceuticals, Inc., Alnylam Pharmaceuticals, Inc., Dicerna Pharmaceuticals, Inc., Arbutus Biopharma Corp., Wave Life Sciences Ltd., Dynavax Technologies Corp., Idera Pharmaceuticals, Inc., Mologen AG, and Checkmate Pharmaceuticals, Inc. These and other competitors compete with us in recruiting scientific and managerial talent, and for funding from pharmaceutical companies.

Our success will partially depend on our ability to develop and protect therapeutics that are safer and more effective than competing therapeutics. Our commercial opportunity and success will be reduced or eliminated if competing therapeutics are safer, more effective, or less expensive than the therapeutics we develop.

If our lead therapeutic candidates are approved for the indications we are currently pursuing, they will compete with a range of therapeutic treatments that are either in development or currently marketed. A number of therapeutics for treating psoriasis and cancers are on the market or in clinical development. For the treatment of psoriasis, marketed therapies range from small molecules like topical steroids to biologics, such as AbbVie Inc.'s adalimumab. In addition, numerous compounds are in clinical development for psoriasis treatment. With respect to immunogenic cancers such as melanoma, the most common treatments are chemotherapeutic compounds, radiation therapy and now immunotherapeutic antibodies such as ipilimumab, atezolizumab and pembrolizumab.

Many of our competitors have significantly greater financial, technical, manufacturing, marketing, sales and supply resources or experience than we do. If we successfully obtain approval for any therapeutic candidate, we will face competition based on many different factors, including the safety and effectiveness of our therapeutics, the ease with which our therapeutics can be administered and the extent to which patients accept relatively new routes of administration, the timing and scope of regulatory approvals for these therapeutics, the availability and cost of manufacturing, marketing and sales capabilities, price, reimbursement coverage and patent position. Competing therapeutics could present superior treatment alternatives, including by being more effective, safer, less expensive or marketed and sold more effectively than any therapeutics we may develop. Competitive therapeutics may make any therapeutics we develop obsolete or noncompetitive before we recover the expense of developing and commercializing our therapeutic candidates. Such competitors could also recruit our employees, which could negatively impact our level of expertise and our ability to execute our business plan.

The market may not be receptive to our therapeutic candidates based on a novel therapeutic modality, and we may not generate any future revenue from the sale or licensing of therapeutic candidates.

Even if approval is obtained for a therapeutic candidate, we may not generate or sustain revenue from sales of the product due to factors such as whether the product can be sold at a competitive cost and otherwise accepted in the market. The therapeutic candidates that we are developing are based on our SNA technology. Market participants with significant influence over acceptance of new treatments, such as physicians and third party payors, may not adopt a treatment based on SNA technology, and we may not be able to convince the medical community and third party payors to accept and use, or to provide favorable reimbursement for, any therapeutic candidates developed by us or any current or future collaborators. Market acceptance of our therapeutic candidates will depend on, among other factors:

- the timing of our receipt of any marketing and commercialization approvals;
- the terms of any approvals and the countries in which approvals are obtained;
- the safety and efficacy of our therapeutic candidates;
- the prevalence and severity of any adverse side effects associated with our therapeutic candidates;
- limitations or warnings contained in any labeling approved by the FDA or other regulatory authority;

- relative convenience and ease of administration of our therapeutic candidates;
- the willingness of patients to accept any new methods of administration;
- the success of our physician education programs;
- the availability of adequate government and third party payor reimbursement;
- the pricing of our products, particularly as compared to alternative treatments; and
- availability of alternative effective treatments for indications our therapeutic candidates are intended to treat and the relative risks, benefits and costs of those treatments.

With our focus on SNAs, these risks may increase to the extent the space becomes more competitive or less favored in the commercial marketplace. Additional risks apply in relation to any disease indications we may pursue which are classified as rare diseases and allow for orphan drug designation by regulatory agencies in major commercial markets, such as the U.S., Europe and Japan. Because of the small patient population for a rare disease, if pricing is not approved or accepted in the market at an appropriate level for an approved product with orphan drug designation, such therapeutic may not generate enough revenue to offset costs of development, manufacturing, marketing and commercialization despite any benefits received from the orphan drug designation, such as market exclusivity, assistance in clinical trial design or a reduction in user fees or tax credits related to development expense. Market size is also a variable in disease indications not classified as rare. Our estimates regarding potential market size for any indication may be materially different from what we discover to exist at the time we commence commercialization, if any, for a therapeutic, which could result in significant changes in our business plan and have a material adverse effect on our business, financial condition, results of operations and prospects.

If a therapeutic candidate that has orphan drug designation subsequently receives the first FDA approval for the indication for which it has such designation, the therapeutic candidate is entitled to orphan product exclusivity, which means that the FDA may not approve any other applications to market the same therapeutic candidate for the same indication, except in very limited circumstances, for seven years. Orphan drug exclusivity, however, could also block the approval of one of our therapeutic candidates for seven years if a competitor obtains approval of the same therapeutic candidate as defined by the FDA or if our therapeutic candidate is determined to be contained within the competitor's therapeutic candidate for the same indication or disease.

As in the U.S., we may apply for designation of a therapeutic candidate as an orphan drug for the treatment of a specific indication in the European Union before the application for marketing authorization is made. Sponsors of orphan drugs in the European Union can enjoy economic and marketing benefits, including up to ten years of market exclusivity for the approved indication. During such period, marketing applications for similar medicinal products will not be accepted, unless certain exceptions apply. In the EU, a "similar medicinal product" is a medicinal product containing a similar active substance or substances as contained in a currently authorized orphan medicinal product, and which is intended for the same therapeutic indication.

Any inability to attract and retain qualified key management and technical personnel would impair our ability to implement our business plan.

Our success largely depends on the continued service of key management and other specialized personnel, including David A. Giljohann, Ph.D., our Chief Executive Officer, David S. Snyder, our Chief Financial Officer, and Ekambar Kandimalla, Ph.D., our Chief Scientific Officer. The loss of one or more members of our management team or other key employees or advisors could delay our research and development programs and materially harm our business, financial condition, results of operations and prospects. The relationships that our key managers have cultivated within our industry make us particularly dependent upon their continued employment with us. We are dependent on the continued service of our technical personnel because of the highly technical nature of our therapeutic candidates and our technology and the specialized nature of the regulatory approval process. Because our management team and key employees are not obligated to provide us with continued service, they could

terminate their employment with us at any time without penalty. We do not maintain key person life insurance policies on any of our management team members or key employees. Our future success will depend in large part on our continued ability to attract and retain highly qualified scientific, technical and management personnel, as well as personnel with expertise in clinical testing, manufacturing, governmental regulation and commercialization. We face competition for personnel from other companies, universities, public and private research institutions, government entities and other organizations.

If our therapeutic candidates advance into clinical trials, we may experience difficulties in managing our growth and expanding our operations.

We have limited experience in therapeutic development and limited experience with clinical trials of therapeutic candidates. As our therapeutic candidates enter and advance through preclinical studies and clinical trials, we will need to expand our development, regulatory and manufacturing capabilities or contract with other organizations to provide these capabilities for us. In the future, we expect to have to manage additional relationships with collaborators or partners, suppliers and other organizations. Our ability to manage our operations and future growth will require us to continue to improve our operational, financial and management controls, reporting systems and procedures. We may not be able to implement improvements to our management information and control systems in an efficient or timely manner and may discover deficiencies in existing systems and controls.

If any of our therapeutic candidates are approved for marketing and commercialization and we are unable to develop sales, marketing and distribution capabilities on our own or enter into agreements with third parties to perform these functions on acceptable terms, we will be unable to successfully commercialize any such future therapeutics.

We currently have no sales, marketing or distribution capabilities or experience. If any of our therapeutic candidates is approved, we will need to develop internal sales, marketing and distribution capabilities to commercialize such therapeutics, which would be expensive and time-consuming, or enter into collaborations with third parties to perform these services. If we decide to market our approved therapeutics directly, we will need to commit significant financial and managerial resources to develop a marketing and sales force with technical expertise and supporting distribution, administration and compliance capabilities. If we rely on third parties with such capabilities to market our approved therapeutics or decide to co-promote therapeutics with collaborators, we will need to establish and maintain marketing and distribution arrangements with third parties, and there can be no assurance that we will be able to enter into such arrangements on acceptable terms or at all. In entering into third party marketing or distribution arrangements, any revenue we receive will depend upon the efforts of the third parties and there can be no assurance that such third parties will establish adequate sales and distribution capabilities or be successful in gaining market acceptance of any approved therapeutic. If we are not successful in commercializing any therapeutic approved in the future, either on our own or through third parties, our business, financial condition, results of operations and prospects could be materially and adversely affected.

If we fail to comply with U.S. or foreign regulatory requirements, regulatory authorities could withhold marketing or commercialization approvals, limit or withdraw any marketing or commercialization approvals we may receive and subject us to other penalties that could materially harm our business.

We and our therapeutic candidates, as well as our suppliers, contract manufacturers, distributors, and contract testing laboratories are subject to extensive regulation by governmental authorities in the European Union, the U.S., and other countries, with the regulations differing from country to country.

If we or current or future collaborators, manufacturers or service providers fail to comply with applicable requirements, these regulatory authorities could refuse to issue necessary approvals for marketing and commercialization. Even if we receive marketing and commercialization approval of a therapeutic candidate, we and our third party service providers will be subject to continuing regulatory requirements, including a broad array of regulations related to establishment, registration and product listing, manufacturing processes, risk management measures, quality and pharmacovigilance systems, pre- and post-approval clinical data, labeling, advertising and promotional activities for such therapeutic, record keeping, distribution, and import and export of therapeutics for

any therapeutic for which we obtain marketing approval. We are required to submit safety and other post market information and reports and are subject to continuing regulatory review, including in relation to adverse patient experiences with the therapeutic and clinical results that are reported after a therapeutic is made commercially available, both in the U.S. and any foreign jurisdiction in which we seek regulatory approval. The FDA and certain foreign regulatory authorities, such as the EMA, have significant post-market authority, including the authority to require labeling changes based on new safety information and to require post-market studies or clinical trials to evaluate safety risks related to the use of a therapeutic or to require withdrawal of the therapeutic from the market. The FDA also has the authority to require a Risk Evaluation and Mitigation Strategies, or REMS, plan either before or after approval, which may impose further requirements or restrictions on the distribution or use of an approved therapeutic. The EMA now routinely requires risk management plans, or RMPs, as part of the marketing authorization application process, and such plans must be continually modified and updated throughout the lifetime of the product as new information becomes available. In addition, for nationally authorized medicinal products, the relevant governmental authority of any European Union member state can request an RMP whenever there is a concern about the risk/benefit balance of the product.

The manufacturer and manufacturing facilities we use to make a future therapeutic, if any, will also be subject to periodic review and inspection by the FDA and other regulatory agencies, including for continued compliance with cGMP requirements. The discovery of any new or previously unknown problems with our third party manufacturers, manufacturing processes or facilities may result in restrictions on the therapeutic, manufacturer or facility, including withdrawal of the therapeutic from the market. If we rely on third party manufacturers, we will not have control over compliance with applicable rules and regulations by such manufacturers. Any product promotion and advertising will also be subject to regulatory requirements and continuing regulatory review. If we or our future collaborators, manufacturers or service providers fail to comply with applicable continuing regulatory requirements in the U.S. or foreign jurisdictions in which we seek to market our therapeutics, we or they may be subject to, among other things, fines, warning and untitled letters, clinical holds, delay or refusal by the FDA or foreign regulatory authorities to approve pending applications or supplements to approved applications, suspension, refusal to renew or withdrawal of regulatory approval, recalls, seizures or administrative detention of products, refusal to permit the import or export of therapeutics, operating restrictions, inability to participate in government programs including Medicare and Medicaid, and total or partial suspension of production or distribution, injunction, restitution, disgorgement, debarment, civil and criminal penalties and criminal prosecution.

Price controls imposed in foreign markets may adversely affect our future profitability.

In some countries, particularly member states of the European Union, the pricing of prescription drugs is subject to governmental control at the national level, and in some cases also at the regional level. In these countries, pricing negotiations with governmental authorities can take considerable time after receipt of marketing approval for a therapeutic. In addition, there can be considerable pressure by governments and other stakeholders on prices and reimbursement levels, including as part of cost containment measures. Political, economic and regulatory developments may further complicate pricing and reimbursement negotiations, and pricing negotiations may continue after reimbursement has been obtained. Reference pricing used by various European Union member states and parallel distribution, or arbitrage between low-priced and high-priced member states, can further reduce prices. In some countries, we or current or future collaborators may be required to conduct a clinical trial or other studies that compare the cost-effectiveness of our SNA therapeutic candidates to other available therapies in order to obtain or maintain reimbursement or pricing approval. Publication of discounts by third party payors or authorities may lead to further pressure on the prices or reimbursement levels within the country of publication and other countries. If reimbursement of any therapeutic candidate approved for marketing is unavailable or limited in scope or amount, or if pricing is set at unsatisfactory levels, our business, financial condition, results of operations or prospects could be adversely affected.

Our business entails a significant risk of product liability and our inability to obtain sufficient insurance coverage could have a material adverse effect on our business, financial condition, results of operations or prospects.

Our business exposes us to significant product liability risks inherent in the development, testing, manufacturing and marketing of therapeutic treatments. Product liability claims could delay or prevent completion of our development programs. If we succeed in marketing therapeutics, such claims could result in an investigation by certain regulatory authorities, such as the FDA or foreign regulatory authorities, of the safety and effectiveness of our therapeutics, our manufacturing processes and facilities or our marketing programs and potentially a recall of our therapeutics or more serious enforcement action, limitations on the approved indications for which they may be used or suspension or withdrawal of approvals. Regardless of the merits or eventual outcome, liability claims may also result in decreased demand for our therapeutics, injury to our reputation, costs to defend the related litigation, a diversion of management's time and our resources, substantial monetary awards to trial participants or patients and a decline in our stock price. We currently have product liability insurance that we believe is appropriate for our stage of development and may need to obtain higher levels of product liability insurance prior to marketing any of our therapeutic candidates. Any insurance we have or may obtain may not provide sufficient coverage against potential liabilities. Furthermore, clinical trial and product liability insurance is becoming increasingly expensive. As a result, we may be unable to obtain sufficient insurance at a reasonable cost to protect us against losses caused by product liability claims that could have a material adverse effect on our business.

Our employees may engage in misconduct or other improper activities, including noncompliance with regulatory standards and requirements which could have an adverse effect on our business.

We are exposed to the risk of employee fraud or other misconduct. Misconduct by employees could include, but is not limited to, intentional failures to comply with FDA regulations, applicable laws, regulations, guidance or codes of conduct set by foreign governmental authorities or self-regulatory industry organizations, or provide accurate information to any governmental authorities, such as the FDA, comply with manufacturing standards we may establish, comply with federal and state healthcare fraud and abuse laws and regulations, report financial information or data accurately or disclose unauthorized activities to us.

In particular, sales, marketing and business arrangements in the healthcare industry are subject to extensive laws, regulations, guidance and codes of conduct intended to prevent fraud, kickbacks, self-dealing and other abusive practices. These laws, regulations, guidance and codes of conduct may restrict or prohibit a wide range of pricing, discounting, marketing and promotion, sales commission, customer incentive programs and other business arrangements.

Employee misconduct could also involve the improper use of information obtained in the course of clinical trials, which could result in regulatory sanctions, including debarment or disqualification of those employees from participation in FDA-regulated activities, and serious harm to our reputation. This could include violations of the U.S. federal Health Insurance Portability and Accountability Act of 1996, or HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act, or HITECH, other U.S. federal and state law, and requirements of non-U.S. jurisdictions, including the European Union Data Protection Directive.

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, regulations, guidance or codes of conduct. If any such actions are instituted against us, and we are not successful in defending ourselves or asserting our rights, those actions could have a significant impact on our business, including the imposition of significant fines or other sanctions.

Compliance with governmental regulations regarding the treatment of animals used in research could increase our operating costs, which would adversely affect the commercialization of our technology.

The Animal Welfare Act, or AWA, is the federal law that covers the treatment of certain animals used in research. Currently, the AWA imposes a wide variety of specific regulations that govern the humane handling, care, treatment and transportation of certain animals by producers and users of research animals, most notably relating to personnel, facilities, sanitation, cage size, and feeding, watering and shipping conditions. Third parties with whom we contract are subject to registration, inspections and reporting requirements under the AWA. Furthermore, some states have their own regulations, including general anti-cruelty legislation, which establish certain standards in handling animals. Comparable rules, regulations, and or obligations exist in many foreign jurisdictions. If we or our contractors fail to comply with regulations concerning the treatment of animals used in research, we may be subject to fines and penalties and adverse publicity, and our operations could be adversely affected.

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

Despite the implementation of security measures, our internal computer systems and those of our CROs and other contractors and consultants are vulnerable to damage from computer viruses, unauthorized access, natural disasters, terrorism, war and telecommunication and electrical failures. Such events could cause interruptions of our operations. For instance, the loss of preclinical study or clinical trial data involving our therapeutic candidates could result in delays in our development and regulatory filing efforts and significantly increase our costs. In addition, theft or other exposure of data may interfere with our ability to protect our intellectual property, trade secrets, and other information critical to our operations. We can provide no assurances that certain sensitive and proprietary information relating to one or more of our therapeutic candidates has not been, or will not in the future be, compromised. Although we have invested resources to enhance the security of our computer systems, there can be no assurances we will not experience additional unauthorized intrusions into our computer systems, or those of our CROs and other contractors and consultants, that we will successfully detect future unauthorized intrusions in a timely manner, or that future unauthorized intrusions will not result in material adverse effects on our financial condition, reputation, or business prospects. Payments related to the elimination of ransomware may materially affect our financial condition and results of operations.

Certain data breaches must also be reported to affected individuals and the government, and in some cases to the media, under provisions of HIPAA, as amended by HITECH, other U.S. federal and state law, and requirements of non-U.S. jurisdictions, including the European Union Data Protection Directive, and financial penalties may also apply.

To the extent that any disruption or security breach were to result in a loss of, or damage to, our data, or inappropriate disclosure of confidential or proprietary information, we could incur liability and the development of our therapeutic candidates could be delayed.

If we do not comply with laws regulating the protection of the environment and health and human safety, our business could be adversely affected.

Our research, development and manufacturing involve the use of hazardous materials and various chemicals. We maintain quantities of various flammable and toxic chemicals in our facilities in Skokie, Illinois that are required for our research, development and manufacturing activities. We are subject to federal, state and local laws and regulations governing the use, manufacture, storage, handling and disposal of these hazardous materials. We believe our procedures for storing, handling and disposing these materials in our Skokie facilities comply with the relevant guidelines of Skokie, the state of Illinois, and the Occupational Safety and Health Administration of the U.S. Department of Labor. Although we believe that our safety procedures for handling and disposing of these materials comply with the standards mandated by applicable regulations, the risk of accidental contamination or injury from these materials cannot be eliminated. If an accident occurs, we could be held liable for resulting damages, which could be substantial. We are also subject to numerous environmental, health and workplace safety laws and regulations, including those governing laboratory procedures, exposure to blood-borne pathogens and the handling

of animals and biohazardous materials. Although we maintain workers' compensation insurance to cover us for costs and expenses we may incur due to injuries to our employees resulting from the use of these materials, this insurance may not provide adequate coverage against potential liabilities. We do not maintain insurance for environmental liability or toxic tort claims that may be asserted against us in connection with our storage or disposal of biological or hazardous materials. Additional federal, state and local laws and regulations affecting our operations may be adopted in the future. We may incur substantial costs to comply with, and substantial fines or penalties if we violate, any of these laws or regulations.

Our information technology systems could face serious disruptions that could adversely affect our business.

Our information technology and other internal infrastructure systems, including corporate firewalls, servers, leased lines and connection to the Internet, face the risk of systemic failure that could disrupt our operations. A significant disruption in the availability of our information technology and other internal infrastructure systems could cause interruptions and delays in our research and development work.

Our current operations are concentrated in one location and any events affecting this location may have material adverse consequences.

Our current operations are located in our facilities situated in Skokie, Illinois. Any unplanned event, such as flood, fire, explosion, earthquake, extreme weather condition, medical epidemics, power shortage, telecommunication failure or other natural or man-made accidents or incidents that result in us being unable to fully utilize the facilities, may have a material adverse effect on our ability to operate our business, particularly on a daily basis, and have significant negative consequences on our financial and operating conditions. Loss of access to these facilities may result in increased costs, delays in the development of our therapeutic candidates or interruption of our business operations. As part of our risk management policy, we maintain insurance coverage at levels that we believe are appropriate for our business. However, in the event of an accident or incident at these facilities, we cannot assure you that the amounts of insurance will be sufficient to satisfy any damages and losses. If our facilities are unable to operate because of an accident or incident or for any other reason, even for a short period of time, any or all of our research and development programs may be harmed. Any business interruption may have a material adverse effect on our business, financial position, results of operations and prospects.

The investment of our cash, cash equivalents and fixed income marketable securities is subject to risks which may cause losses and affect the liquidity of these investments.

As of December 31, 2017 and as of December 31, 2016, we had \$25.8 million and \$19.6 million in cash and cash equivalents, respectively. We historically have invested excess cash in certificates of deposit or money market mutual funds that invest exclusively in U.S. government or U.S. government agency securities. These investments are subject to general credit, liquidity, market and interest rate risks, including potential future impacts similar to the impact of U.S. sub-prime mortgage defaults that have affected various sectors of the financial markets and caused credit and liquidity issues. We may realize losses in the fair value of these investments, an inability to access cash in these investments for a potentially meaningful period, or a complete loss of these investments, which would have a negative effect on our financial statements.

In addition, should our investments cease paying or reduce the amount of interest paid to us, our interest income would suffer. The market risks associated with our investment portfolio may have an adverse effect on our results of operations, liquidity and financial condition.

Changes in accounting rules and regulations, or interpretations thereof, could result in unfavorable accounting charges or require us to change our compensation policies.

Accounting methods and policies for biotechnology companies, including policies governing revenue recognition, research and development and related expenses, and accounting for stock-based compensation, are subject to review, interpretation and guidance from our auditors and relevant accounting authorities, including the SEC. Changes to accounting methods or policies, or interpretations thereof, may require us to reclassify, restate or

otherwise change or revise our historical financial statements, including those contained in this Annual Report on Form 10-K.

Our business may be affected by litigation and government investigations.

We may from time to time receive inquiries and subpoenas and other types of information requests from government authorities and others and we may become subject to claims and other actions related to our business activities. While the ultimate outcome of investigations, inquiries, information requests and legal proceedings is difficult to predict, defense of litigation claims can be expensive, time-consuming and distracting, and adverse resolutions or settlements of those matters may result in, among other things, modification of our business practices, costs and significant payments, any of which could have a material adverse effect on our business, financial condition, results of operations and prospects.

Risks Related to Intellectual Property

If we are not able to obtain and enforce patent protection for our technology or therapeutic candidates, development and commercialization of our therapeutic candidates may be adversely affected.

Our success depends in part on our ability to obtain and maintain patents and other forms of intellectual property rights, including in-licenses of intellectual property rights of others, for our therapeutic candidates, methods used to manufacture our therapeutic candidates and methods for treating patients using our therapeutic candidates, as well as our ability to preserve our trade secrets, to prevent third parties from infringing upon our proprietary rights and to operate without infringing upon the proprietary rights of others. As of December 31, 2017, our patent portfolio consists of over 55 issued patents and allowed patent applications and over 135 pending patent applications. We may not be able to apply for patents on certain aspects of our therapeutic candidates in a timely fashion or at all. Our existing issued and granted patents and any future patents we obtain may not be sufficiently broad to prevent others from using our technology or from developing competing therapeutics and technology. There is no guarantee that any of our pending patent applications will result in issued or granted patents, that any of our issued or granted patents will not later be found to be invalid or unenforceable or that any issued or granted patents will include claims that are sufficiently broad to cover our therapeutic candidates or to provide meaningful protection from our competitors. Moreover, the patent position of pharmaceutical and biotechnology companies can be highly uncertain because it involves complex legal and factual questions. We will be able to protect our proprietary rights from unauthorized use by third parties only to the extent that our current and future proprietary technology and therapeutic candidates are covered by valid and enforceable patents or are effectively maintained as trade secrets. If third parties disclose or misappropriate our proprietary rights, it may materially and adversely impact our position in the market.

The U.S. Patent and Trademark Office, or USPTO, and various foreign governmental patent agencies require compliance with a number of procedural, documentary, fee payment and other provisions during the patent process. There are situations in which noncompliance can result in abandonment or lapse of a patent or patent application, resulting in partial or complete loss of patent rights in the relevant jurisdiction. In such an event, competitors might be able to enter the market earlier than would otherwise have been the case. The standards applied by the USPTO and foreign patent offices in granting patents are not always applied uniformly or predictably. For example, there is no uniform worldwide policy regarding patentable subject matter or the scope of claims allowable in biotechnology and pharmaceutical patents. As such, we do not know the degree of future protection that we will have on our proprietary therapeutics and technology. While we will endeavor to try to protect our therapeutic candidates with intellectual property rights such as patents, as appropriate, the process of obtaining patents is time-consuming, expensive and sometimes unpredictable.

In addition, there are numerous recent changes to the patent laws and proposed changes to the rules of the USPTO, which may have a significant impact on our ability to protect our technology and enforce our intellectual property rights. For example, the Leahy-Smith America Invents Act enacted in 2011, involves significant changes in patent legislation. The U.S. Supreme Court has ruled on several patent cases in recent years, some of which cases either narrow the scope of patent protection available in certain circumstances or weaken the rights of patent owners

in certain situations. The 2013 decision by the Supreme Court in *Association for Molecular Pathology v. Myriad Genetics, Inc.* precludes a claim to a nucleic acid having a stated nucleotide sequence that is identical to a sequence found in nature and unmodified. We currently are not aware of an immediate impact of this decision on our patents or patent applications because we are developing oligonucleotide therapeutics which contain modifications that we believe are not found in nature. However, this decision has yet to be clearly interpreted by courts and by the USPTO. We cannot assure you that the interpretations of this decision or subsequent rulings will not adversely impact our patents or patent applications. In addition to increasing uncertainty with regard to our ability to obtain patents in the future, this combination of events has created uncertainty with respect to the value of patents, once obtained. Depending on decisions by the U.S. Congress, the federal courts and the USPTO, the laws and regulations governing patents could change in unpredictable ways that may weaken our ability to obtain new patents or to enforce our existing patents and patents that we might obtain in the future.

Once granted, patents may remain open to opposition, interference, re-examination, post-grant review, inter partes review, nullification or derivation action in court or before patent offices or similar proceedings for a given period after allowance or grant, during which time third parties can raise objections against such initial grant. In the course of such proceedings, which may continue for a protracted period of time, the patent owner may be compelled to limit the scope of the allowed or granted claims thus attacked, or may lose the allowed or granted claims altogether. In addition, there can be no assurance that:

- Others will not or may not be able to make, use or sell compounds that are the same as or similar to our therapeutic candidates but that are not covered by the claims of the patents that we own or license.
- We or our licensors, or any current or future collaborators, are the first to make the inventions covered by each of our issued patents and pending patent applications that we own or license.
- We or our licensors, or any current or future collaborators, are the first to file patent applications covering certain aspects of our inventions.
- Others will not independently develop similar or alternative technologies or duplicate any of our technology without infringing our intellectual property rights.
- A third party will not challenge our patents and, if challenged, a court may not hold that our patents are valid, enforceable and infringed.
- Any issued patents that we own or have licensed will provide us with any competitive advantages, or will not be challenged by third parties.
- We will develop additional proprietary technologies that are patentable.
- The patents of others will not have an adverse effect on our business.
- Our competitors will not conduct research and development activities in countries where we lack enforceable patent rights and then use the information learned from such activities to develop competitive therapeutics for sale in our major commercial markets.

We currently license patent rights from Northwestern University and may in the future license patent rights from third party owners or licensees. If Northwestern University or such other owners or licensees do not properly or successfully obtain, maintain or enforce the patents underlying such licenses, or if they retain or license to others any competing rights, our competitive position and business prospects may be adversely affected.

We do, and will continue to, rely on intellectual property rights licensed from third parties to protect our technology. We are a party to a number of licenses that give us rights to third party intellectual property that is necessary or useful for our business. In particular, we have a license from Northwestern University, which provides us the exclusive worldwide right under certain patents and patent applications owned by Northwestern University to

exploit therapeutics and processes using nanoparticles, nanotechnology, microtechnology and nanomaterial-based constructs as therapeutics or accompanying therapeutics as a means of administration. See “—Our Intellectual Property—Northwestern University License Agreements.” We may also license additional third party intellectual property in the future. Our success will depend in part on the ability of our licensors to obtain, maintain and enforce patent protection for our licensed intellectual property, and in particular, for those patents to which we have secured exclusive rights. Our licensors may not successfully prosecute the patent applications licensed to us. Even if patents issue or are granted, our licensors may fail to maintain these patents, may determine not to pursue litigation against other companies that are infringing these patents, or may pursue litigation less aggressively than we would. Further, we may not obtain exclusive rights, which would allow for third parties to develop competing therapeutics. Without protection for, or exclusive rights to, the intellectual property we license, other companies might be able to offer substantially identical therapeutics for sale, which could adversely affect our competitive business position and harm our business prospects. In addition, the U.S. government has certain rights to the inventions covered by the patent rights licensed to us by third parties and Northwestern University, as an academic research and medical center, has reserved the right to practice the patent rights it has licensed to us (i) for research, teaching and/or other educationally related purposes (including the right to distribute materials for such purposes) and (ii) for use in the field of diagnostics (including theradiagnostics) and in any field other than the field of use licensed to us.

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

Oligonucleotide and SNA-based therapeutics are a relatively new scientific field. We have obtained grants and issuances of SNA therapeutic patents and have licensed many of these patents from a third party on an exclusive basis for therapeutics applications. The issued patents and pending patent applications in the U.S. and in key markets around the world that we own or license claim many different methods, compositions and processes relating to the discovery, development, manufacture and commercialization of SNA therapeutics. Specifically, we own and have licensed a portfolio of patents, patent applications and other intellectual property covering SNA compositions of matter as well as their methods of use.

As the field of SNA therapeutics matures, patent applications are being processed by national patent offices around the world. There is uncertainty about which patents will issue, and, if they do, as to when, to whom, and with what claims. In addition, third parties may attempt to invalidate our intellectual property rights. Even if our rights are not directly challenged, disputes could lead to the weakening of our intellectual property rights. Our defense against any attempt by third parties to circumvent or invalidate our intellectual property rights could be costly to us, could require significant time and attention of our management and could have a material adverse effect on our business and our ability to successfully compete.

There are many issued and pending patents that claim aspects of oligonucleotide chemistry and modifications that we may need to apply to our SNA therapeutic candidates. There are also many issued patents that claim targeting genes or portions of genes that may be relevant for SNA therapeutics we wish to develop. Thus, it is possible that one or more organizations will hold patent rights to which we will need a license. If those organizations refuse to grant us a license to such patent rights on reasonable terms, we may not be able to market therapeutics or perform research and development or other activities covered by these patents.

We may be unable to protect our intellectual property rights throughout the world.

Obtaining a valid and enforceable issued or granted patent covering our technology in the U.S. and worldwide can be extremely costly. In jurisdictions where we have not obtained patent protection, competitors may use our technology to develop their own therapeutics and, further, may export otherwise infringing therapeutics to territories where we have patent protection, but where it is more difficult to enforce a patent as compared to the U.S. Competitor therapeutics may compete with our future therapeutics in jurisdictions where we do not have issued or granted patents or where our issued or granted patent claims or other intellectual property rights are not sufficient to prevent competitor activities in these jurisdictions. The legal systems of certain countries, particularly certain developing countries, make it difficult to enforce patents and such countries may not recognize other types of intellectual property protection, particularly that relating to biotechnology and pharmaceuticals. This could make it

difficult for us to prevent the infringement of our patents or marketing of competing therapeutics in violation of our proprietary rights generally in certain 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.

We generally file a provisional patent application first, also known as a priority filing, at the USPTO. An international application under the Patent Cooperation Treaty, or PCT, is usually filed within twelve months after the priority filing. Based on the PCT filing, national and regional patent applications may be filed in the U.S., European Union, Japan, Australia and Canada and, depending on the individual case, also in any or all of, *inter alia*, China, India, South Korea, and Mexico. We have so far not filed for patent protection in all national and regional jurisdictions where such protection may be available. In addition, we may decide to abandon national and regional patent applications before grant. Finally, the grant proceeding of each national or regional patent is an independent proceeding which may lead to situations in which applications might in some jurisdictions be refused by the relevant registration authorities, while granted by others. It is also quite common that depending on the country, various scopes of patent protection may be granted on the same therapeutic candidate or technology.

The laws of some jurisdictions do not protect intellectual property rights to the same extent as the laws in the U.S., and many companies have encountered significant difficulties in protecting and defending such rights in such jurisdictions. If we or our licensors encounter difficulties in protecting, or are otherwise precluded from effectively protecting, the intellectual property rights important for our business in such jurisdictions, the value of these rights may be diminished and we may face additional competition from others in those jurisdictions. Many countries have compulsory licensing laws under which a patent owner may be compelled to grant licenses to third parties. In addition, many countries limit the enforceability of patents against government agencies or government contractors. In these countries, the patent owner may have limited remedies, which could materially diminish the value of such patent. If we or any of our licensors are forced to grant a license to third parties with respect to any patents relevant to our business, our competitive position in the relevant jurisdiction may be impaired and our business and results of operations may be adversely affected.

We or our licensors, or any current or future strategic partners, may become subject to third party claims or litigation alleging infringement of patents or other proprietary rights or seeking to invalidate patents or other proprietary rights, and we may need to resort to litigation to protect or enforce our patents or other proprietary rights, all of which could be costly, time consuming, delay or prevent the development and commercialization of our therapeutic candidates, or put our patents and other proprietary rights at risk.

We or our licensors, or any current or future strategic partners, may be subject to third party claims for infringement or misappropriation of patent or other proprietary rights. We are generally obligated under our license agreements to indemnify and hold harmless our licensors for damages arising from intellectual property infringement by us. If we or our licensors, or any current or future strategic partners, are found to infringe a third party patent or other intellectual property rights, we could be required to pay damages, potentially including treble damages, if we are found to have willfully infringed. In addition, we or our licensors, or any current or future strategic partners, may choose to seek, or be required to seek, a license from a third party, which may not be available on acceptable terms, if at all. Even if a license can be obtained on acceptable terms, the rights may be non-exclusive, which could give our competitors access to the same technology or intellectual property rights licensed to us. If we fail to obtain a required license, we or any current or future collaborator may be unable to effectively market therapeutic candidates based on our technology, which could limit our ability to generate revenue or achieve profitability and possibly prevent us from generating revenue sufficient to sustain our operations. In addition, we may find it necessary to pursue claims or initiate lawsuits to protect or enforce our patent or other intellectual property rights. The cost to us in defending or initiating any litigation or other proceeding relating to patent or other proprietary rights, even if resolved in our favor, could be substantial, and litigation would divert our management's attention. Some of our competitors may be able to sustain the costs of complex patent litigation more effectively than we can because they have substantially greater resources. Uncertainties resulting from the initiation and continuation of patent litigation or other proceedings could delay our research and development efforts and limit our ability to continue our operations.

If we were to initiate legal proceedings against a third party to enforce a patent covering one of our therapeutics or our technology, the defendant could counterclaim that our patent is invalid or unenforceable. In patent litigation in the U.S., defendant counterclaims alleging invalidity or unenforceability are commonplace. Grounds for a validity challenge could be an alleged failure to meet any of several statutory requirements, for example, lack of novelty, obviousness or non-enablement. Grounds for an unenforceability assertion could be an allegation that someone connected with prosecution of the patent withheld relevant information from the USPTO, or made a misleading statement, during prosecution. The outcome following legal assertions of invalidity and unenforceability during patent litigation is unpredictable. With respect to the validity question, for example, we cannot be certain that there is no invalidating prior art, of which we and the patent examiner were unaware during prosecution. If a defendant were to prevail on a legal assertion of invalidity or unenforceability, we would lose at least part, and perhaps all, of the patent protection on one or more of our therapeutics or certain aspects of our technology. Such a loss of patent protection could have a material adverse impact on our business. Patents and other intellectual property rights also will not protect our technology if competitors design around our protected technology without legally infringing our patents or other intellectual property rights.

It is also possible that we have failed to identify relevant third party patents or applications. For example, U.S. applications filed before November 29, 2000 and certain U.S. applications filed after that date that will not be filed outside the U.S. remain confidential until patents issue. Patent applications in the U.S. and elsewhere are published approximately 18 months after the earliest filing for which priority is claimed, with such earliest filing date being commonly referred to as the priority date. Therefore, patent applications covering our therapeutics or technology could have been filed by others without our knowledge. Additionally, pending patent applications which have been published can, subject to certain limitations, be later amended in a manner that could cover our SNA technology, our therapeutics or the use of our therapeutics. Third party intellectual property right holders may also actively bring infringement claims against us. We cannot guarantee that we will be able to successfully settle or otherwise resolve such infringement claims. If we are unable to successfully settle future claims on terms acceptable to us, we may be required to engage in or continue costly, unpredictable and time-consuming litigation and may be prevented from or experience substantial delays in marketing our therapeutics. If we fail in any such dispute, in addition to being forced to pay damages, we may be temporarily or permanently prohibited from commercializing any of our therapeutic candidates that are held to be infringing. We might, if possible, also be forced to redesign therapeutic candidates so that we no longer infringe the third party intellectual property rights. Any of these events, even if we were ultimately to prevail, could require us to divert substantial financial and management resources that we would otherwise be able to devote to our business.

If we fail to comply with our obligations under any license, collaboration or other agreements, we may be required to pay damages and could lose intellectual property rights that are necessary for developing and protecting our therapeutic candidates or we could lose certain rights to grant sublicenses.

Our current licenses impose, and any future licenses we enter into are likely to impose, various development, commercialization, funding, milestone, royalty, diligence, sublicensing, insurance, patent prosecution and enforcement, and other obligations on us. If we breach any of these obligations, or use the intellectual property licensed to us in an unauthorized manner, we may be required to pay damages and the licensor may have the right to terminate the license, which could result in us being unable to develop, manufacture and sell therapeutics that are covered by the licensed technology or could enable a competitor to gain access to the licensed technology. Moreover, our licensors may own or control intellectual property that has not been licensed to us and, as a result, we may be subject to claims, regardless of their merit, that we are infringing or otherwise violating the licensor's rights in such unlicensed intellectual property. In addition, while we cannot currently determine the amount of the royalty obligations we would be required to pay on sales of future therapeutics, if any, the amounts may be significant. The amount of our future royalty obligations will depend on the technology and intellectual property we use in therapeutics that we successfully develop and commercialize, if any. Therefore, even if we successfully develop and commercialize therapeutics, we may be unable to achieve or maintain profitability.

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

In addition to seeking patent protection for certain aspects of our therapeutic candidates, we also consider trade secrets, including confidential and unpatented know-how important to the maintenance of our competitive position. We protect trade secrets and confidential and unpatented know-how, in part, by entering into non-disclosure and confidentiality agreements with parties who have access to such knowledge, such as our employees, corporate collaborators, outside scientific collaborators, CROs, contract manufacturers, consultants, advisors and other third parties. We also enter into confidentiality and invention or patent assignment agreements with our employees and consultants that obligate them to maintain confidentiality and assign their inventions to us. Despite these efforts, any of these parties may breach the agreements and disclose our proprietary information, including our trade secrets, and we may not be able to obtain adequate remedies for such breaches. Enforcing a claim that a party illegally disclosed or misappropriated a trade secret is difficult, expensive and time-consuming, and the outcome is unpredictable. In addition, some courts in the U.S. and certain foreign jurisdictions are less willing or unwilling to protect trade secrets. If any of our trade secrets were to be lawfully obtained or independently developed by a competitor, we would have no right to prevent them from using that technology or information to compete with us. If any of our trade secrets were to be disclosed to or independently developed by a competitor, our competitive position would be harmed.

Under the terms of the Northwestern University license agreements, Northwestern University could publish research findings relating to the patent rights licensed to us by Northwestern University, which could have a material adverse effect on our business.

We are also subject both in the U.S. and outside the U.S. to various regulatory schemes regarding requests for the information we provide to regulatory authorities, which may include, in whole or in part, trade secrets or confidential commercial information. While we are likely to be notified in advance of any disclosure of such information and would likely object to such disclosure, there can be no assurance that our challenge to the request would be successful.

We may be subject to claims that we or our employees or consultants have wrongfully used or disclosed alleged trade secrets of our employees' or consultants' former employers or their clients. These claims may be costly to defend and if we do not successfully do so, we may be required to pay monetary damages and may lose valuable intellectual property rights or personnel.

Many of our employees were previously employed at universities or pharmaceutical or biotechnology companies, including our competitors or potential competitors. Although no claims against us are currently pending, we may be subject to claims that these employees or we have inadvertently or otherwise used or disclosed trade secrets or other proprietary information of their former employers. Litigation may be necessary to defend against these claims. If we fail in defending such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights or personnel. A loss of key research personnel or their work product could hamper our ability to commercialize, or prevent us from commercializing, our therapeutic candidates, which could severely harm our business. Even if we are successful in defending against these claims, litigation could result in substantial costs and be a distraction to management.

If our trademarks and trade names are not adequately protected, then we may not be able to build name recognition in our markets of interest and our business may be adversely affected.

Our trademarks or trade names may be challenged, infringed, circumvented or declared generic or determined to be infringing on other marks. We may not be able to protect our rights to these trademarks and trade names or may be forced to stop using these names, which we need for name recognition by potential partners or customers in our markets of interest. If we are unable to establish name recognition based on our trademarks and trade names, we may not be able to compete effectively and our business may be adversely affected.

Third parties may independently develop similar or superior technology.

There can be no assurance that others will not independently develop, or have not already developed, similar or more advanced technologies than our technology; or that others will not design around, or have not already designed around, aspects of our technology and/or our trade secrets developed therefrom. If third parties develop technology similar or superior to our technology, or they successfully design around our current or future technology, our competitive position, business prospects, and results of operations could be materially and adversely affected.

The intellectual property which we have licensed from Northwestern University was discovered through government funded programs and thus may be subject to federal regulations such as “march-in” rights, certain reporting requirements, and a preference for U.S. industry. Compliance with such regulations may limit our exclusive rights, subject us to expenditure of resources with respect to reporting requirements, and limit our ability to contract with non-U.S. manufacturers.

We have licensed certain intellectual property from Northwestern University pursuant to the Northwestern University license agreements. The Northwestern University license agreements indicate that the rights licensed to us by Northwestern University are subject to the obligations to and the rights of the U.S. government, including those set forth in the Bayh-Dole Act of 1980, or the Bayh-Dole Act. As a result, the U.S. government may have certain rights to intellectual property embodied in our current or future therapeutics based on the licensed Northwestern University intellectual property. These U.S. government rights in certain inventions developed under a government-funded program include a non-exclusive, non-transferable, irrevocable worldwide license to use inventions for any governmental purpose. In addition, the U.S. government has the right to require us to grant exclusive, partially exclusive, or nonexclusive licenses to any of these inventions to a third party if it determines that: (i) adequate steps have not been taken to commercialize the invention; (ii) government action is necessary to meet public health or safety needs; or (iii) government action is necessary to meet requirements for public use under federal regulations, also referred to as “march-in rights.” While the U.S. government has sparingly used, and to the Company’s knowledge never successfully exercised, such march-in rights, any exercise of the march-in rights by the U.S. government could harm our competitive position, business, financial condition, results of operations, and prospects. If the U.S. government exercises such march-in rights, we may receive compensation that is deemed reasonable by the U.S. government in its sole discretion, which may be less than what we might be able to obtain in the open market. Intellectual property generated under a government funded program is also subject to certain reporting requirements, compliance with which may require us to expend substantial resources.

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

Risks Related to Government Regulation

We may be unable to obtain U.S. or foreign regulatory approval and, as a result, unable to commercialize our therapeutic candidates.

Our therapeutic candidates are subject to extensive governmental regulations relating to, among other things, research, testing, development, manufacturing, safety, efficacy, approval, recordkeeping, reporting, labeling, storage, packaging, advertising and promotion, pricing, marketing, sampling, and distribution of therapeutics. Rigorous preclinical testing and clinical trials and an extensive regulatory approval process are required to be successfully completed in the U.S. and in many foreign jurisdictions before a new therapeutic can be marketed. Satisfaction of these and other regulatory requirements is costly, time consuming, uncertain and subject to unanticipated delays. It is possible that none of the therapeutic candidates we may develop will obtain the regulatory approvals necessary for us or any current or future collaborators to begin selling them.

We have very limited experience in conducting and managing the clinical trials necessary to obtain regulatory approvals, including approval by the FDA as well as foreign regulatory authorities, such as the EMA and European Union national competent authorities. The time required to obtain FDA and foreign regulatory approvals is unpredictable but typically takes many years following the commencement of clinical trials, depending upon the type, complexity and novelty of the therapeutic candidate. The standards that the FDA and its foreign counterparts use when regulating us are not always applied predictably or uniformly and can change. Any analysis we perform of data from preclinical and clinical activities is subject to confirmation and interpretation by regulatory authorities, which could delay, limit or prevent regulatory approval. We may also encounter unexpected delays or increased costs due to new government regulations, for example, from future legislation or administrative action, or from changes in the policy of the FDA or foreign regulatory authorities during the period of therapeutic development, clinical trials and regulatory review by the FDA or foreign regulatory authorities. It is impossible to predict whether legislative changes will be enacted, or whether FDA or foreign laws, regulations, guidance or interpretations will be changed, or what the impact of such changes, if any, may be.

Because the therapeutics we are developing may represent a new class of therapeutic, the FDA and its foreign counterparts have not yet established any definitive policies, practices or guidelines in relation to these therapeutics. While we believe the therapeutic candidates that we are currently developing are regulated as new drugs under the Federal Food, Drug, and Cosmetic Act, or the FDCA, the FDA could decide to regulate them or other therapeutics we may develop as biologics under the Public Health Service Act. The lack of policies, practices or guidelines may hinder or slow review by the FDA or foreign regulatory authorities of any regulatory filings that we may submit. Moreover, the FDA may respond to these submissions by defining requirements we may not have anticipated. Such responses could lead to significant delays in the clinical development of our therapeutic candidates. In addition, because there may be therapeutic candidates approved for some of the diseases for which we may seek approval, in order to receive regulatory approval, we may need to demonstrate through clinical trials that the therapeutic candidates we develop to treat these diseases, if any, are not only safe and effective, but safer or more effective than existing products.

Any delay or failure in obtaining required approvals could have a material adverse effect on our ability to generate revenues from the particular therapeutic candidate for which we are seeking approval. Furthermore, any regulatory approval to market a therapeutic may be subject to limitations on the approved uses for which we may market the therapeutic or the labeling or other restrictions. Regulatory authorities also may impose requirements for costly post-marketing studies or clinical trials and surveillance to monitor the safety or efficacy of the therapeutic. In addition, the FDA has the authority to require a REMS plan as part of a NDA or a Biologics License Application, or BLA, or after approval, which may impose further requirements or restrictions on the distribution or use of an approved drug or biologic, such as limiting prescribing to certain physicians or medical centers that have undergone specialized training, limiting treatment to patients who meet certain safe-use criteria and requiring treated patients to enroll in a registry. These limitations and restrictions may limit the size of the market for the therapeutic and affect coverage and reimbursement by third party payors.

We are also subject to numerous foreign regulatory requirements governing, among other things, the conduct of clinical trials, manufacturing and marketing authorization, pricing and third party reimbursement. The foreign regulatory approval process varies among countries and may include all of the risks associated with FDA approval described above as well as risks attributable to the satisfaction of local regulations in foreign jurisdictions. Moreover, the time required to obtain approval may differ from that required to obtain FDA approval. Approval by the FDA does not ensure approval by regulatory authorities outside the U.S. and vice versa.

Certain of our product candidates may require companion diagnostics in certain indications. Failure to successfully develop, validate and obtain regulatory clearance or approval for such tests could harm our product development strategy or prevent us from realizing the full commercial potential of our product candidates.

Certain of our product candidates may require companion diagnostics to identify appropriate patients for those product candidates in certain indications. Companion diagnostics are subject to regulation by the FDA and comparable foreign regulatory authorities as a medical device and may require separate regulatory authorization prior to commercialization. We may rely on third parties for the design, development, testing and manufacturing of

these companion diagnostics, the application for and receipt of any required regulatory authorization, and the commercial supply of these companion diagnostics. If these parties are unable to successfully develop companion diagnostics for these product candidates, or experience delays in doing so, the development of our product candidates may be adversely affected and we may not be able to obtain marketing authorization for these product candidates. Furthermore, our ability to market and sell, as well as the commercial success, of any of our product candidates that require a companion diagnostic will be tied to, and dependent upon, the receipt of required regulatory authorization and the continued ability of such third parties to make the companion diagnostic commercially available on reasonable terms in the relevant geographies. Any failure to develop, validate, obtain and maintain marketing authorization for a companion diagnostic and supply such companion diagnostic will harm our business, results of operations and financial condition.

If we or current or future collaborators, manufacturers or service providers fail to comply with healthcare laws and regulations, we or they could be subject to enforcement actions, which could affect our ability to develop, market and sell our therapeutics and may harm our reputation.

Although we do not currently have any products on the market, once we begin commercializing our therapeutic candidates, we will be subject to additional healthcare statutory and regulatory requirements and enforcement by the federal, state and foreign governments of the jurisdictions in which we conduct our business. Healthcare providers, physicians and third-party payors play a primary role in the recommendation and prescription of any therapeutic candidates for which we obtain marketing approval. Our future arrangements with third-party payors and customers may expose us to broadly applicable fraud and abuse and other healthcare laws and regulations that may constrain the business or financial arrangements and relationships through which we market, sell and distribute our therapeutic candidates for which we obtain marketing approval. Restrictions under applicable federal and state healthcare laws and regulations, include the following:

- the U.S. federal Anti-Kickback Statute, which prohibits, among other things, persons from soliciting, receiving, offering or providing remuneration, directly or indirectly, to induce either the referral of an individual for a healthcare item or service, or the purchasing or ordering of an item or service, for which payment may be made, in whole or in part, under a federal healthcare program such as Medicare or Medicaid;
- the U.S. federal False Claims Act, which imposes 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, 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. In addition, the government may assert that a claim including items and services resulting from a violation of the federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the False Claims Act;
- HIPAA includes a fraud and abuse provision referred to as the HIPAA All-Payor Fraud Law, which imposes criminal and civil liability for executing a scheme to defraud any healthcare benefit program, or knowingly and willfully falsifying, concealing or covering up a material fact or making any materially false statement in connection with the delivery of or payment for healthcare benefits, items or services; similar to the federal Anti-Kickback Statute, a person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation;
- HIPAA, as amended by HITECH, and its implementing regulations, which impose obligations on certain covered entity healthcare providers, health plans, and healthcare clearinghouses as well as their business associates that perform certain services involving the use or disclosure of individually identifiable health information, including mandatory contractual terms, with respect to safeguarding the privacy, security, and transmission of individually identifiable health information, and require notification to affected individuals and regulatory authorities of certain breaches of security of individually identifiable health information;
- the federal Physician Payment Sunshine Act and the implementing regulations, also referred to as “Open Payments,” issued under the Patient Protection and Affordable Care Act, as amended by the Health Care

and Education Reconciliation Act, collectively, the ACA, which require that manufacturers of pharmaceutical and biological drugs reimbursable under Medicare, Medicaid, and Children's Health Insurance Programs report to the Department of Health and Human Services all consulting fees, travel reimbursements, research grants, and other payments, transfers of value or gifts made to physicians and teaching hospitals with limited exceptions; and

- analogous state laws and regulations, such as, state anti-kickback and false claims laws potentially applicable to sales or marketing arrangements and claims involving healthcare items or services reimbursed by non-governmental third-party payors, including private insurers; and 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 in addition to requiring drug manufacturers to report information related to payments to physicians and other healthcare providers or marketing expenditures, and state laws governing the privacy and security of health information in certain circumstances, many of which differ from each other in significant ways and often are not preempted by HIPAA, thus complicating compliance efforts.

Ensuring that our future business arrangements with third-parties comply with applicable healthcare laws and regulations could involve substantial costs. If our operations are found to be in violation of any such requirements, we may be subject to penalties, including civil or criminal penalties, monetary damages, the curtailment or restructuring of our operations, or exclusion from participation in government contracting, healthcare reimbursement or other government programs, including Medicare and Medicaid, any of which could adversely affect our financial results. Although effective compliance programs can mitigate the risk of investigation and prosecution for violations of these laws, these risks cannot be entirely eliminated. Any action against us for an alleged or suspected violation could cause us to incur significant legal expenses and could divert our management's attention from the operation of our business, even if our defense is successful. In addition, achieving and sustaining compliance with applicable laws and regulations may be costly to us in terms of money, time and resources.

If we or current or future collaborators, manufacturers or service providers fail to comply with applicable federal, state or foreign laws or regulations, we could be subject to enforcement actions, which could affect our ability to develop, market and sell our therapeutics successfully and could harm our reputation and lead to reduced acceptance of our therapeutics by the market. These enforcement actions include, among others:

- adverse regulatory inspection findings;
- warning or untitled letters;
- voluntary product recalls or public notification or medical product safety alerts to healthcare professionals;
- restrictions on, or prohibitions against, marketing our therapeutics;
- restrictions on, or prohibitions against, importation or exportation of our therapeutics;
- suspension of review or refusal to approve pending applications or supplements to approved applications;
- exclusion from participation in government-funded healthcare programs;
- exclusion from eligibility for the award of government contracts for our therapeutics;
- FDA debarment;
- suspension or withdrawal of therapeutic approvals;
- seizures or administrative detention of therapeutics;

- injunctions; and
- civil and criminal penalties and fines.

Any therapeutics we develop may become subject to unfavorable pricing regulations, third party coverage and reimbursement practices or healthcare reform initiatives, thereby harming our business.

The regulations that govern marketing approvals, pricing and reimbursement for new therapeutics vary widely from country to country. Some countries require approval of the sale price of a therapeutic before it can be marketed. In many countries, the pricing review period begins after marketing or therapeutic licensing approval is granted. In some foreign markets, prescription pharmaceutical pricing remains subject to continuing governmental control even after initial approval is granted. Although we intend to monitor these regulations, our programs are currently in the early stages of development and we will not be able to assess the impact of price regulations for a number of years. As a result, we might obtain regulatory approval for a therapeutic in a particular country, but then be subject to price regulations that delay our commercial launch of the therapeutic and negatively impact the revenues we are able to generate from the sale of the therapeutic in that country.

Our ability to commercialize any therapeutics successfully also will depend in part on the extent to which coverage and reimbursement for these therapeutics and related treatments will be available from government health administration authorities, private health insurers and other organizations. However, there may be significant delays in obtaining coverage for newly-approved therapeutics. Moreover, eligibility for coverage does not necessarily signify that a therapeutic will be reimbursed in all cases or at a rate that covers our costs, including research, development, manufacture, sale and distribution costs. Also, interim payments for new therapeutics, if applicable, may be insufficient to cover our costs and may not be made permanent. Thus, even if we succeed in bringing one or more therapeutics to the market, these therapeutics may not be considered cost-effective, and the amount reimbursed for any therapeutics may be insufficient to allow us to sell our therapeutics on a competitive basis. Because our programs are in the early stages of development, we are unable at this time to determine their cost effectiveness or the likely level or method of reimbursement. Increasingly, the third party payors who reimburse patients or healthcare providers, such as government and private insurance plans, are seeking greater upfront discounts, additional rebates and other concessions to reduce the prices for therapeutics. If the price we are able to charge for any therapeutics we develop, or the reimbursement provided for such therapeutics, is inadequate in light of our development and other costs, our return on investment could be adversely affected.

We currently expect that some therapeutics we develop may need to be administered under the supervision of a physician on an outpatient basis. Under currently applicable U.S. law, certain therapeutics that are not usually self-administered (including injectable therapeutics) may be eligible for coverage under Medicare through Medicare Part B. Medicare Part B is part of original Medicare, the federal health care program that provides health care benefits to the aged and disabled, and covers outpatient services and supplies, including certain pharmaceutical products that are medically necessary to treat a beneficiary's health condition. Specifically, Medicare Part B coverage may be available for eligible beneficiaries when the following, among other requirements, have been satisfied:

- the product is reasonable and necessary for the diagnosis or treatment of the illness or injury for which the product is administered according to accepted standards of medical practice;
- the product is typically furnished incident to a physician's services;
- the indication for which the product will be used is included or approved for inclusion in certain Medicare-designated pharmaceutical compendia (when used for an off-label use); and
- the product has been approved by the FDA.

Under current law, as a condition of receiving Medicare Part B reimbursement (the Medicare program that generally covers physician-administered, outpatient drugs) for a manufacturer's eligible drugs or biologicals, the manufacturer is required to participate in other government healthcare programs, including the Medicaid Drug

Rebate Program, the Veterans Health Administration program, and the 340B Drug Pricing Program. The Medicaid Drug Rebate Program requires pharmaceutical manufacturers to enter into and have in effect a national rebate agreement with the Secretary of the Department of Health and Human Services as a condition for states to receive federal matching funds for the manufacturer's outpatient drugs furnished to Medicaid patients. Under the 340B Drug Pricing Program, the manufacturer must extend discounts to entities eligible to participate in the program. Average prices for drugs may be reduced by mandatory discounts or rebates required by government healthcare programs or private payors and by any future relaxation of laws that presently restrict imports of therapeutics from countries where they may be sold at lower prices than in the U.S. Reimbursement rates under Medicare Part B would depend in part on whether the newly approved therapeutic would be eligible for a unique billing code. Self-administered therapeutics are typically reimbursed under Medicare Part D, and therapeutics that are administered in an inpatient hospital setting are typically reimbursed under Medicare Part A under a bundled payment. It is difficult for us to predict how Medicare coverage and reimbursement policies will be applied to our therapeutics in the future and coverage and reimbursement under different federal healthcare programs are not always consistent. Medicare reimbursement rates may also reflect budgetary constraints placed on the Medicare program.

Third-party payors often rely upon Medicare coverage policies and payment limitations in setting their own reimbursement rates. These coverage policies and limitations may rely, in part, on compendia listings for approved therapeutics. Our inability to promptly obtain relevant compendia listings, coverage, and adequate reimbursement from both government-funded and private payors for new therapeutics we develop and for which we obtain regulatory approval could have a material adverse effect on our operating results, our ability to raise capital needed to commercialize products and our financial condition.

We believe that the efforts of governments and third party payors to contain or reduce the cost of healthcare and legislative and regulatory proposals to broaden the availability of healthcare will continue to affect the business and financial condition of pharmaceutical and biotechnology companies. A number of legislative and regulatory changes in the healthcare system in the U.S. and other major healthcare markets have been proposed, and such efforts have expanded substantially in recent years. These developments could, directly or indirectly, affect our ability to sell our therapeutics, if approved, at a favorable price.

For example, in the U.S., in 2010, the U.S. Congress passed the ACA, a sweeping law intended to broaden access to health insurance, reduce or constrain the growth of health spending, enhance remedies against fraud and abuse, add new transparency requirements for the healthcare and health insurance industries, impose new taxes and fees on the health industry and impose additional policy reforms.

Among the provisions of the ACA addressing coverage and reimbursement of pharmaceutical products, of importance to our potential therapeutic candidates are the following:

- Increases to pharmaceutical manufacturer rebate liability under the Medicaid Drug Rebate Program due to an increase in the minimum basic Medicaid rebate on most branded prescription drugs and the application of Medicaid rebate liability to drugs used in risk-based Medicaid managed care plans.
- The expansion of the 340B Drug Pricing Program to require discounts for "covered outpatient drugs" sold to certain children's hospitals, critical access hospitals, freestanding cancer hospitals, rural referral centers, and sole community hospitals.
- Requirements imposed on pharmaceutical companies to offer discounts on brand-name drugs to patients who fall within the Medicare Part D coverage gap, commonly referred to as the "Donut Hole." In February 2018, Congress passed the Bipartisan Budget Act of 2018, which, beginning in 2019, increased the discount to be paid by pharmaceutical companies from 50% to 70% of a brand-name drug's negotiated price and added biosimilars to the coverage gap discount program.
- Requirements imposed on pharmaceutical companies to pay an annual non-tax-deductible fee to the federal government based on each company's market share of prior year total sales of branded drugs to certain federal healthcare programs, such as Medicare, Medicaid, Department of Veterans Affairs, and Department

of Defense. Since we currently expect our branded pharmaceutical sales to constitute a small portion of the total federal healthcare program pharmaceutical market, we do not currently expect this annual assessment to have a material impact on our financial condition.

- For therapeutic candidates classified as biologics, marketing approval for a follow-on biologic therapeutic may not become effective until 12 years after the date on which the reference innovator biologic therapeutic was first licensed by the FDA, with a possible six-month extension for pediatric therapeutics. After this exclusivity ends, it may be possible for biosimilar manufacturers to enter the market, which is likely to reduce the pricing for such therapeutics and could affect our profitability if our therapeutics are classified as biologics.

Separately, pursuant to the health reform legislation and related initiatives, the Centers for Medicare and Medicaid Services, or CMS, is working with various healthcare providers to develop, refine, and implement Accountable Care Organizations, or ACOs, and other innovative models of care for Medicare and Medicaid beneficiaries, including the Bundled Payments for Care Improvement Initiative, the Comprehensive Primary Care Initiative, the Duals Demonstration, and other models. The continued development and expansion of ACOs and other innovative models of care will have an uncertain impact on any future reimbursement we may receive for approved therapeutics administered by such organizations.

In addition, in recent years, the U.S. Congress has enacted various laws seeking to reduce the federal debt level and contain healthcare expenditures. For example, as a result of the Budget Control Act of 2011 and the Bipartisan Budget Act of 2015, an annual 2% reduction to Medicare payments took effect on April 1, 2013 and has been extended through 2027. These across-the-board spending cuts could adversely affect our future revenues, earnings, and cash flows.

The financial impact of U.S. healthcare reform legislation over the next few years will depend on a number of factors, including the policies reflected in implementing regulations and guidance and changes in sales volumes for therapeutics affected by the legislation.

From time to time, legislation is drafted, introduced and passed in the U.S. Congress that could significantly change the statutory provisions governing coverage, reimbursement, and marketing of products regulated by CMS or other government agencies. In addition to new legislation, CMS coverage and reimbursement policies are often revised or interpreted in ways that may significantly affect our business and our products. In particular, we expect that the new administration and the U.S. Congress will seek to modify, repeal, or otherwise invalidate all, or certain provisions of, the U.S. healthcare reform legislation. Since taking office, President Trump has continued to support the repeal of all or portions of the ACA. President Trump has also issued an executive order in which he stated that it is his administration's policy to seek the prompt repeal of the ACA and in which he directed executive departments and federal agencies to waive, defer, grant exemptions from, or delay the implementation of the provisions of the ACA to the maximum extent permitted by law. Congress has also enacted legislation that repeals certain portions of the ACA, including the Tax Cuts and Jobs Act, passed in December 2017, which included a provision that eliminates the penalty under the ACA's individual mandate, effective January 1, 2019, as well as the Bipartisan Budget Act of 2018, passed in February 2018, which, among other things, repealed the Independent Payment Advisory Board that was established by the ACA and was intended to reduce the rate of growth in Medicare spending. There is still uncertainty with respect to the impact President Trump's Administration and the U.S. Congress may have, if any, and any changes will likely take time to unfold. Such reforms could have an adverse effect on anticipated revenues from therapeutic candidates that we may successfully develop and for which we may obtain regulatory approval and may affect our overall financial condition and ability to develop therapeutic candidates. However, we cannot predict the ultimate content, timing or effect of any healthcare reform legislation or the impact of potential legislation on us.

The healthcare industry is heavily regulated in the U.S. at the federal, state, and local levels, and our failure to comply with applicable requirements may subject us to penalties and negatively affect our financial condition.

As a healthcare company, our operations, clinical trial activities and interactions with healthcare providers may be subject to extensive regulation in the U.S., particularly if the company receives FDA approval for any of its

therapeutics in the future. For example, if we receive FDA approval for a therapeutic for which reimbursement is available under a federal healthcare program (e.g., Medicare, Medicaid), it would be subject to a variety of federal laws and regulations, including those that prohibit the filing of false or improper claims for payment by federal healthcare programs (e.g., the False Claims Act), prohibit unlawful inducements for the referral of business reimbursable by federal healthcare programs (e.g., the federal Anti-Kickback Statute), and require disclosure of certain payments or other transfers of value made to U.S.-licensed physicians and teaching hospitals, or Open Payments. We are not able to predict how third parties will interpret these laws and apply applicable governmental guidance and may challenge our practices and activities under one or more of these laws. If our past or present operations are found to be in violation of any of these laws, we could be subject to civil and criminal penalties, which could hurt our business, our operations and financial condition.

Similarly, HIPAA prohibits, among other offenses, knowingly and willfully executing a scheme to defraud any health care benefit program, including private payors, or 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 items or services under a health care benefit program. To the extent that we act as a business associate to a healthcare provider engaging in electronic transactions, we may also be subject to the privacy and security provisions of HIPAA, as amended by HITECH, which restricts the use and disclosure of patient-identifiable health information, mandates the adoption of standards relating to the privacy and security of patient-identifiable health information, and requires the reporting of certain security breaches to healthcare provider customers with respect to such information. Additionally, many states have enacted similar laws that may impose more stringent requirements on entities like ours. Failure to comply with applicable laws and regulations could result in substantial penalties and adversely affect our financial condition and results of operations.

Our ability to obtain services, reimbursement or funding from the federal government may be impacted by possible reductions in federal spending.

U.S. federal government agencies currently face potentially significant spending reductions. The Budget Control Act of 2011, or the BCA, established a Joint Select Committee on Deficit Reduction, which was tasked with achieving a reduction in the federal debt level of at least \$1.2 trillion. That committee did not draft a proposal by the BCA's deadline. As a result, automatic cuts, referred to as sequestration, in various federal programs were scheduled to take place, beginning in January 2013, although the American Taxpayer Relief Act of 2012 delayed the BCA's automatic cuts until March 1, 2013. While the Medicare program's eligibility and scope of benefits are generally exempt from these cuts, Medicare payments to providers and Part D health plans are not exempt. The BCA did, however, provide that the Medicare cuts to providers and Part D health plans would not exceed two percent. President Obama issued the sequestration order on March 1, 2013, and cuts went into effect on April 1, 2013. Additionally, the Bipartisan Budget Act of 2015 extended sequestration for Medicare through fiscal year 2027.

The U.S. federal budget remains in flux, which could, among other things, cut Medicare payments to providers. Although the BBA passed in February 2018 enacts a two-year federal spending agreement and raises the federal spending cap on non-defense spending for fiscal years 2018 and 2019, the Medicare program is frequently identified as a target for spending cuts. The full impact on our business of any future cuts in Medicare or other programs is uncertain. In addition, we cannot predict any impact President Trump's administration and the U.S. Congress may have on the federal budget. If federal spending is reduced, anticipated budgetary shortfalls may also impact the ability of relevant agencies, such as the FDA or the National Institutes of Health, to continue to function at current levels. Amounts allocated to federal grants and contracts may be reduced or eliminated. These reductions may also impact the ability of relevant agencies to timely review and approve therapeutic research and development, manufacturing, and marketing activities, which may delay our ability to develop, market, and sell any therapeutics we may develop.

If any of our therapeutic candidates receives marketing approval and we or others later identify undesirable side effects caused by the therapeutic candidate, our ability to market and derive revenue from the therapeutic candidates could be compromised.

In the event that any of our therapeutic candidates receive regulatory approval and we or others identify undesirable side effects, adverse events or other problems caused by one of our therapeutics, any of the following adverse events could occur, which could result in the loss of significant revenue to us and materially and adversely affect our results of operations and business:

- regulatory authorities may withdraw their approval of the therapeutic or seize the therapeutic;
- we may need to recall the therapeutic or change the way the therapeutic is administered to patients;
- additional restrictions may be imposed on the marketing of the particular therapeutic or the manufacturing processes for the therapeutic or any component thereof;
- we may be subject to fines, restitution or disgorgement of profits or revenues, injunctions, or the imposition of civil penalties or criminal prosecution;
- regulatory authorities may require the addition of labeling statements, such as a “black box” warning or a contraindication;
- regulatory authorities may require us to implement a REMS, or to conduct post-marketing studies or clinical trials and surveillance to monitor the safety or efficacy of the therapeutic;
- we may be required to create a Medication Guide outlining the risks of such side effects for distribution to patients;
- we could be sued and held liable for harm caused to patients;
- the therapeutic may become less competitive; and
- our reputation may suffer.

Significant developments stemming from the United Kingdom’s recent referendum on membership in the European Union could have a material adverse effect on our business.

On June 23, 2016, the United Kingdom held a referendum and voted in favor of leaving the European Union. This referendum has created political and economic uncertainty, particularly in the United Kingdom and the European Union, and this uncertainty may last for years. Any business we conduct, now and in the future, in the United Kingdom, the European Union, and worldwide could be affected during this period of uncertainty, and perhaps longer, by the impact of the United Kingdom’s referendum. The referendum, and the likely withdrawal of the United Kingdom from the European Union it triggers, has caused and, along with events potentially occurring in the future as a consequence of the United Kingdom’s withdrawal, including the possible breakup of the United Kingdom, may continue to cause significant volatility in global financial markets, including in global currency and debt markets. This volatility could cause a slowdown in economic activity in the United Kingdom, Europe, or globally, which could adversely affect our operating results and growth prospects. In addition, our business could be negatively affected by new trade agreements between the United Kingdom and other countries, including the U.S., and by the possible imposition of trade or other regulatory barriers in the United Kingdom.

It is currently unclear how regulations affecting clinical trials, the approval of our future therapeutic candidates, and the sale of these therapeutic candidates will be affected by this referendum either in the United Kingdom or elsewhere in Europe. These possible negative impacts, and others resulting from the United Kingdom’s actual or threatened withdrawal from the European Union, may adversely affect our operating results and growth prospects.

Risks Related to Our Common Stock

We are an “emerging growth company” and we cannot be certain if the reduced reporting requirements applicable to emerging growth companies will make our common stock less attractive to investors.

We are an “emerging growth company” as defined in the Jumpstart Our Business Startups Act of 2012, or the 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 (1) not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act of 2002, or the Sarbanes-Oxley Act, (2) reduced disclosure obligations regarding executive compensation in this Annual Report on Form 10-K and our other periodic reports and proxy statements and (3) exemptions from the requirements of holding a nonbinding advisory vote on executive compensation and stockholder approval of any golden parachute payments not previously approved. In addition, as an emerging growth company, we are only required to provide two years of audited financial statements and two years of selected financial data in this Annual Report on Form 10-K. We could be an emerging growth company for up to five years from the date of the first sale of our common stock pursuant to an effective registration statement, 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 \$1.07 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, or if we issue more than \$1.0 billion in non-convertible debt during any three-year period before that time, in which case we would no longer 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 this Annual Report on Form 10-K and our other 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 share 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.

Our stock price may be volatile and purchasers of our common stock could incur substantial losses.

If a market for our common stock develops, its market price could fluctuate substantially due to a variety of factors, including the other risks described in this section of the Annual Report on Form 10-K titled “Risk Factors” and the following:

- the success of competitive therapeutics or technologies;
- results of our preclinical studies and clinical trials of our therapeutic candidates, or those of our competitors, or any current or future collaborators;
- regulatory or legal developments in the U.S. and other countries, especially changes in laws or regulations applicable to our therapeutics;
- introductions and announcements of new therapeutics by us, our future commercialization partners, or our competitors, and the timing of these introductions or announcements;
- actions taken by regulatory agencies with respect to our therapeutics, clinical studies, manufacturing process or sales and marketing terms;

- actual or anticipated variations in our financial results or those of companies that are perceived to be similar to us;
- the success of our efforts to acquire or in-license additional technologies, therapeutics or therapeutic candidates;
- developments concerning any current or future collaborations, including but not limited to those with our sources of manufacturing supply and our commercialization partners;
- announcements by us or our competitors of significant acquisitions, strategic partnerships, joint ventures or capital commitments;
- developments or disputes concerning patents or other proprietary rights, including patents, litigation matters and our ability to obtain patent protection for our therapeutics;
- our ability or inability to raise additional capital and the terms on which we raise it;
- the recruitment or departure of key personnel;
- changes in the structure of healthcare payment systems;
- market conditions in the pharmaceutical and biotechnology sectors;
- actual or anticipated changes in earnings estimates or changes in stock market analyst recommendations regarding our common stock, other comparable companies or our industry generally;
- our failure or the failure of our competitors to meet analysts' projections or guidance that we or our competitors may give to the market;
- fluctuations in the valuation of companies perceived by investors to be comparable to us;
- announcement and expectation of additional financing efforts;
- speculation in the press or investment community;
- trading volume of our common stock;
- sales of our common stock by us or our stockholders;
- the concentrated ownership of our common stock;
- changes in accounting principles;
- terrorist acts, acts of war or periods of widespread civil unrest;
- natural disasters and other calamities; and
- general economic, industry and market conditions.

In addition, the stock markets in general, and the markets for pharmaceutical and biotechnology stocks in particular, have experienced extreme volatility that has been often unrelated to the operating performance of the issuer. These broad market and industry factors may seriously harm the market price of our common stock, regardless of our operating performance.

The future issuance of equity or of debt securities that are convertible into equity may dilute your investment and reduce your equity interest.

We may choose to raise additional capital in the future, depending on market conditions, strategic considerations and operational requirements. To the extent that we raise additional capital through the issuance of shares or other securities convertible into shares, our stockholders will be diluted. Future issuances of our common stock or other equity securities, or the perception that such sales may occur, could adversely affect the prevailing market price of our common stock and impair our ability to raise capital through future offerings of equity or equity-linked securities. For example, we have filed, and the SEC has declared effective, a registration statement to register the resale of up to 39,714,143 shares of our common stock issued in connection with the Merger and the Private Placement or held by pre-Merger stockholders of us. This registration statement will permit the resale of these shares at any time for up to five years from the effective date of the registration statement. The resale of a substantial number of shares of our common stock in the public market could adversely affect the market price for our common stock and make it more difficult for you to sell shares of our common stock at times and prices that you feel are appropriate. Furthermore, we expect that, because there will be a large number of shares registered pursuant to this registration statement, selling stockholders will continue to offer shares covered by this registration statement for a significant period of time, the precise duration of which cannot be predicted. Accordingly, the adverse market and price pressures resulting from an offering pursuant to this registration statement may continue for an extended period of time and continued negative pressure on the market price of our common stock could have a material adverse effect on our ability to raise additional equity capital.

Our debt obligations expose us to risks that could adversely affect our business, operating results and financial condition and may result in further dilution to our stockholders.

We have entered into a loan and security agreement with Hercules pursuant to which we may borrow in an aggregate principal amount of up to \$10.0 million from Hercules at a floating per annum interest rate (based on a year consisting of 360 days) equal to the greater of either (i) 9.95% or (ii) the sum of (a) 9.95% plus (b) the prime rate (as reported in *The Wall Street Journal*) minus 3.50%. We were required to make interest only payments on the amounts borrowed until June 2017. Commencing on July 1, 2017, the loan began amortizing in equal monthly installments of principal and interest in an amount sufficient to fully amortize the outstanding principal balance of the loan over the remaining scheduled monthly payments due prior to the maturity date on September 1, 2019. Pursuant to an amendment dated January 15, 2018, amortization payments due for the thirteen (13) consecutive months commencing on December 1, 2017 through and including December 1, 2018 were deferred. Commencing on January 1, 2019, and continuing on the first business day of each month thereafter, the loan, including the deferred payments, shall begin amortizing in equal monthly installments of principal and interest based upon an amortization schedule equal to eighteen (18) consecutive months. Any remaining obligations under the loan agreement and other loan documents (other than the warrant) are due and payable on the maturity date. On the earliest to occur of the maturity date, the date we prepay the term loan in full or the date the loan otherwise becomes due and payable, we must pay the lender under the agreement an additional charge equal to 3.85% of the total amounts funded under the loan agreement. To the extent we desire to prepay the indebtedness prior to maturity, we will be obligated to pay a prepayment penalty to Hercules ranging from 1% to 3% of the amounts being prepaid, depending on when such prepayment occurs. The loan agreement was amended on October 10, 2016 to revise the language granting Hercules a contingent security interest in certain of our assets. Under the loan agreement, Hercules or its affiliates have a right to participate in a single subsequent unregistered financing by us in an amount of up to \$1.0 million on the same terms, conditions and pricing afforded to others participating in such financing. Hercules has not yet exercised this right to participate.

Our ability to make payments on this indebtedness depends on our ability to generate cash in the future. We expect to experience negative cash flow for the foreseeable future as we fund our operations and capital expenditures. There can be no assurance that we will be in a position to repay this indebtedness when due or obtain extensions of the maturity date. We anticipate that we will need to secure additional funding in order for us to be able to satisfy our obligations when due. We cannot guarantee that future financing will be available in sufficient amounts or on terms acceptable to us, if at all. If that additional funding involves the sale of equity securities or convertible securities, it would result in the issuance of additional shares of our capital stock, which would result in

dilution to our stockholders. The indebtedness is secured by substantially all of our assets other than intellectual property, on which we have given Hercules a negative pledge. In addition, under the loan agreement, we are subject to certain customary covenants that limit or restrict our ability to, among other things, incur additional indebtedness, grant any security interests, pay cash dividends, repurchase our common stock, make loans, or enter into certain transactions without the prior consent of Hercules.

This level of debt could have important consequences to you as an investor in our securities. For example, it could:

- limit our flexibility in planning for the development, clinical testing, approval and marketing of our products;
- place us at a competitive disadvantage compared to any of our competitors that are less leveraged than we are;
- increase our vulnerability to both general and industry-specific adverse economic conditions; and
- limit our ability to obtain additional funds.

The employment agreements with our executive officers may require us to pay severance benefits to officers in connection with termination of employment or upon a change of control of us, which could harm our financial condition.

Each of David A. Giljohann, our Chief Executive Officer, Ekambar Kandimalla, our Chief Scientific Officer, and David S. Snyder, our Chief Financial Officer, is entitled to receive cash severance equal to twelve months, six months, and six months, respectively, of his base salary if his employment is terminated by us without cause (as such term is defined in his employment offer letter). In addition, our 2015 Plan, which was assumed by us in the Merger, generally provides for accelerated vesting of equity awards upon the involuntary termination of an employee within the twelve month period following a change in control (as defined under the plan) and accelerated vesting of equity awards upon a change of control (as defined under the plan) for each of our executive officers. This vesting acceleration is intended to provide each of our executive officers with the full benefit of their equity awards and reward them for a successful outcome for our stockholders. The accelerated vesting of equity awards could result in dilution to our existing stockholders and harm the market price of our common stock. The payment of these severance benefits could harm our financial condition. In addition, these potential severance payments may discourage or prevent third parties from seeking a business combination with us.

There is currently no market for our common stock and we cannot assure you that any market will ever develop. You may therefore be unable to re-sell shares of our common stock at times and prices that you believe are appropriate.

Our common stock is not listed on a national securities exchange or any other exchange, or quoted on an over-the-counter market. Therefore, there is no trading market, active or otherwise, for our common stock and our common stock may never be included for trading on any stock exchange, automated quotation system or any over-the-counter market. Accordingly, our common stock is highly illiquid and you will likely experience difficulty in re-selling such shares at times and prices that you may desire and without depressing the market price for the shares or at all.

Our common stock may not be eligible for listing or quotation on any securities exchange.

We do not currently meet the initial quantitative listing standards of any national securities exchange. We cannot assure you that we will be able to meet the initial listing standards of any national securities exchange, or, if we do meet such initial listing standards, that we will be able to maintain any such listing. Further, the national securities exchanges are adopting so-called “seasoning” rules that will require that we meet certain requirements, including prescribed periods of time trading over-the-counter and minimum filings of periodic reports with the SEC, before we

are eligible to apply for listing on such national securities exchanges. We have contacted an authorized market maker for an over-the-counter quotation system for sponsorship of our common stock, but we cannot guarantee that such sponsorship will be approved and our common stock listed and quoted for sale. Even if our common stock is quoted for sale on an over-the-counter quotation system, buyers may be insufficient in numbers to allow for a robust market and it may prove impossible to sell your shares. In addition, an investor may find it difficult to obtain accurate quotations as to the market value of our common stock. In addition, if we fail to meet the criteria set forth in SEC regulations, various requirements would be imposed by law on broker-dealers who sell our securities to persons other than established customers and accredited investors. Consequently, such regulations may deter broker-dealers from recommending or selling our common stock, which may further affect its liquidity. This would also make it more difficult for us to raise additional capital.

The designation of our common stock as a “penny stock” would limit the liquidity of our common stock.

Our common stock may be deemed a “penny stock” (as that term is defined under Rule 3a51-1 of the Exchange Act) in any market that may develop in the future. Generally, a “penny stock” is a common stock that is not listed on a securities exchange and trades for less than \$5.00 a share. Prices often are not available to buyers and sellers and the market may be very limited. Penny stocks in start-up companies are among the riskiest equity investments. Broker-dealers who sell penny stocks must provide purchasers of these stocks with a standardized risk-disclosure document prepared by the SEC. The document provides information about penny stocks and the nature and level of risks involved in investing in the penny stock market. A broker must also provide purchasers with bid and offer quotations and information regarding broker and salesperson compensation and make a written determination that the penny stock is a suitable investment for the purchaser and obtain the purchaser’s written agreement to the purchase. Many brokers choose not to participate in penny stock transactions. Because of the penny stock rules, there may be less trading activity in penny stocks in any market that develops for our common stock in the future and stockholders are likely to have difficulty selling their shares.

FINRA sales practice requirements may limit a stockholder’s ability to buy and sell our stock.

The Financial Industry Regulatory Authority, or FINRA, has adopted rules requiring that, in recommending an investment to a customer, a broker-dealer must have reasonable grounds for believing that the investment is suitable for that customer. Prior to recommending speculative or low-priced securities to their non-institutional customers, broker-dealers must make reasonable efforts to obtain information about the customer’s financial status, tax status, investment objectives and other information. Under interpretations of these rules, FINRA has indicated its belief that there is a high probability that speculative or low-priced securities will not be suitable for at least some customers. If these FINRA requirements are applicable to us or our securities, they may make it more difficult for broker-dealers to recommend that at least some of their customers buy our common stock, which may limit the ability of our stockholders to buy and sell our common stock and could have an adverse effect on the market for and price of our common stock.

If securities or industry analysts do not publish research or reports about our business, or if they issue an adverse or misleading opinion regarding our stock, our stock price and trading volume could decline.

The trading market for our common stock will be influenced by the research and reports that industry or securities analysts publish about us or our business. We do not currently have and may never obtain research coverage by securities and industry analysts. In addition, because we did not become a reporting company by conducting an underwritten initial public offering of our common stock, and because we will not be listed on a national securities exchange, security analysts of brokerage firms may not provide coverage of our Company. In addition, investment banks may be less likely to agree to underwrite secondary offerings on our behalf than they might if we became a public reporting company by means of an underwritten initial public offering, because they may be less familiar with our Company as a result of more limited coverage by analysts and the media, and because we became public at an early stage in our development. The failure to receive research coverage or support in the market for our shares will have an adverse effect on our ability to develop a liquid market for our common stock and the trading price for our stock would be negatively impacted.

In the event we obtain securities or industry analyst coverage, if any of the analysts who cover us issue an adverse or misleading opinion regarding us, our business model, our intellectual property or our stock performance, or if our target studies and operating results fail to meet the expectations of analysts, our stock price would likely decline. If one or more of these analysts cease coverage of us or fail to publish reports on us regularly, we could lose visibility in the financial markets, which in turn could cause our stock price or trading volume to decline.

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

Based on the beneficial ownership of our common stock as of December 31, 2017, our executive officers and directors, together with holders of five percent or more of our outstanding common stock and their respective affiliates, will beneficially own approximately 47.9 percent of our outstanding common stock. As a result, these stockholders, if acting together, will continue to have significant influence over the outcome of corporate actions requiring stockholder approval, including the election of directors, any merger, consolidation or sale of all or substantially all of our assets and any other significant corporate transaction. The interests of these stockholders may not be the same as or may even conflict with your interests. For example, these stockholders could delay or prevent a change of control of our Company, even if such a change of control would benefit our other stockholders, which could deprive our stockholders of an opportunity to receive a premium for their common stock as part of a sale of our company or our assets and might affect the prevailing market price of our common stock. The significant concentration of stock ownership may adversely affect the trading price of our common stock due to investors' perception that conflicts of interest may exist or arise.

Anti-takeover provisions in our charter documents and under the General Corporation Law of the State of Delaware could make an acquisition of us more difficult and may prevent attempts by our stockholders to replace or remove our management.

Provisions in our amended and restated certificate of incorporation and our bylaws may delay or prevent an acquisition of us or a change in our management. These provisions include a classified board of directors, a prohibition on actions by written consent of our stockholders, and the ability of the board of directors to issue preferred stock without stockholder approval. In addition, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporation Law, or the DGCL, which prohibits stockholders owning in excess of 15% of the outstanding combined organization voting stock from merging or combining with the combined organization. Although we believe these provisions collectively will provide for an opportunity to receive higher bids by requiring potential acquirers to negotiate with our board of directors, they would apply even if the offer may be considered beneficial by some stockholders. In addition, these provisions may frustrate or prevent any attempts by our stockholders to replace or remove then-current management by making it more difficult for stockholders to replace members of the board of directors, which is responsible for appointing the members of management.

Anti-takeover provisions in our charter documents could discourage, delay or prevent a change in control of us and may affect the trading price of our common stock.

Our corporate documents and the DGCL contain provisions that may enable our board of directors to resist a change in control of us even if a change in control were to be considered favorable by our stockholders. These provisions:

- stagger the terms of our board of directors and require 66 and 2/3% stockholder voting to remove directors, who may only be removed for cause;
- authorize our board of directors to issue "blank check" preferred stock and to determine the rights and preferences of those shares, which may be senior to our common stock, without prior stockholder approval;
- establish advance notice requirements for nominating directors and proposing matters to be voted on by stockholders at stockholders' meetings;

- prohibit our stockholders from calling a special meeting and prohibit stockholders from acting by written consent;
- require 66 and 2/3% stockholder voting to effect certain amendments to our certificate of incorporation and bylaws; and
- prohibit cumulative voting in the election of directors, which limits the ability of minority stockholders to elect director candidates.

These provisions could discourage, delay or prevent a transaction involving a change in control of us. These provisions could also discourage proxy contests and make it more difficult for stockholders to elect directors of their choosing and cause us to take other corporate actions our stockholders desire.

The requirements of being a public company may strain our resources and divert management's attention.

As a public company, we are subject to the reporting requirements of the Exchange Act, the Sarbanes-Oxley Act, the Dodd-Frank Act, and other applicable securities rules and regulations. In the future, we may also be subject to the listing requirements of the NASDAQ Stock Market. Despite recent reforms made possible by the JOBS Act, compliance with these rules and regulations nonetheless increases our legal and financial compliance costs, makes some activities more difficult, time-consuming or costly, and increases demand on our systems and resources, particularly after we will no longer be an "emerging growth company." The Exchange Act requires, among other things, that we file annual, quarterly, and current reports with respect to our business and operating results.

As a result of disclosure of information in this report and in other filings required of a public company, our business and financial condition are more visible, which we believe may result in threatened or actual litigation, including by competitors and other third parties. If such claims are successful, our business and operating results could be harmed, and even if the claims do not result in litigation or are resolved in our favor, these claims, and the time and resources necessary to resolve them, could divert the resources of our management and adversely affect our business, brand and reputation and results of operations.

We also expect that being a public company and these new rules and regulations will make it more expensive for us to obtain director and officer liability insurance, and we may be required to accept reduced coverage or incur substantially higher costs to obtain coverage. These factors could also make it more difficult for us to attract and retain qualified members of our board of directors, particularly to serve on our audit committee and compensation committee, and qualified executive officers.

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.

We may incur significant costs from class action litigation due to our expected stock volatility.

Our stock price may fluctuate for many reasons, including as a result of public announcements regarding the progress of our development efforts or the development efforts of current or future collaborators or competitors, the addition or departure of our key personnel, variations in our quarterly operating results and changes in market valuations of pharmaceutical and biotechnology companies. This risk is especially relevant to us because pharmaceutical and biotechnology companies have experienced significant stock price volatility in recent years. When the market price of a stock has been volatile as our stock price may be, holders of that stock have occasionally brought securities class action litigation against the company that issued the stock. If any of our stockholders were to bring a lawsuit of this type against us, even if the lawsuit is without merit, we could incur substantial costs defending the lawsuit. The lawsuit could also divert the time and attention of our management.

Our amended and restated certificate of incorporation designates the Court of Chancery of the State of Delaware as the sole and exclusive forum for certain types of actions and proceedings that may be initiated by our stockholders, which could limit our stockholders' ability to obtain a favorable judicial forum for disputes with us or our directors, officers, employees or agents.

Our amended and restated certificate of incorporation provides that, unless we consent in writing to an alternative forum, the Court of Chancery of the State of Delaware will be the sole and exclusive forum for any derivative action or proceeding brought on our behalf, any action asserting a claim of breach of a fiduciary duty owed by any of our directors, officers, employees or agents to us or our stockholders, any action asserting a claim arising pursuant to any provision of the DGCL, our amended and restated certificate of incorporation or our amended and restated bylaws or any action asserting a claim that is governed by the internal affairs doctrine, in each case subject to the Court of Chancery having personal jurisdiction over the indispensable parties named as defendants therein and the claim not being one which is vested in the exclusive jurisdiction of a court or forum other than the Court of Chancery or for which the Court of Chancery does not have subject matter jurisdiction. Any person purchasing or otherwise acquiring any interest in any shares of our common stock shall be deemed to have notice of and to have consented to this provision of our amended and restated certificate of incorporation. This choice of forum provision may limit our stockholders' ability to bring a claim in a judicial forum that it finds favorable for disputes with us or our directors, officers, employees or agents, which may discourage such lawsuits against us and our directors, officers, employees and agents even though an action, if successful, might benefit our stockholders. Stockholders who do bring a claim in the Court of Chancery could face additional litigation costs in pursuing any such claim, particularly if they do not reside in or near Delaware. The Court of Chancery may also reach different judgments or results than would other courts, including courts where a stockholder considering an action may be located or would otherwise choose to bring the action, and such judgments or results may be more favorable to us than to our stockholders. Alternatively, if a court were to find this provision of our amended and restated certificate of incorporation inapplicable to, or unenforceable in respect of, one or more of the specified types of actions or proceedings, we may incur additional costs associated with resolving such matters in other jurisdictions, which could have a material adverse effect on our business, financial condition or results of operations.

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

We have incurred substantial losses during our history and do not expect to become profitable in the near future and we may never achieve profitability. To the extent that we continue to generate taxable losses, unused losses will carry forward to offset future taxable income, if any, until such unused losses expire. Under Sections 382 and 383 of the Internal Revenue Code of 1986, as amended, if a corporation undergoes an "ownership change," generally defined as a greater than 50% change (by value) in its equity ownership over a three-year period, the corporation's ability to use its pre-change net operating loss carryforwards, or NOLs, and other pre-change tax attributes (such as research tax credits) to offset its post-change income or taxes may be limited. The Merger, our prior equity offerings and other changes in our stock ownership may have resulted in ownership changes. In addition, we may experience ownership changes in the future as a result of subsequent shifts in our stock ownership, some of which are outside of our control. As a result, if we earn net taxable income, our ability to use our pre-change net operating loss carryforwards to offset U.S. federal taxable income may be subject to limitations, which could potentially result in increased future tax liability to us. In addition, at the state level, there may be periods during which the use of NOLs is suspended or otherwise limited, which could accelerate or permanently increase state taxes owed.

Item 1B. Unresolved Staff Comments.

None.

Item 2. Properties.

Our corporate headquarters are located in Skokie, Illinois, where we lease approximately 12,000 square feet of office and laboratory space. The lease term for our office and laboratory space in Skokie, Illinois commenced in March 2012 for a lease term of three years. In March 2014, we amended the lease agreement to extend the term for an additional six years, which expires in 2021. In May 2016, we amended the lease agreement to include additional space to be used primarily for administrative functions.

We believe that our existing facilities are adequate for our current needs and have sufficient laboratory space to house additional scientists as we grow. When our lease expires, we may exercise our renewal options or look for additional or alternate space for our operations. We believe that suitable additional or alternative space will be available in the future on commercially reasonable terms.

Item 3. Legal Proceedings.

From time to time, we may be subject to legal proceedings. We are not currently a party to or aware of any proceedings that we believe will have, individually or in the aggregate, a material adverse effect on our business, financial condition or results of operations.

Item 4. Mine Safety Disclosures.

Not applicable.

PART II

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

Market Information for Common Stock

Our common stock is not listed on a national securities exchange, an over-the-counter market or any other exchange. Therefore, there is no trading market, active or otherwise, for our common stock and our common stock may never be included for trading on any stock exchange, automated quotation system or any over-the-counter market.

Holders of Record

As of February 28, 2018, we have 39,454,821 shares of common stock outstanding held by 208 stockholders of record.

Dividend Policy

We currently intend to retain future earnings, if any, for use in the operation of our business and to fund future growth. We have never declared or paid cash dividends on our common stock and we do not intend to pay any cash dividends on our common stock for the foreseeable future. Any future determination related to our dividend policy will be made at the discretion of our board of directors in light of conditions then-existing, including factors such as our results of operations, financial condition and requirements, business conditions and covenants under any applicable contractual arrangements.

Securities Authorized for Issuance under Equity Compensation Plans

Information about our equity compensation plans is incorporated herein by reference to Part III, Item 12 of this Annual Report .

Performance Graph

Pursuant to the accompanying instructions, the information called for by Item 201(e) of Regulation S-K is not required.

Item 6. Selected Financial Data.

The following tables set forth selected financial data for us as of and for the years ended December 31, 2017, 2016 and 2015 and should be read together with the consolidated financial statements and the related notes and the sections of this Annual Report on Form 10-K entitled "Risk Factors" and "Management's Discussion and Analysis of Financial Condition and Results of Operations" appearing elsewhere in this Annual Report on Form 10-K. The selected financial data in this section is not intended to replace our financial statements and related notes. The selected financial data as of and for the years ended December 31, 2017, 2016 and 2015 are derived from our audited consolidated financial statements. Our audited consolidated financial statements as of and for the years ended December 31, 2017 and 2016 are included elsewhere in this Annual Report on Form 10-K. Our historical results are not necessarily indicative of our future results.

	December 31, 2017	December 31, 2016	December 31, 2015
<i>(in thousands)</i>			
Balance Sheet Data			
Cash and cash equivalents	\$ 25,764	\$ 19,623	\$ 18,731
Current assets	26,706	20,041	19,204
Total assets	28,055	20,576	19,621
Current portion of long-term debt	—	1,213	—
Current liabilities	3,452	12,158	1,343
Long-term debt, net	4,855	4,454	—
Preferred stock warrant liability	—	201	—
Common stock warrant liability	523	—	—
Total liabilities	9,108	18,128	1,391
Non-redeemable preferred stock			
Series C	—	33,483	33,039
Series B-2	—	3,641	3,641
Series B-1	—	5,371	5,371
Series A	—	135	135
Common stock	4	—	—
Additional paid-in capital	53,586	(17,578)	(18,293)
Accumulated deficit	(34,643)	(22,604)	(5,663)
Total stockholders' equity	18,947	2,448	18,230

All share and per share figures in the following table are retrospectively adjusted to reflect the conversion of each share of Exicure OpCo common and preferred stock (other than shares of Exicure OpCo's Series C preferred stock) and common stock options issued and outstanding immediately prior to the closing of the Merger into 0.49649 shares of the Company's common stock, and each share of Exicure OpCo's Series C preferred stock issued and outstanding immediately prior to the closing of the Merger into 0.7666652 shares of the Company's common stock.

	Year Ended December 31,		
	2017	2016	2015
<i>(in thousands except share and per share data)</i>			
Statement of Operations Data			
Revenue:			
Collaboration revenue	\$ 9,719	\$ 690	\$ —
Grant income	—	346	2,388
Total revenue	9,719	1,036	2,388
Operating expenses:			
Research and development expense	14,108	13,659	10,124
General and administrative expense	7,046	3,539	5,408
Total operating expenses	21,154	17,198	15,532
Operating loss	(11,435)	(16,162)	(13,144)
Other income (expense), net:			
Interest expense	(795)	(724)	—
Other income (loss), net	191	(55)	(7)
Total other income (loss), net	(604)	(779)	(7)
Net loss attributable to members of AuraSense Therapeutics, LLC	—	—	(7,488)
Net loss attributable to stockholders of Exicure, Inc.	(12,039)	(16,941)	(5,663)
Net loss attributable to members of AuraSense Therapeutics, LLC/stockholders of Exicure, Inc.	\$ (12,039)	\$ (16,941)	\$ (13,151)
Basic and diluted loss per common share	\$ (1.19)	\$ (149.37)	\$ (244.13)
Basic and diluted weighted-average common shares outstanding	10,119,569	113,418	53,870

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

You should read the following discussion and analysis of our financial condition and results of operations together with our consolidated financial statements and the related notes and other financial information included elsewhere in 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, includes forward-looking statements that involve risks and uncertainties as described under the heading "Cautionary Note Regarding Forward-Looking Statements" elsewhere in this Annual Report on Form 10-K. You should review the disclosure under the heading "Risk Factors" in 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.

Operating Overview

We are a clinical-stage biotechnology company developing gene regulatory and immuno-oncology therapeutics based on our proprietary Spherical Nucleic Acid, or SNA, technology. SNAs are nanoscale constructs consisting of densely packed synthetic nucleic acid sequences that are radially arranged in three dimensions. We believe the design of our SNAs gives rise to distinct chemical and biological properties that may provide advantages over other nucleic acid therapeutics and enable therapeutic activity outside of the liver. Since our SNAs have shown in a Phase 1 clinical trial and in preclinical studies that they can cross certain biological barriers when administered locally, we believe that they have the therapeutic potential to target diseases not typically addressed with other nucleic acid therapeutics. We have demonstrated the ability to cross certain biological barriers in a Phase 1 clinical trial of our lead therapeutic candidate, AST-005, and in preclinical studies of two other therapeutic candidates, XCUR17 and AST-008, both of which we are advancing to the clinic.

AST-005 is an SNA targeting tumor necrosis factor, or TNF, for the treatment of mild to moderate psoriasis that is intended to be administered locally in a gel to psoriatic lesions. In a completed Phase 1 clinical trial, AST-005, when topically administered to the skin of patients with mild to moderate psoriasis, resulted in no drug associated adverse events, and demonstrated a reduction of tumor necrosis factor messenger RNA, or TNF mRNA. The TNF mRNA reduction elicited by the highest strength of AST-005 gel was statistically significant when compared to the effects of the vehicle. While we did not observe an antipsoriatic effect in our Phase 1 clinical trial, we believe this is due to the short duration of the treatment. The results of a clinical trial with etanercept, a systemic TNF inhibitor, indicate that at least four weeks of therapy is required before antipsoriatic efficacy can be observed.

On December 2, 2016, we entered into a research collaboration, option and license agreement with Purdue referred to as the Purdue Collaboration. Purdue has the option to obtain from us the full worldwide development and commercial rights to AST-005, an option to obtain three additional collaboration targets and a further option to obtain from us the full worldwide development and commercial rights to any therapeutic candidates developed targeting the three additional collaboration targets. Additionally, Purdue has rights of first offer to some potential collaboration targets. These rights of first offer are subject to limitations in time and scope. In connection with the Purdue Collaboration, we received a non-refundable development fee of \$10.0 million. In addition, we are eligible to receive up to \$776.5 million upon successful completion of certain research, regulatory and commercial sales milestones. We cannot assure you that these milestones will be achieved as they are subject to highly significant risks and uncertainties, many of which are outside of our control. In the event a therapeutic candidate subject to the collaboration results in commercial sales, we are eligible to receive royalties ranging from the low single digits to a maximum of 10% on future net sales of such commercialized therapeutic candidates. Pursuant to the Purdue Collaboration, Purdue is conducting a Phase 1b clinical trial in psoriasis patients in Germany to evaluate the effect of higher concentrations of AST-005 gel on TNF mRNA and downstream mRNA expression. Patient dosing is complete and no serious adverse events have been reported. We expect to have the topline results of the clinical trial in early 2018.

Our second therapeutic candidate, XCUR17, is an SNA targeted to IL-17RA for the treatment of mild to moderate psoriasis. We filed a CTA for a Phase 1 clinical trial of XCUR17 in patients with psoriasis in Germany in

the third quarter of 2017. Our CTA was approved in February 2018 and we expect the first patient in our Phase 1 clinical trial to be dosed in early 2018. We expect this clinical trial to be completed in mid-2018.

Our third therapeutic candidate, AST-008, is an SNA consisting of toll-like receptor 9, or TLR9, agonists designed for immuno-oncology applications. AST-008 has exhibited anti-tumor activity as both a monotherapy and in combination with certain checkpoint inhibitors across a range of preclinical models of solid and hematological cancers. In the third quarter of 2017, we received an authorization from the MHRA to conduct a Phase 1 clinical trial with AST-008. We began subject dosing in our Phase 1 clinical trial for AST-008 in the fourth quarter of 2017. We expect this trial to be completed in mid-2018. We ultimately plan to clinically advance AST-008 in combination with checkpoint inhibitors.

Since our inception in 2011, we have devoted substantial resources to the research and development of SNAs and the protection and enhancement of our intellectual property. We have no products approved for sale and all of our \$15.4 million in revenue through December 31, 2017 has been earned through our research collaboration, license, and option agreement with Purdue or as a primary contractor or as a subcontractor on government grants. In addition to our revenue, through December 31, 2017, we have funded our operations through private placements of preferred stock with gross proceeds totaling \$42.8 million, sales of common stock in the Private Placement with gross proceeds totaling \$31.5 million and debt financing totaling \$6.0 million. As of December 31, 2017, our cash and cash equivalents were \$25.8 million .

Since our inception, we have incurred significant operating losses. Our net loss was \$12.0 million and \$16.9 million for the years ended December 31, 2017 and 2016, respectively. As of December 31, 2017, our accumulated deficit was \$53.5 million . Substantially all of our operating losses resulted from expenses incurred in connection with our research programs and from general and administrative costs associated with our operations.

We expect to continue to incur significant and increasing losses in the foreseeable future. Our net losses may fluctuate significantly from quarter to quarter and year to year. We anticipate that our expenses will increase substantially as we:

- conduct further preclinical studies and clinical trials of AST-008 and XCUR17;
- increase research and development for the discovery and development of additional therapeutic candidates;
- advance other therapeutic candidates into preclinical and clinical development;
- increase our research and development to enhance our technology;
- procure clinical trial materials;
- seek regulatory approval for our therapeutic candidates that successfully complete clinical trials;
- maintain, expand and protect our intellectual property portfolio;
- add operational, financial and management information systems and personnel, including personnel to support our product development and planned future commercialization efforts; and
- operate as a public company.

We have not generated any commercial product revenue nor do we expect to generate substantial revenue from product sales unless and until we successfully complete development and obtain regulatory approval for one or more of our therapeutic candidates. Successful therapeutic development and regulatory approval are subject to significant uncertainty and we expect will take at least five years. If we obtain regulatory approval for any of our therapeutic candidates, we expect to incur significant commercialization expenses related to product sales, marketing, manufacturing and distribution. Other sources of revenue could include a combination of research and development

payments, license fees and other upfront payments, milestone payments, and royalties in connection with our current and any future collaborations and licenses. Until such time, if ever, that we generate revenue from whatever source, we expect to finance our cash needs through a combination of public or private equity offerings, debt financings and research collaboration and license agreements. We may be unable to raise capital or enter into such other arrangements when needed or on favorable terms. Our failure to raise capital or enter into such other arrangements as and when needed would have a negative impact on our financial condition and our ability to develop our therapeutic candidates.

Basis of Presentation

The audited financial statements of Exicure, Inc. for the fiscal years ended December 31, 2017 and 2016, contained herein, include a summary of our significant accounting policies and should be read in conjunction with the discussion below.

Recent Developments

Reverse Merger

On September 26, 2017, pursuant to the Merger Agreement, Max-1 Acquisition Sub, Inc., a wholly-owned subsidiary of Max-1 Acquisition Corporation, or Max-1, merged with and into Exicure Operating Company (f/k/a Exicure, Inc.), a privately-held Delaware Corporation referred to herein as Exicure OpCo, with Exicure OpCo remaining as the surviving entity and a wholly-owned operating subsidiary of Max-1, or the Merger. The Merger was effective as of September 26, 2017, or the Effective Time, upon the filing of a Certificate of Merger with the Secretary of State of the State of Delaware.

At the Effective Time, the legal existence of Max-1 Acquisition Sub, Inc. ceased. At the Effective Time, each share of Exicure OpCo common and preferred stock (other than shares of Exicure OpCo's Series C preferred stock) issued and outstanding immediately prior to the closing of the Merger was converted into 0.49649 shares of Max-1's common stock, and each share of Exicure OpCo's Series C preferred stock issued and outstanding immediately prior to the closing of the Merger was converted into 0.7666652 shares of Max-1's common stock. As a result, an aggregate of 26,666,627 shares of Max-1's common stock were issued to the holders of Exicure OpCo's capital stock, which is incremental to the 2,080,000 shares of Max-1's common stock that were outstanding immediately prior to the Merger. In addition, pursuant to the Merger Agreement options to purchase 7,414,115 shares of Exicure OpCo common stock issued and outstanding immediately prior to the closing of the Merger were assumed and converted into options to purchase 3,680,997 shares of Max-1's common stock. After the filing of the Certificate of Merger with the Secretary of State of the State of Delaware, Max-1 changed its name to Exicure, Inc.

The Merger is considered a "reverse merger", whereby Exicure OpCo is considered the accounting acquirer in the Merger. Exicure OpCo was determined to be the accounting acquirer based on the terms of the Merger and other factors including: (i) legacy Exicure OpCo shareholders own approximately 94% of the combined company on a fully diluted basis immediately following the closing of the Merger, (ii) legacy Exicure OpCo directors will hold all six board seats of the combined company, and (iii) legacy Exicure OpCo management will hold all key positions in management of the combined company. The transaction is accounted for as an asset acquisition rather than a business combination because as of the acquisition date, Max-1 did not meet the definition of a business as defined by U.S. Generally Accepted Accounting Principles, or GAAP. Consequently, the assets, liabilities and operations that are reflected in Exicure's historical financial statements prior to the Merger will be those of Exicure OpCo, and the consolidated financial statements after completion of the Merger will include the assets, liabilities and results of operations of Exicure OpCo up to the day prior to the closing of the Merger and the assets, liabilities and results of operations of the combined company from and after the closing date of the Merger. The assets and liabilities of Max-1 included in the accompanying consolidated financial statements are recorded at the historical cost basis of Max-1.

Private Placement

Following the Effective Time of the Merger, we held several closings of the Private Placement on September 26, 2017, October 27, 2017 and November 2, 2017 in which we sold to accredited investors approximately \$31.5 million worth of shares of common stock (before deducting placement agent fees and expenses which are approximately \$4.0 million), or 10,504,196 shares, at a price of \$3.00 per share. Also, we granted the investors in the Private Placement registration rights requiring us to register those shares of common stock for public resale. The then existing stockholders of Exicure OpCo who agreed to become parties to the registration rights agreement also became entitled to such registration rights. We filed and caused to become effective a registration statement with the SEC on February 6, 2018 registering the resale of 39,714,143 shares of our common stock (including shares underlying warrant agreements) issued in connection with the Merger and the Private Placement.

Each investor in any subsequent closing of the Private Placement, or a Subsequent Closing, was required to represent that, at the time of the applicable closing, it (i) had a substantive, pre-existing relationship with us, or had direct contact with the Company or the Placement Agents or other enumerated parties outside of the Private Placement, (ii) was not identified or contacted through the marketing of the Private Placement, and (iii) did not independently contact us as a result of general solicitation by means of any of our SEC filings, any press release or any other public disclosure disclosing the material terms of the Private Placement.

Segment Reporting

We view our operations and manage our business as one segment, which is the discovery, research and development of treatments based on our SNA technology.

Critical Accounting Policies and Significant Judgments and Estimates

Our management's discussion and analysis of financial condition and results of operations is based on our financial statements, which have been prepared in accordance with GAAP. The preparation of these financial statements requires us to make estimates and assumptions that affect the reported amounts of assets and liabilities and the disclosure of contingent assets and liabilities at the date of the financial statements, as well as the revenue and expenses incurred during the reported periods. We base our estimates on historical experience and on various other factors that we believe are reasonable under the circumstances, the results of which form the basis for making judgments about the carrying value of assets and liabilities that are not apparent from other sources. Changes in estimates are reflected in reported results for the period in which they become known. Actual results may differ from these estimates under different assumptions or conditions.

While our significant accounting policies are described in the notes to our financial statements appearing in this Annual Report on Form 10-K, we believe that the following critical accounting policies are most important to understanding and evaluating our reported financial results.

Revenue recognition

We recognize revenue when the following criteria have been met: (1) persuasive evidence of an arrangement exists; (2) delivery has occurred or services have been rendered and risk of loss has passed; (3) the fee is fixed or determinable; and (4) collectability is reasonably assured. When payments are received in advance of recognizing revenue, we include the amount in deferred revenue on the balance sheet. Amounts deferred that are not anticipated to be recognized as revenue within a year of the balance sheet date are classified as noncurrent liabilities.

We have generated all of our revenue to date through our research collaboration, license, and option agreement with Purdue or as a primary contractor or as a subcontractor on government grants. We have not generated any commercial product revenue. Historically, our research collaborations and grants have been either as a direct contractor or as a sub-awardee on contracts funded by various governmental agencies.

In arrangements involving the delivery of more than one element, each required deliverable is evaluated to determine whether it qualifies as a separate unit of accounting. The determination is based on whether the deliverable has “standalone value” to the customer. If a deliverable does not qualify as a separate unit of accounting, it is combined with the other applicable undelivered item(s) within the arrangement and these combined deliverables are treated as a single unit of accounting.

The arrangement’s consideration that is fixed or determinable is allocated to each separate unit of accounting based on the relative selling price methodology in accordance with the selling price hierarchy, which includes vendor-specific objective evidence, or VSOE, of selling price, if available, or third-party evidence of selling price if VSOE is not available, or the best estimate of selling price, if neither VSOE nor third-party evidence is available.

Payments or reimbursements for our research and development efforts for the arrangements where such efforts are considered as deliverables are recognized as the services are performed and are presented on a gross basis. When upfront payments are received and if there is no discernible pattern of performance and/or objectively measurable performance measures do not exist, we recognize revenue ratably over the associated period of performance.

Purdue Collaboration

On December 2, 2016, Exicure entered into a research collaboration, option and license agreement with Purdue and referred to as the Purdue Collaboration. Purdue has the option to obtain from us the full worldwide development and commercial rights to AST-005 (the Company’s lead therapeutic candidate that targets tumor necrosis factor), an option to obtain three additional collaboration targets and a further option to obtain from us the full worldwide development and commercial rights to any therapeutic candidates developed targeting the three additional collaboration targets. Additionally, Purdue has rights of first offer to some potential collaboration targets. These rights of first offer are subject to limitations in time and scope. In connection with the Purdue Collaboration, we received a non-refundable development fee of \$10.0 million. In addition, we are eligible to receive up to \$776.5 million upon successful completion of certain research, regulatory and commercial sales milestones. The research milestones are payable upon target identification and IND-enabling pre-clinical development, per program, with an aggregate total of up to \$16.5 million. The regulatory milestones are payable upon the initiation or completion of clinical trials, and regulatory approval in the United States and outside the United States, per program, with an aggregate total of up to \$410.0 million. The commercial sales milestones are payable upon achievement of specified aggregate product sales thresholds and total up to \$350.0 million. There can be no assurance these milestones will be achieved as they are subject to highly significant risks and uncertainties, many of which are outside of our control. In the event a therapeutic candidate subject to the collaboration results in commercial sales, the Company is eligible to receive royalties ranging from the low single digits to a maximum of 10% on future net sales of such commercialized therapeutic candidates. Additionally, Purdue had an obligation to invest in a qualified equity financing of the Company if such financing was completed before June 2, 2017. We did not complete such qualified equity financing before June 2, 2017.

In accordance with ASC 605-25, we identified the following deliverables at the inception of the Purdue Collaboration agreement: (1) exclusive rights to the TNF- α target, (2) the obligation to participate in a joint research committee, (3) the provision of research and development activities based on a prescribed full-time employee rate per year, (4) a non-voting board of director observer role, (5) Purdue’s right to participate in a future qualified equity financing of the Company if such financing occurs prior to June 2, 2017 or the pricing of the initial public offering of shares of the Company’s common stock, (6) the option for an exclusive development and commercialization license to AST-005 or a TNF- α development candidate other than AST-005, (7) the option to select and develop three additional collaboration targets, and (8) the option for an exclusive development and commercialization license to any developed therapeutic candidate targeting the three additional collaboration targets. We determined that deliverables (2), (4), (5), and (6) do not have stand-alone value to Purdue, and accordingly, deliverables (2), (4), (5) and (6) were combined with deliverables (1) and (3) as a single unit of accounting. We concluded that, at the inception of the agreement, deliverables (7) and (8) are substantive options and do not contain a significant or incremental discount; as a result, no portion of the upfront \$10.0 million is allocated to deliverables (7) and (8).

The upfront payment of \$10.0 million was allocated to the single unit of accounting consisting of deliverables (1), (2), (3), (4), (5), and (6) above and was recorded as deferred revenue and is being recognized on a ratable basis over the estimated performance period of the relevant research and development activities of 14.5 months.

During the years ended December 31, 2017 and 2016, we recognized collaboration revenue of \$9.7 million and \$0.7 million, respectively, which included \$1.4 million and zero, respectively, of research and development activities that have been or will be reimbursed by Purdue and is presented on a gross basis in the accompanying consolidated statement of operations. As of December 31, 2017 and 2016, deferred revenue relating to the Purdue Collaboration was \$1.0 million and \$9.3 million, respectively, of which \$1.0 million and \$8.3 million, respectively, is classified as the current portion of deferred revenue in the accompanying consolidated balance sheet.

The Purdue Collaboration agreement includes contingent payments related to specified research, development and regulatory milestones and sales-based milestones. Each contingent and milestone payment is evaluated to determine whether it is substantive and at risk to both parties. We recognize any payment that is contingent upon the achievement of a substantive milestone entirely in the period in which the milestone is achieved. Any payments that are contingent upon achievement of a non-substantive milestone are recognized as revenue prospectively, when such payments become due and collectible, over the remaining expected performance period under the arrangement, which is generally the remaining period over which the research and development services are expected to be provided. To date, we have not recognized any contingent payments in connection with the Purdue Collaboration as revenue.

Equity-based compensation

We measure the cost of common stock option awards at fair value and record the cost of the awards, net of estimated forfeitures, on a straight-line basis over the requisite service period. We measure fair value for all common stock options using the Black-Scholes option-pricing model. For all common stock option awards to employees, the fair value measurement date is the date of grant and the requisite service period is the period over which the employee is required to provide service in exchange for the common stock option awards, which is generally the vesting period. For all common stock option awards to nonemployees, we remeasure fair value at each financial statement reporting date and recognize compensation expense as services are rendered, generally on a straight-line basis.

The Black-Scholes option-pricing model requires the input of highly subjective assumptions, including: (1) the estimated grant date fair value of Exicure's or Exicure OpCo's (as the case may be) common stock; (2) the option exercise price; (3) the expected term of the option in years; (4) the annualized volatility of the stock; (5) the risk-free interest rate; and (6) the annual rate of quarterly dividends on the stock.

The Company's common stock has not yet been publicly traded, therefore the Company estimates the fair value of its common stock underlying its common stock options. The grant date fair value of the Company's common stock has been determined by the Board exercising their judgment in the consideration of a variety of factors. For financial reporting purposes, the Company has periodically estimated the per share fair value of Exicure OpCo's common stock at various dates using valuations performed in accordance with the guidance outlined in the American Institute of Certified Public Accountants Practice Aid, Valuation of Privately-Held Company Equity Securities Issued as Compensation (Practice Aid). At December 31, 2017, for financial reporting purposes and principally to aid Exicure in the revaluation of certain common stock option awards to non-employees and certain warrant liabilities, Exicure estimated the per share fair value of its common stock to be \$3.00, which is the per share price paid by outside investors in the Private Placement on September 26, 2017, October 27, 2017, and November 2, 2017.

The expected term is based upon the "simplified method" as described in Staff Accounting Bulletin Topic 14.D.2. Currently, the Company does not have sufficient experience to provide a reasonable estimate of an expected term of its common stock options. The Company will continue to use the "simplified method" until there is sufficient experience to provide a more reasonable estimate in conformance with ASC 718-10-30-25 through 30-26. The risk-free interest rate assumptions were based on the U.S. Treasury bond rate appropriate for the expected term in effect.

at the time of grant. The expected volatility is based on calculated enterprise value volatilities for publicly traded companies in the same industry and general stage of development. The estimated forfeiture rates were based on historical experience for similar classes of employees. The dividend yield was based on expected dividends at the time of grant.

Common stock warrant liability

Freestanding warrants related to shares that are redeemable, contingently redeemable, or for purchases of common stock that are not indexed to the Company's own stock are classified as a liability on the Company's balance sheet. The common stock warrants are recorded at fair value, estimated using the Black-Scholes option-pricing model, and marked to market at each balance sheet date with changes in the fair value of the liability recorded in other income (expense), net in the statements of operations.

A 10% change in the estimate of expected volatility at December 31, 2017 would increase or decrease the aggregate fair value of the common stock warrant liability in the amount of \$45,000 . A 10% change in the estimate of fair value of the common stock at December 31, 2017 would increase or decrease the aggregate fair value of the common stock warrant liability in the amount of \$87,000 .

Recently adopted accounting pronouncements

In March 2016, the Financial Accounting Standards Board, or FASB, issued Accounting Standards Update, or ASU, 2016-09, *Improvements to Employee Share-Based Payment Accounting* . ASU 2016-09 changes several aspects of the accounting for share-based payment transactions, including the income tax consequences, classification of awards as either equity or liabilities, and classification on the statement of cash flows. ASU 2016-09 requires all excess tax benefits and tax deficiencies to be recognized as income tax expense or benefit in the income statement and treated as discrete items in the reporting period. Further, excess tax benefits are required to be classified along with other income tax cash flows as an operating activity. The guidance was effective for the Company in the first quarter of 2017. Adoption of this guidance did not have a significant impact to the Company's financial statements.

Recent accounting pronouncements not yet adopted

In May 2014, the FASB, issued ASU, 2014-09 (ASC 606), *Revenue from Contracts with Customers* . This ASU, as amended by ASU 2015-14, affects any entity that either enters into contracts with customers to transfer goods and services or enters into contracts for the transfer of nonfinancial assets. ASU 2014-09 will replace most existing revenue recognition guidance in GAAP when it becomes effective. The standard's core principle is that a company will recognize revenue when it transfers promised goods or services to customers in an amount that reflects the consideration to which the company expects to be entitled in exchange for those goods or services. In doing so, companies will need to use more judgment and make more estimates than under the currently effective guidance. These may include identifying performance obligations in the contract, estimating the amount of variable consideration to include in the transaction price and allocating the transaction price to each separate performance obligation. ASU 2014-09 is effective for Exicure in the first quarter of 2018 and early adoption is permitted beginning in the first quarter of 2017. The Company intends to adopt this standard on January 1, 2018 on a modified retrospective basis and continues to analyze and assess the impact, if any, of this standard on its financial statements.

In February 2016, FASB issued ASU 2016-02, *Leases (Topic 842)* , which requires lessees to recognize right-of-use assets and lease liabilities on the balance sheet. ASU 2016-02 is to be applied using a modified retrospective approach at the beginning of the earliest comparative period in the financial statements. ASU 2016-02 will be effective for the Company beginning in the first quarter of 2019. Early adoption is permitted. The Company is currently evaluating the impact of adopting this standard on its financial statements.

In August 2016, the FASB issued ASU 2016-15, *Statement of Cash Flows (Topic 230): Classification of Certain Cash Receipts and Cash Payments* . ASU 2016-15 addresses the classification of certain specific cash flow issues

including debt prepayment or extinguishment costs, settlement of certain debt instruments, contingent consideration payments made after a business combination, proceeds from the settlement of certain insurance claims and distributions received from equity method investees. ASU 2016-15 is effective for the Company in the first quarter of 2018 and early adoption is permitted. An entity that elects early adoption must adopt all of the amendments in the same period. The Company is currently evaluating the impact of this guidance on its statement of cash flows.

In May 2017, the FASB issued ASU 2017-09, *Compensation - Stock Compensation (Topic 718): Scope of Modification Accounting*. ASU 2017-09 clarifies when changes to the terms or conditions of a share-based payment award must be accounted for as modifications. Under the new guidance, modification accounting is required only if the fair value, the vesting conditions, or the classification of the award changes as a result of the change in terms or conditions. ASU 2017-09 will be applied prospectively to awards modified on or after the adoption date. ASU 2017-09 is effective for the Company for fiscal years beginning after December 15, 2017, and interim periods within those fiscal years. Early adoption is permitted. The Company is currently evaluating the impact of this guidance on its financial statements.

Components of Statements of Operations

Revenue

We have earned all of our revenue through December 31, 2017 through our research collaboration, license, and option agreement with Purdue or as a primary contractor or as a subcontractor on government grants. We do not intend for government grants to be a principal commercial or strategic focus, but will evaluate opportunities when consistent with our strategic priorities. We have not generated any commercial product revenue and do not expect to generate any product revenue for the foreseeable future.

In the future, we may generate revenue from partnership activities including a combination of research and development payments, license fees and other upfront payments, milestone payments, product sales and royalties, and reimbursement of certain research and development expenses, in connection with the Purdue Collaboration or any future collaborations and licenses. We expect that any such revenue we generate will fluctuate in future periods as a result of the timing of achievement, if at all, of preclinical, clinical, regulatory and commercialization milestones, the timing and amount of any payments to us relating to such milestones and the extent to which any of our therapeutic candidates are approved and successfully commercialized by us or potential development partners. If we, or any potential development partner fails to develop therapeutic candidates in a timely manner or obtain regulatory approval for them, our ability to generate future revenue, and our results of operations and financial position, would be materially and adversely affected.

Research and development expense

Research and development expense consists of costs associated with our research activities, including discovery and development of our SNAs, and their therapeutic applications. Our research and development expenses include:

- direct research and development expenses incurred under arrangements with third parties, such as contract research organizations, contract manufacturing organizations, and consultants;
- laboratory materials and supplies;
- costs of maintaining our intellectual property portfolio, including license fees, sublicense fees, patent maintenance and other similar fees;
- employee-related expenses, including salaries, bonuses, benefits and equity-based compensation expense; and

- facilities, depreciation and other allocated expenses, which include direct and allocated expenses for rent and maintenance of facilities, depreciation of leasehold improvements and equipment and laboratory and other supplies.

We expense research and development costs as they are incurred. A significant portion of our research and development costs are not tracked by project as they benefit multiple projects or our technology.

We expect our research and development expenses to increase for the foreseeable future as we advance our therapeutic candidates through preclinical studies and clinical trials. The process of conducting preclinical studies and clinical trials necessary to obtain regulatory approval is costly and time-consuming. We or future development partners may never succeed in obtaining marketing approval for any of our therapeutic candidates. The probability of success for each therapeutic candidate may be affected by numerous factors, including preclinical data, clinical data, competition, manufacturing capability and commercial viability.

All of our research and development programs are at an early stage and successful development of future therapeutic candidates from these programs is highly uncertain and may not result in approved products. Completion dates and completion costs can vary significantly for each future therapeutic candidate and are difficult to predict. We anticipate we will make determinations as to which therapeutic candidates to pursue and how much funding to direct to each therapeutic candidate on an ongoing basis in response to our ability to maintain or enter into development partnership with respect to each therapeutic candidate, the scientific and clinical success of each therapeutic candidate as well as ongoing assessments as to the commercial potential of therapeutic candidates. We will need to raise additional capital and may seek collaborations in the future in order to advance our various therapeutic candidates. Additional private or public financings may not be available to us on acceptable terms, or at all. Our failure to raise capital as and when needed would have a material adverse effect on our financial condition and our ability to pursue our business strategy.

General and administrative expense

General and administrative expense consists primarily of salaries and related benefits, including equity-based compensation, related to our executive, finance, legal, business development and support functions. Other general and administrative expenses include travel expenses, professional fees for auditing, tax and legal services and allocated facility-related costs not otherwise included in research and development expenses.

We expect that general and administrative expenses will increase in the future as we expand our operating activities and incur additional costs associated with being a publicly-traded company. These increases will likely include legal, accounting and filing fees, directors' and officers' liability insurance premiums and fees associated with investor relations.

Interest expense

Interest expense consists of interest expense pursuant to the loan and security agreement with Hercules Technology Growth Capital, or Hercules, that we closed on February 17, 2016 with an initial advance of \$6.0 million.

Other income (loss), net

Other income (loss), net consists of interest income earned on our cash and cash equivalents, fair value adjustments of our preferred and common stock warrant liabilities, and gains and losses on foreign currency transactions.

Results of Operations

Comparison of the Years Ended December 31, 2017 and 2016

The following table summarizes the results of our operations for the years ended December 31, 2017 and 2016:

<i>(dollars in thousands)</i>	Year Ended December 31,		Change	
	2017	2016		
Revenue:				
Collaboration revenue	\$ 9,719	\$ 690	\$ 9,029	1,309 %
Grant income	—	346	(346)	(100)%
Total revenue	9,719	1,036	8,683	838 %
Operating expenses:				
Research and development expense	14,108	13,659	449	3 %
General and administrative expense	7,046	3,539	3,507	99 %
Total operating expenses	21,154	17,198	3,956	23 %
Operating loss	(11,435)	(16,162)	4,727	(29)%
Other income (expense), net:				
Interest expense	(795)	(724)	(71)	10 %
Other income (loss), net	191	(55)	246	n/m
Total other income (loss), net	(604)	(779)	175	(22)%
Net loss	\$ (12,039)	\$ (16,941)	\$ 4,902	(29)%

Revenue

The following table summarizes our revenue recognized during the periods indicated:

<i>(dollars in thousands)</i>	Year Ended December 31,		Change	
	2017	2016		
Collaboration revenue	\$ 9,719	\$ 690	\$ 9,029	1,309 %
Grant income	—	346	(346)	(100)%
Total revenue	\$ 9,719	\$ 1,036	\$ 8,683	838 %

We recognized revenue of \$9.7 million and \$1.0 million for the years ended December 31, 2017 and 2016, respectively. In connection with the Purdue Collaboration, we received a non-refundable development fee of \$10.0 million in December 2016 which was deferred and is recognized as collaboration revenue over the period in which the revenue is earned. All of our revenue recognized during the year ended December 31, 2017 was in connection with the Purdue Collaboration and included \$1.4 million of research and development activities that is reimbursable by Purdue and is presented on a gross basis in the accompanying consolidated statement of operations. We recognized \$0.7 million of collaboration revenue in the year ended December 31, 2016 related to one month of amortization of deferred revenue mentioned above. The grant income revenue of \$0.3 million recognized during the year ended December 31, 2016 related to our performance as a primary contractor or as a subcontractor on government grants that concluded in early 2016. We did not have any active grants as of December 31, 2017 and 2016.

We do not intend for government grants to be a principal commercial or strategic focus, but will evaluate opportunities when consistent with our strategic priorities. We do not expect to generate any product revenue for the foreseeable future. However, future revenue may include amounts attributable to partnership activities including, a combination of research and development payments, license fees and other upfront payments, milestone payments, product sales and royalties, and reimbursement of certain research and development expenses, in connection with the Purdue Collaboration or any future collaboration and licenses.

Research and development expense

The following table summarizes our research and development expenses incurred during the periods indicated:

<i>(dollars in thousands)</i>	Year Ended December 31,		Change	
	2017	2016		
Clinical development programs expense	\$ 7,518	\$ 5,315	\$ 2,203	41 %
Platform and discovery-related expense	3,146	5,314	(2,168)	(41)%
Employee-related expense	2,583	2,196	387	18 %
Facilities, depreciation, and other expenses	861	834	27	3 %
Total research and development expense	\$ 14,108	\$ 13,659	\$ 449	3 %
 Full time employees (end of period)	 16	 17	 (1)	

Research and development expense was \$14.1 million for the year ended December 31, 2017 and \$13.7 million for the year ended December 31, 2016, an increase of \$0.4 million, or 3%. Included in clinical development expense for the year ended December 31, 2017 was approximately \$1.4 million of expense that is reimbursed by Purdue (included in revenue) related to the Phase 1b trial of AST-005. The increase in research and development expense of \$0.4 million was primarily due to a net increase in costs related to our clinical development programs of \$2.2 million and higher employee-related expenses of \$0.4 million, mostly offset by lower platform and discovery-related expense of \$2.2 million.

The net increase in clinical development programs expense of \$2.2 million was mostly due to higher costs for preparation for the Phase 1 clinical trials of both AST-008 and XCUR17. Higher employee-related expense of \$0.4 million was mostly the result of salary increases and a change in mix of scientific staff as well as higher bonus expense. The decrease in platform and discovery-related expense of \$2.2 million is mostly due to the absence of a Northwestern University license agreements fee and lower costs related to contract research organizations, partially offset by higher costs to maintain our intellectual property portfolio.

We expect our research and development expenses to increase in 2018 as we continue spending on our clinical development programs, further develop our SNA technology platform and broaden our pipeline of SNA-based candidates.

General and administrative expense

The following table summarizes our general and administrative expense incurred during the periods indicated:

<i>(dollars in thousands)</i>	Year Ended December 31,		Change	
	2017	2016		
General and administrative expense	\$ 7,046	\$ 3,539	\$ 3,507	99%
Full time employees	7	6	1	

General and administrative expense was \$7.0 million for the year ended December 31, 2017 and \$3.5 million for the year ended December 31, 2016, an increase of \$3.5 million, or 99%. This increase is primarily due to higher costs for legal and accounting services of approximately \$1.7 million, which were incurred in support of a potential public offering that was abandoned during the second quarter of 2017 as well as in support of registering the resale of 39,714,143 shares of our common stock issued in connection with the Merger and the Private Placement. Also contributing to the increase in general and administrative expense in the year ended December 31, 2017 was higher equity-based compensation expense of \$0.8 million, mostly related to stock options granted in January 2017, \$0.3 million higher expense associated with preparing to be a publicly-traded company including transfer agent and compliance-related costs as well as higher director's and officers' liability insurance costs, higher compensation and related expense of \$0.2 million, and expense of \$0.2 million related to the termination of a contract with a placement agent that did not participate in the Private Placement.

We expect that general and administrative expenses will increase in the future as we expand our operating activities and incur additional costs associated with being a publicly-traded company. These increases will likely include legal, accounting and filing fees, directors' and officers' liability insurance premiums and fees associated with investor relations.

Interest expense

Interest expense consists of interest expense pursuant to the loan and security agreement with Hercules that we closed on February 17, 2016 with an initial advance of \$6.0 million.

Other income (loss), net

Other income (loss), net consists of interest income earned on our cash and cash equivalents, fair value adjustments of our preferred and common stock warrant liabilities, and gains and losses on foreign currency transactions. Other income, net of \$0.2 million for the year ended December 31, 2017 included a gain of \$0.2 million in connection with the fair value adjustment of the liability for the preferred stock warrants that terminated in connection with the Merger.

Liquidity and Capital Resources

Overview

To date we have primarily funded our operations through private placements of equity securities, the Purdue Collaboration, a debt financing, and grants from governmental agencies. Through December 31, 2017, we have received approximately \$95.3 million in aggregate gross proceeds from these transactions, including \$42.8 million in aggregate gross proceeds from private placement offerings of preferred stock, \$31.5 million in gross proceeds from the Private Placement, an upfront payment of \$10.0 million in connection with the Purdue Collaboration, \$6.0 million in debt financing, and an aggregate of \$5.0 million from grants awarded by governmental agencies.

Since our inception, we have not generated any product revenue and have incurred recurring net losses. Our Company is not profitable, and we cannot provide any assurance that we will ever be profitable. As of December 31,

2017, we have an accumulated deficit of \$53.5 million . We believe that our cash and cash equivalents of \$25.8 million as of December 31, 2017 is sufficient to fund the Company for the next twelve months as of the date of this report. See “—Funding Requirements” below for additional information on our future capital needs.

Cash Flows

The following table shows a summary of our cash flows for the years ended December 31, 2017 and 2016:

<i>(in thousands)</i>	Year Ended December 31,	
	2017	2016
Net cash used in operating activities	\$ (19,789)	\$ (5,050)
Net cash used in investing activities	(926)	(394)
Net cash provided by financing activities	26,856	6,336
Net increase in cash and cash equivalents	\$ 6,141	\$ 892

Operating activities

Net cash used in operating activities was \$19.8 million and \$5.1 million for the years ended December 31, 2017 and 2016, respectively. The increase in cash used in operating activities of \$14.7 million was primarily due to the cash impact of higher research and development expenses in the year ended December 31, 2017, the payment for legal and accounting services of approximately \$1.5 million, which were incurred in support of a potential public offering that was abandoned during the second quarter of 2017 and also in support of registering the resale of 39,714,143 shares of our common stock issued in connection with the Merger and the Private Placement, the payment of \$1.5 million in connection with the Northwestern University license agreements, as well as the prepayment of directors and officers liability insurance, partially offset by the receipt of the \$10.0 million upfront payment in connection with the Purdue Collaboration in December 2016.

Investing activities

Net cash used in investing activities was \$0.9 million and \$0.4 million for the years ended December 31, 2017 and 2016, respectively. Cash used in investing activities for each of the above-mentioned periods was primarily due to the purchase of scientific equipment.

Financing activities

Net cash provided by financing activities of \$26.9 million during the year ended December 31, 2017 is primarily due to the sale of common stock in the Private Placement. Gross proceeds from the Private Placement of \$31.5 million , less financing costs paid in 2017 of \$3.7 million , were partially offset by the repayment of debt of \$1.0 million . Net cash provided by financing activities of \$6.3 million during the year ended December 31, 2016 is mostly due to net proceeds of \$5.9 million from our February 2016 secured debt financing with Hercules and \$0.4 million from our January 2016 Series C preferred stock offering.

Hercules Loan and Security Agreement

On February 17, 2016, we entered into a loan and security agreement with Hercules. The loan agreement provided for funding in an aggregate principal amount of up to \$10.0 million in two separate tranches. The first tranche was funded on February 17, 2016 in the amount of \$6.0 million. A second tranche of \$4.0 million was available provided that we met certain milestones on or before December 31, 2016. We did not meet these milestones and, therefore, we did not draw the second tranche, the availability of which expired on December 31, 2016. The principal balance of the term loan under the Hercules loan facility bears interest at a floating per annum

interest rate (based on a year consisting of 360 days) equal to the greater of either (i) 9.95% or (ii) the sum of (a) 9.95% plus (b) the prime rate (as reported in The Wall Street Journal) minus 3.50%. We were required to make interest-only payments through June 2017. Commencing on July 1, 2017, the loan began amortizing in equal monthly installments of principal and interest in an amount sufficient to fully amortize the outstanding principal balance of the loan over the remaining scheduled monthly payments due prior to the maturity date on September 1, 2019. Pursuant to an amendment dated January 15, 2018, amortization payments due for the thirteen (13) consecutive months commencing on December 1, 2017 through and including December 1, 2018 were deferred. Commencing on January 1, 2019, and continuing on the first business day of each month thereafter, the loan, including the deferred payments, shall begin amortizing in equal monthly installments of principal and interest based upon an amortization schedule equal to eighteen (18) consecutive months. Any remaining obligations under the loan agreement and other loan documents (other than the warrant described below) are due and payable on the maturity date. On the earliest to occur of the maturity date, the date we prepay the term loan in full or the date the loan otherwise becomes due and payable, we must pay the lender under the agreement an additional charge equal to 3.85% of the total amounts funded under the loan agreement. In addition, if we prepaid the term loan on or prior to February 1, 2017, we would be required to pay a prepayment charge equal to 3% of the amount being prepaid, if we prepaid the term loan after February 1, 2017 but on or prior to February 1, 2018, we would be required to pay a prepayment charge equal to 2% of the amount being prepaid, and if we prepay the term loan after February 1, 2018, we must pay a prepayment charge of 1% of the amount being prepaid. As of the date of this Annual Report on Form 10-K, we have not prepaid the Hercules term loan. The loan agreement was amended on October 10, 2016 to revise the language granting Hercules a contingent security interest in certain of our assets.

The term loan under the Hercules loan facility is secured by substantially all of our assets, other than intellectual property, which is the subject of a negative pledge. Under the loan agreement, we are subject to certain customary covenants that limit or restrict our ability to, among other things, incur additional indebtedness, grant any security interests, pay cash dividends, repurchase our common stock, make loans, or enter into certain transactions without Hercules' prior consent.

Under the loan agreement, Hercules or its affiliates have a right to participate in a single subsequent unregistered financing by us in an amount of up to \$1.0 million on the same terms, conditions and pricing afforded to others participating in such financing. Hercules has not yet exercised this right to participate which expires on the earliest to occur of the maturity date, the date we prepay the term loan in full or the date the loan otherwise becomes due and payable.

In connection with the Hercules loan agreement, we issued Hercules a warrant to purchase up to 80,000 shares of our Series C preferred stock at an exercise price of \$3.00 per share, plus an additional number of shares in the event that the second tranche of funding had been drawn before it expired on December 31, 2016. The warrant terminated at the closing of the Merger.

Funding Requirements

We expect that our primary uses of capital will continue to be third-party clinical research and development services, compensation and related expenses, laboratory and related supplies, legal and other regulatory expenses and general overhead costs. We believe that our existing cash and cash equivalents as of December 31, 2017 is sufficient to meet our anticipated cash requirements for the next twelve months as of the date of this report. However, we may require additional capital for the further development of our existing therapeutic candidates and may also need to raise additional funds sooner to pursue other development activities related to additional therapeutic candidates. We believe that we will be able to obtain additional working capital through equity financings, partnerships and licensing, or other arrangements to fund our current operating plans, which we believe will allow us to execute on the strategy and pipeline development as described in this report. To the extent that we raise additional capital through future equity financings, the ownership interest of our stockholders will be diluted, and the terms of these securities may include liquidation or other preferences that adversely affect the rights of our existing common stockholders. If we raise additional funds through the issuance of debt securities, these securities could contain covenants that would restrict our operations. We cannot assure you that such additional financing, if available, can be obtained on terms acceptable to us. If we are unable to obtain such additional financing, we would need to reevaluate our future operating plans.

Our forecast of the period of time through which our financial resources will be adequate to support our operations is a forward-looking statement that involves risks and uncertainties, and actual results could vary materially as a result of a number of factors. We have based this estimate on assumptions that may prove to be wrong, and we could utilize our available capital resources sooner than we currently expect. Our future capital requirements are difficult to forecast and will depend on many factors, including:

- the terms and timing of any other collaboration, licensing and other arrangements that we may establish;
- the initiation, progress, timing and completion of preclinical studies and clinical trials for our potential therapeutic candidates;
- the number and characteristics of therapeutic candidates that we pursue;
- the progress, costs and results of our preclinical studies and clinical trials;
- the outcome, timing and cost of regulatory approvals;
- delays that may be caused by changing regulatory requirements;
- the cost and timing of hiring new employees to support our continued growth;
- unknown legal, administrative, regulatory, accounting, and information technology costs as well as additional costs associated with operating as a public company;
- the costs involved in filing and prosecuting patent applications and enforcing and defending patent claims;
- the costs of filing and prosecuting intellectual property rights and enforcing and defending any intellectual property-related claims;
- the costs and timing of procuring clinical and commercial supplies of our therapeutic candidates;
- the extent to which we acquire or in-license other therapeutic candidates and technologies; and
- the extent to which we acquire or invest in other businesses, therapeutic candidates or technologies.

Please see the section titled “Risk Factors” elsewhere in this Annual Report on Form 10-K for additional risks associated with our substantial capital requirements.

Until such time, if ever, we generate product revenue, we expect to finance our cash needs through a combination of public or private equity offerings, debt financings and research collaboration and license agreements. We may be unable to raise capital or enter into such other arrangements when needed or on favorable terms or at all. Our failure to raise capital or enter into such other arrangements as and when needed would have a negative impact on our financial condition and our ability to develop our therapeutic candidates.

Contractual Obligations and Commitments

The following is a summary of our significant contractual obligations as of December 31, 2017 (in thousands):

Contractual Obligations	Payments Due by Period				
	Total	Less than 1 Year	1-3 Years	3-5 Years	After 5 Years
Long-term debt (1)	\$ 4,999	\$ —	\$ 4,999	\$ —	\$ —
Operating lease obligations (2)	1,100	341	700	59	—
Interest payments on long-term debt	864	535	329	—	—
Total	\$ 6,963	\$ 876	\$ 6,028	\$ 59	\$ —

(1) Includes principal only.

(2) Future minimum lease payments under our non-cancelable operating lease for our current office and lab space in Skokie, Illinois that expires in February 2021.

We enter into agreements in the normal course of business with contract research organizations and vendors for clinical trials, preclinical studies, and other services and products for operating purposes which are cancelable at any time by us, generally upon 30 days prior written notice. We also have obligations to make future payments to Northwestern University that become due and payable on the achievement of certain commercial milestones. These payments are not included in this table of contractual obligations.

Off-balance Sheet Arrangements

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

JOBS Act

In April 2012, the JOBS Act was enacted by the federal government. Section 107 of the JOBS Act provides that an emerging growth company can take advantage of the extended transition period for complying with new or revised accounting standards. Thus, an emerging growth company can delay the adoption of certain accounting standards until those standards would otherwise apply to private companies. We have irrevocably elected not to avail ourselves of this extended transition period and, as a result, we will adopt new or revised accounting standards on the relevant dates on which adoption of such standards is required for other public companies.

In addition, as an emerging growth company, we will not be required to provide an auditor’s report on our internal control over financial reporting in this and future annual reports on Form 10-K as otherwise required by Section 404(b) of the Sarbanes-Oxley Act.

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

The primary objectives of our investment activities are to ensure liquidity and to preserve principal while at the same time maximizing the income we receive from our marketable securities without significantly increasing risk. Some of the securities that we invest in may have market risk related to changes in interest rates. As of December 31, 2017 and 2016, we had cash equivalents of \$25.8 million and \$19.6 million, respectively, consisting of interest-bearing money market accounts. Our primary exposure to market risk is interest rate sensitivity, which is affected by changes in the general level of U.S. interest rates. Due to the short-term maturities of our cash equivalents and the low risk profile of our investments, an immediate 100 basis point change in interest rates would not have a material effect on the fair market value of our cash equivalents. To minimize the risk in the future, we intend to maintain our portfolio of cash equivalents and short-term investments in a variety of securities, including commercial paper, money market funds, government and non-government debt securities and corporate obligations.

We are subject to interest rate risk in connection with our borrowings under the \$6.0 million term loan with Hercules. The principal balance of the term loan under the Hercules loan facility bears interest at a floating per annum interest rate (based on a year consisting of 360 days) equal to the greater of either (i) 9.95% or (ii) the sum of (a) 9.95% plus (b) the prime rate (as reported in The Wall Street Journal) minus 3.50% which bears interest at a variable per annum rate calculated for any day as the greater of either (i) the prime rate plus 6.80%, and (ii) 10.55%. We currently do not engage in any interest rate hedging activity and we have no intention to do so in the foreseeable future. Based on the current interest rate of the term loan with Hercules and the scheduled payments thereunder, we believe a 100 basis point increase in interest rates would not have a material impact on our financial condition or results of operations.

Item 8. Financial Statements and Supplementary Data.

**EXICURE, INC.
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Report of Independent Registered Public Accounting Firm

To the Stockholders and Board of Directors
Exicure, Inc.:

Opinion on the Consolidated Financial Statements

We have audited the accompanying consolidated balance sheets of Exicure, Inc. and subsidiary (the Company) as of December 31, 2017 and 2016, the related consolidated statements of operations, stockholders' equity, and cash flows for each of the years in the two-year period ended December 31, 2017, 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, 2017 and 2016, and the results of its operations and its cash flows for each of the years in the two-year period ended December 31, 2017, 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. 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.

(signed) KPMG LLP

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

Chicago, IL
March 9, 2018

EXICURE, INC.

CONSOLIDATED BALANCE SHEETS
(in thousands, except share and per share data)

	December 31, 2017	December 31, 2016
ASSETS		
Current assets:		
Cash and cash equivalents	\$ 25,764	\$ 19,623
Unbilled revenue receivable	13	—
Receivable from related party (Note 12)	17	15
Prepaid expenses and other assets	912	403
Total current assets	26,706	20,041
Property and equipment, net (Note 4)	1,317	503
Other noncurrent assets	32	32
Total assets	\$ 28,055	\$ 20,576
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Current portion of long-term debt (Note 5)	\$ —	\$ 1,213
Accounts payable	1,049	509
Accrued expenses and other current liabilities (Note 4)	1,369	2,160
Current portion of deferred revenue (Note 3)	1,034	8,276
Total current liabilities	3,452	12,158
Long-term debt, net (Note 5)	4,855	4,454
Preferred stock warrant liability (Note 10)	—	201
Common stock warrant liability (Note 10)	523	—
Deferred revenue, net of current portion (Note 3)	—	1,034
Other noncurrent liabilities	278	281
Total liabilities	\$ 9,108	\$ 18,128
Stockholders' equity (Note 6):		
Non-redeemable preferred stock		
Series C: \$0.00001 par value per share; no shares authorized, issued, and outstanding, December 31, 2017; 16,100,000 shares authorized; 11,239,359 shares issued and outstanding, December 31, 2016	—	33,483
Series B-2: \$0.00001 par value per share; no shares authorized, issued, and outstanding, December 31, 2017; 1,403,984 shares authorized, issued and outstanding, December 31, 2016	—	3,641
Series B-1: \$0.00001 par value per share; no shares authorized, issued, and outstanding, December 31, 2017; 2,451,560 shares authorized, issued and outstanding, December 31, 2016	—	5,371
Series A: \$0.00001 par value per share; no shares authorized, issued, and outstanding, December 31, 2017; 11,381,640 shares authorized, issued and outstanding, December 31, 2016	—	135
Common stock, \$0.0001 par value per share; 200,000,000 shares authorized, 39,300,823 issued and outstanding, December 31, 2017; 30,782,380 shares authorized, 131,644 issued and outstanding, December 31, 2016	4	—
Additional paid-in capital	53,586	(17,578)
Accumulated deficit	(34,643)	(22,604)
Total stockholders' equity	18,947	2,448
Total liabilities and stockholders' equity	\$ 28,055	\$ 20,576

See Accompanying Notes to Consolidated Financial Statements.

EXICURE, INC.

CONSOLIDATED STATEMENTS OF OPERATIONS
(in thousands, except share and per share data)

	Year Ended December 31,	
	2017	2016
Revenue:		
Collaboration revenue	\$ 9,719	\$ 690
Grant income	—	346
Total revenue	9,719	1,036
Operating expenses:		
Research and development expense	14,108	13,659
General and administrative expense	7,046	3,539
Total operating expenses	21,154	17,198
Operating loss	(11,435)	(16,162)
Other income (expense), net:		
Interest expense	(795)	(724)
Other income (loss), net	191	(55)
Total other income (loss), net	(604)	(779)
Net loss	\$ (12,039)	\$ (16,941)
Basic and diluted loss per common share	\$ (1.19)	\$ (149.37)
Basic and diluted weighted-average common shares outstanding	10,119,569	113,418

See Accompanying Notes to Consolidated Financial Statements.

EXICURE, INC.

CONSOLIDATED STATEMENTS OF CHANGES IN STOCKHOLDERS' EQUITY
(in thousands, except shares)

	Non-Redeemable Preferred Stock										Additional Paid-in- Capital	Accumulated Deficit	Total Stockholders' Equity
	Series C		Series B-2		Series B-1		Series A		Common Stock				
	Shares	\$	Shares	\$	Shares	\$	Shares	\$	Shares	\$			
Balance at December 31, 2015	11,089,360	\$33,039	1,403,984	\$3,641	2,451,560	\$5,371	11,381,640	\$135	82,849	\$—	\$(18,293)	\$ (5,663)	\$ 18,230
Exercise of options	—	—	—	—	—	—	—	—	48,795	—	33	—	33
Equity-based compensation	—	—	—	—	—	—	—	—	—	—	682	—	682
Issuance of preferred stock, net	149,999	444	—	—	—	—	—	—	—	—	—	—	444
Net loss	—	—	—	—	—	—	—	—	—	—	—	(16,941)	(16,941)
Balance at December 31, 2016	11,239,359	\$33,483	1,403,984	\$3,641	2,451,560	\$5,371	11,381,640	\$135	131,644	\$—	\$(17,578)	\$(22,604)	\$ 2,448
Exercise of options	—	—	—	—	—	—	—	—	58,440	—	43	—	43
Equity-based compensation	—	—	—	—	—	—	—	—	—	—	1,462	—	1,462
Share conversion in connection with the Merger	(11,239,359)	(33,483)	(1,403,984)	(3,641)	(2,451,560)	(5,371)	(11,381,640)	(135)	28,556,543	3	42,596	—	(31)
Issuance of common stock, net	—	—	—	—	—	—	—	—	10,554,196	1	27,063	—	27,064
Net loss	—	—	—	—	—	—	—	—	—	—	—	(12,039)	(12,039)
Balance at December 31, 2017	—	\$ —	—	\$ —	—	\$ —	—	\$ —	39,300,823	\$ 4	\$ 53,586	\$(34,643)	\$ 18,947

See Accompanying Notes to Consolidated Financial Statements.

EXICURE, INC.

CONSOLIDATED STATEMENTS OF CASH FLOWS
(in thousands)

	Year Ended December 31,	
	2017	2016
Cash flows from operating activities:		
Net loss	\$ (12,039)	\$ (16,941)
Adjustments to reconcile net loss to cash used in operating activities:		
Depreciation and amortization	232	180
Equity-based compensation	1,462	682
Amortization of long-term debt issuance costs and fees	189	193
Change in fair value of warrant liabilities	(214)	67
Changes in operating assets and liabilities:		
Unbilled revenue receivable and accounts receivable	(13)	237
Receivable from related party	(2)	42
Prepaid expenses and other current assets	(509)	(244)
Accounts payable	195	(126)
Accrued expenses and other current liabilities	(811)	1,548
Deferred revenue	(8,276)	9,310
Other noncurrent liabilities	(3)	2
Net cash used in operating activities	(19,789)	(5,050)
Cash flows from investing activities:		
Capital expenditures	(926)	(394)
Net cash used in investing activities	(926)	(394)
Cash flows from financing activities:		
Proceeds from common stock offering	31,513	—
Proceeds from preferred stock offering	—	450
Proceeds from long-term borrowing	—	6,000
Proceeds from exercise of common stock options	43	33
Repayment of long-term debt	(1,001)	—
Payment of long-term debt fees and issuance costs	—	(141)
Payment of common stock financing costs	(3,699)	—
Payment of preferred stock financing costs	—	(6)
Net cash provided by financing activities	26,856	6,336
Net increase in cash and cash equivalents	6,141	892
Cash and cash equivalents - beginning of period	19,623	18,731
Cash and cash equivalents - end of period	\$ 25,764	\$ 19,623
Supplemental disclosure of cash flow information		
Non-cash financing activities:		
Common stock issuance costs (accounts payable and accrued expenses)	\$ 214	\$ —
Issuance of common stock warrants	536	—
Issuance of preferred stock warrants	—	134
Debt issuance costs (accounts payable)	—	231
Non-cash investing activities (capital expenditures) included in other accrued expenses	120	11

See Accompanying Notes to Consolidated Financial Statements.

EXICURE, INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (in thousands, except unit, share, per unit, and per share data)

1. Description of Business and Basis of Presentation

Description of Business

Exicure, Inc. (“Parent”) is a clinical-stage biotechnology company developing gene regulatory and immuno-oncology therapeutics based on the Company’s proprietary Spherical Nucleic Acid (“SNA”) technology. We believe the design of the Company’s SNAs gives rise to chemical and biological properties that may provide advantages over other nucleic acid therapeutics and enable therapeutic activity outside of the liver. The Company intends to build a leading nucleic acid therapeutics company focused on the discovery and development of therapeutics based on the Company’s proprietary SNA technology, either on its own or in collaboration with pharmaceutical partners.

Throughout these consolidated financial statements, the terms “the Company” and “Exicure” refer to Parent and its 100% owned subsidiary, Exicure Operating Company. Exicure Operating Company holds all material assets, and conducts all business activities and operations, of the Company.

The Merger

On September 26, 2017, pursuant to the merger agreement, Max-1 Acquisition Sub, Inc., a wholly-owned subsidiary of Max-1 Acquisition Corporation (“Max-1”), merged with and into Exicure Operating Company (f/k/a Exicure, Inc.), a privately-held Delaware corporation referred to herein as Exicure OpCo., with Exicure OpCo remaining as the surviving entity and a wholly-owned operating subsidiary of Max-1 (the “Merger”). The Merger was effective as of September 26, 2017 (the “Effective Time”), upon the filing of a Certificate of Merger with the Secretary of State of the State of Delaware.

At the Effective Time, the legal existence of Max-1 Acquisition Sub, Inc. ceased. At the Effective Time, each share of Exicure OpCo common and preferred stock (other than shares of Exicure OpCo’s Series C preferred stock) issued and outstanding immediately prior to the closing of the Merger was converted into 0.49649 shares of Max-1’s common stock, and each share of Exicure OpCo’s Series C preferred stock issued and outstanding immediately prior to the closing of the Merger was converted into 0.7666652 shares of Max-1’s common stock. As a result, an aggregate of 26,666,627 shares of Max-1’s common stock were issued to the holders of Exicure OpCo’s capital stock, which is incremental to the 2,080,000 shares of Max-1 common stock that were outstanding immediately prior to the Merger. In addition, pursuant to the Merger Agreement, options to purchase 7,414,115 shares of Exicure OpCo common stock issued and outstanding immediately prior to the closing of the Merger were assumed by Max-1 and converted into options to purchase 3,680,997 shares of Max-1’s common stock. After the filing of the Certificate of Merger with the Secretary of State of the State of Delaware, Max-1 changed its name to Exicure, Inc.

The Merger is considered a “reverse merger,” whereby Exicure OpCo is considered the accounting acquirer in the Merger. Exicure OpCo was determined to be the accounting acquirer based on the terms of the Merger and other factors including: (i) legacy Exicure OpCo shareholders own approximately 94% of the combined company on a fully diluted basis immediately following the closing of the Merger, (ii) legacy Exicure OpCo directors will hold all six board seats of the combined company, and (iii) legacy Exicure OpCo management will hold all positions in management of the combined company. The transaction is accounted for as an asset acquisition rather than a business combination because as of the acquisition date, Max-1 does not meet the definition of a business as defined by accounting principles generally accepted in the United States of America (“GAAP”). Consequently, the assets, liabilities and operations that are reflected in Exicure’s historical financial statements prior to the Merger will be those of Exicure OpCo, and the consolidated financial statements after completion of the Merger will include the assets, liabilities and results of operations of Exicure OpCo up to the day prior to the closing of the Merger and the assets, liabilities and results of operations of the combined company from and after the closing date of the Merger. The assets and liabilities of Max-1 included in the accompanying consolidated financial statements are recorded at the historical cost basis of Max-1.

EXICURE, INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (in thousands, except unit, share, per unit, and per share data)

In these consolidated financial statements, unless otherwise indicated, all share and per share figures are retrospectively adjusted to reflect the conversion of each share of Exicure OpCo common and preferred stock (other than shares of Exicure OpCo's Series C preferred stock), preferred stock warrant liability, and common stock options issued and outstanding immediately prior to the closing of the Merger into 0.49649 shares of the Company's common stock, and each share of Exicure OpCo's Series C preferred stock issued and outstanding immediately prior to the closing of the Merger into 0.766652 shares of the Company's common stock.

Capitalization Prior to the Merger

AuraSense Therapeutics, LLC was formed on June 13, 2011 as a wholly owned subsidiary of AuraSense, LLC, but did not conduct substantive business until December 12, 2011, which is considered the inception date. On December 12, 2011, AuraSense, LLC contributed the assets and liabilities comprising the business of the Company to the Company through a Bill of Sale and Assumption Agreement. Pursuant to this agreement AuraSense, LLC received 11,381,611 Class A Units of the Company.

The assets and liabilities contributed by AuraSense, LLC were transferred at their historical cost and consisted of an unbilled revenue receivable of \$143, scientific equipment of \$309 and a liability of \$317 for accrued legal expenses related to patent protection. The net book value of AuraSense, LLC's contribution at inception was \$135.

Also on December 12, 2011, the Company and AuraSense, LLC entered into a Partial Assignment of License Agreement whereby certain license rights held by AuraSense, LLC pursuant to a License Agreement with Northwestern University were assigned to the Company. Under the terms of the License Agreement and the Partial Assignment of License Agreement, Northwestern University received 1.0% of the Class A units received by AuraSense, LLC in the formation transaction, which amounted to 113,816 units.

On July 9, 2015, AuraSense Therapeutics, LLC was converted into AuraSense Therapeutics, Inc., a Delaware corporation, and on the same date changed its name to Exicure, Inc., which actions together are referred to in these Notes to Consolidated Financial Statements as the corporate conversion. In connection with the corporate conversion, each common unit, Class A unit, Class B-1 unit, Class B-2 unit and Class C unit of AuraSense Therapeutics, LLC issued and outstanding immediately prior to the effectiveness of the corporate conversion was converted into one share of common stock, Series A preferred stock, Series B-1 preferred stock, Series B-2 preferred stock and Series C preferred stock of Exicure OpCo, respectively. No preferred stock was provided in consideration for fractional membership units. Each outstanding option to purchase one common unit of AuraSense Therapeutics, LLC was converted into an option to purchase one share of common stock of Exicure OpCo. In connection with the corporate conversion, the accumulated deficit of AuraSense Therapeutics, LLC of \$18,837 was reclassified to Additional paid in capital.

Refer to Note 6, *Stockholders' Equity*, for more information on capital stock transactions.

Basis of Presentation

The accompanying consolidated financial statements as of December 31, 2017 and 2016, and for the years then ended, have been presented in conformity with GAAP.

Principles of consolidation

The accompanying consolidated financial statements include the accounts of Parent and its 100% owned subsidiary, Exicure Operating Company. All intercompany transactions and accounts are eliminated in consolidation.

Liquidity risk

As of December 31, 2017, the Company has generated an accumulated deficit of \$53,480 since inception and expects to incur significant expenses and negative cash flows for the foreseeable future. Based on the Company's

EXICURE, INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
(in thousands, except unit, share, per unit, and per share data)

current operating plans, it believes that existing working capital at December 31, 2017 is sufficient to fund its current operating plans for the next twelve months as of March 9, 2018. Management believes that it will be able to obtain additional working capital through equity financings, partnerships and licensing, or other arrangements, to fund operations. However, there can be no assurance that such additional financing will be available and, if available, can be obtained on terms acceptable to the Company. If the Company is unable to obtain such additional financing, the Company will need to reevaluate future operating plans.

Use of estimates

The preparation of the financial statements in conformity with 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. Management bases its estimates on certain assumptions which it believes are reasonable in the circumstance and while actual results could differ from those estimates, management does not believe that any change in those assumptions in the near term would have a significant effect on the Company's financial position, results of operations or cash flows. Actual results in future periods could differ from those estimates.

2. Significant Accounting Policies

Cash and cash equivalents

The Company considers all highly liquid investments with original maturities of three months or less to be cash equivalents.

Accounts receivable and unbilled revenue receivable

Accounts receivable and unbilled revenue receivable consist of reimbursement for research and development activities in connection with the research collaboration, license, and option agreement with Purdue Pharma L.P. ("Purdue"). The Company's management believes these receivables are fully collectible.

Fair value of financial instruments

The carrying amounts of financial instruments, which include cash and cash equivalents and accounts payable, approximate their respective fair values due to the relatively short-term nature of these instruments. Management believes that the Company's long-term debt bears interest at the prevailing market rate for instruments with similar characteristics and, accordingly, the carrying value of long-term debt also approximates their fair value.

Concentrations of credit risk and other risks and uncertainties

Financial instruments that potentially expose the Company to concentrations of credit risk consist primarily of cash and cash equivalents. As of December 31, 2017 and 2016, the Company had cash and cash equivalents of \$25,764 and \$19,623, respectively. The cash balances at each respective period were maintained at two institutions. These deposits exceed federally insured limits.

The Company is currently not profitable and no assurance can be provided that it will ever be profitable. The Company's research and development activities have required significant investment since inception and operations are expected to continue to require cash investment in excess of its revenues. See also Note 1, *Description of Business and Basis of Presentation—Liquidity risk*, for more information.

The Company is subject to risks common in therapeutic development including, but not limited to, therapeutic candidates that appear promising in the early phases of development often fail because they prove to be inefficacious or unsafe, clinical trial results are unsuccessful, regulatory bodies may not approve the therapeutic or the therapeutic may not be economical in production or distribution. The Company is also subject to risks common to

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biotechnology firms including, but not limited to new and disruptive technological innovations, dependence on key personnel, protection of proprietary technology, the validity of and continued access to its owned and licensed intellectual property, limitations on the supply of critical materials, compliance with governmental regulations and market acceptance.

Property and equipment

Property and equipment are recorded at cost and depreciated using the straight-line method over the estimated useful lives of the various classes of property and equipment, which range from three to seven years. Leasehold improvements are amortized using the straight-line method over the shorter of the remaining terms of the respective leases or the estimated lives of the assets. Depreciation begins at the time the asset is placed in service.

Property and equipment are reviewed for impairment at least annually or whenever events or changes in circumstances indicate that the carrying amount of an asset may not be recoverable. No impairment losses were recorded from inception in December 2011 through December 31, 2017.

Common stock warrant liability

Freestanding warrants related to shares that are redeemable, contingently redeemable, or for purchases of common stock that are not indexed to the Company's own stock are classified as a liability on the Company's balance sheet. The common stock warrants are recorded at fair value, estimated using the Black-Scholes option-pricing model, and marked to market at each balance sheet date with changes in the fair value of the liability recorded in other income (expense), net in the statements of operations.

Revenue recognition

The Company recognizes revenue when the following criteria have been met: (1) persuasive evidence of an arrangement exists; (2) delivery has occurred or services have been rendered and risk of loss has passed; (3) the fee is fixed or determinable; and (4) collectability is reasonably assured. When payments are received in advance of recognizing revenue, the Company includes the amount in deferred revenue on the balance sheet. Amounts deferred that are not anticipated to be recognized as revenue within a year of the balance sheet date are classified as noncurrent liabilities.

The Company has generated all of its revenue to date through its research collaboration, license, and option agreement with Purdue Pharma L.P. or as a primary contractor or as a subcontractor on government grants. The Company has not generated any commercial product revenue. Historically, the Company's research collaborations and grants have been either as a direct contractor or as a sub-awardee on contracts funded by various governmental agencies.

In arrangements involving the delivery of more than one element, each required deliverable is evaluated to determine whether it qualifies as a separate unit of accounting. The determination is based on whether the deliverable has "standalone value" to the customer. If a deliverable does not qualify as a separate unit of accounting, it is combined with the other applicable undelivered item(s) within the arrangement and these combined deliverables are treated as a single unit of accounting.

The arrangement's consideration that is fixed or determinable is allocated to each separate unit of accounting based on the relative selling price methodology in accordance with the selling price hierarchy, which includes vendor-specific objective evidence ("VSOE") of selling price, if available, or third-party evidence of selling price if VSOE is not available, or the best estimate of selling price, if neither VSOE nor third-party evidence is available.

Payments or reimbursements for the Company's research and development efforts for the arrangements where such efforts are considered as deliverables are recognized as the services are performed and are presented on a gross basis. When upfront payments are received and if there is no discernible pattern of performance and/or objectively

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measurable performance measures do not exist, the Company recognizes revenue ratably over the associated period of performance.

The Company's grant contracts have typically been cost or cost-plus-fee contracts. Revenues on these contracts are recognized as costs are incurred, generally based on allowable costs incurred during the period, plus any recognizable earned fee. The Company considers fixed fees under cost and cost-plus-fee contracts to be earned in proportion to the allowable costs incurred in performance of the contract. The Company has determined that it is the principal for each of its grants with governmental agencies since it maintains primary responsibility for research efforts in connection with these grants. Therefore, it recognizes revenue related to these grants with governmental agencies on a gross basis.

Equity-based compensation

The Company measures the cost of common stock option awards at fair value and records the cost of the awards, net of estimated forfeitures, on a straight-line basis over the requisite service period. The Company measures fair value for all common stock options using the Black-Scholes option-pricing model. For all common stock option awards to employees, the fair value measurement date is the date of grant and the requisite service period is the period over which the employee is required to provide service in exchange for the common stock option awards, which is generally the vesting period. For all common stock option awards to nonemployees, the Company remeasures fair value at each financial statement reporting date and recognizes compensation expense as services are rendered, generally on a straight-line basis.

Segments and geographic information

The Company has determined it has one reporting segment. Disaggregating the Company's operations is impracticable because the Company's research and development activities and its assets overlap and management reviews its business as a single operating segment. Thus, discrete financial information is not available by more than one operating segment. All long-lived assets of the Company are located in the United States.

Deferred rent

Deferred rent consists of rent escalation payment terms, tenant improvement allowances and other incentives received from the landlord related to the Company's operating lease and is presented in "Other noncurrent assets" in the accompanying balance sheet. Rent escalation represents the difference between actual operating lease payments due and straight-line rent expense, which is recorded by the Company over the term of the lease. Tenant improvement allowances and other incentives are recorded as deferred rent and amortized as a reduction of periodic rent expense, over the term of the applicable lease.

Research and development expense

Research and development expense includes wages, benefits, research materials, external services, legal fees related to patent protection, overhead and other expenses directly related to research and development operations. Research and development costs are expensed as incurred in accordance with ASC 730, Research and Development.

Income taxes

From inception through July 9, 2015, the Company was a Delaware LLC for federal and state tax purposes and, therefore, all items of income or loss through July 9, 2015 flowed through to the members of AuraSense Therapeutics, LLC. Effective July 9, 2015, the Company converted from an LLC to a C corporation for federal and state income tax purposes. Accordingly, prior to the conversion to a C corporation, the Company did not record deferred tax assets or liabilities or have any net operating loss carryforwards. The Company recognizes deferred tax assets and liabilities for temporary differences between the financial reporting basis and the tax basis of its assets and liabilities and the expected benefits of net operating loss carryforwards. The impact of changes in tax rates and

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laws on deferred taxes, if any, is applied during the years in which temporary differences are expected to be settled and 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. At December 31, 2017 and 2016, the Company established a full valuation allowance against its deferred tax assets to an amount that is more likely than not to be realized.

Recently adopted accounting pronouncements

In March 2016, the Financial Accounting Standards Board (“FASB”) issued Accounting Standards Update (“ASU”) 2016-09, *Improvements to Employee Share-Based Payment Accounting*. ASU 2016-09 changes several aspects of the accounting for share-based payment transactions, including the income tax consequences, classification of awards as either equity or liabilities, and classification on the statement of cash flows. ASU 2016-09 requires all excess tax benefits and tax deficiencies to be recognized as income tax expense or benefit in the income statement and treated as discrete items in the reporting period. Further, excess tax benefits are required to be classified along with other income tax cash flows as an operating activity. The guidance was effective for the Company in the first quarter of 2017. Adoption of this guidance did not have a significant impact to the Company’s financial statements.

Recent accounting pronouncements not yet adopted

In May 2014, the FASB issued ASU 2014-09 (ASC 606), *Revenue from Contracts with Customers*. This ASU, as amended by ASU 2015-14, affects any entity that either enters into contracts with customers to transfer goods and services or enters into contracts for the transfer of nonfinancial assets. ASU 2014-09 will replace most existing revenue recognition guidance in GAAP when it becomes effective. The standard’s core principle is that a company will recognize revenue when it transfers promised goods or services to customers in an amount that reflects the consideration to which the company expects to be entitled in exchange for those goods or services. In doing so, companies will need to use more judgment and make more estimates than under the currently effective guidance. These may include identifying performance obligations in the contract, estimating the amount of variable consideration to include in the transaction price and allocating the transaction price to each separate performance obligation. ASU 2014-09 is effective for Exicure in the first quarter of 2018 and early adoption is permitted beginning in the first quarter of 2017. The Company intends to adopt this standard on January 1, 2018 on a modified retrospective basis and continues to analyze and assess the impact, if any, of this standard on its financial statements.

In February 2016, FASB issued ASU 2016-02, *Leases (Topic 842)*, which requires lessees to recognize right-of-use assets and lease liabilities on the balance sheet. ASU 2016-02 is to be applied using a modified retrospective approach at the beginning of the earliest comparative period in the financial statements. ASU 2016-02 will be effective for the Company beginning in the first quarter of 2019. Early adoption is permitted. The Company is currently evaluating the impact of adopting this standard on its financial statements.

In August 2016, the FASB issued ASU 2016-15, *Statement of Cash Flows (Topic 230): Classification of Certain Cash Receipts and Cash Payments*. ASU 2016-15 addresses the classification of certain specific cash flow issues including debt prepayment or extinguishment costs, settlement of certain debt instruments, contingent consideration payments made after a business combination, proceeds from the settlement of certain insurance claims and distributions received from equity method investees. ASU 2016-15 is effective for the Company in the first quarter of 2018 and early adoption is permitted. An entity that elects early adoption must adopt all of the amendments in the same period. The Company is currently evaluating the impact of this guidance on its statement of cash flows.

In May 2017, the FASB issued ASU 2017-09, *Compensation - Stock Compensation (Topic 718): Scope of Modification Accounting*. ASU 2017-09 clarifies when changes to the terms or conditions of a share-based payment award must be accounted for as modifications. Under the new guidance, modification accounting is required only if the fair value, the vesting conditions, or the classification of the award changes as a result of the change in terms or conditions. ASU 2017-09 will be applied prospectively to awards modified on or after the adoption date. ASU

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2017-09 is effective for the Company for fiscal years beginning after December 15, 2017, and interim periods within those fiscal years. Early adoption is permitted. The Company is currently evaluating the impact of this guidance on its financial statements.

3. Purdue Collaboration

On December 2, 2016, the Company entered into a research collaboration, option and license agreement with Purdue and referred to herein as the “Purdue Collaboration.” Purdue has the option to obtain from the Company the full worldwide development and commercial rights to AST-005 (the Company’s lead therapeutic candidate that targets tumor necrosis factor), an option to obtain three additional collaboration targets and a further option to obtain from us the full worldwide development and commercial rights to any therapeutic candidates developed targeting the three additional collaboration targets. Additionally, Purdue has rights of first offer to some potential collaboration targets. These rights of first offer are subject to limitations in time and scope. In connection with the Purdue Collaboration, the Company received a non-refundable development fee of \$10,000. In addition, the Company is eligible to receive up to \$776,500 upon successful completion of certain research, regulatory and commercial sales milestones. The research milestones are payable upon target identification and IND-enabling pre-clinical development, per program, with an aggregate total of up to \$16,500. The regulatory milestones are payable upon the initiation or completion of clinical trials, and regulatory approval in the United States and outside the United States, per program, with an aggregate total of up to \$410,000. The commercial sales milestones are payable upon achievement of specified aggregate product sales thresholds and total up to \$350,000. In the event a therapeutic candidate subject to the collaboration results in commercial sales, the Company is eligible to receive royalties ranging from the low single digits to a maximum of 10% on future net sales of such commercialized therapeutic candidates. Additionally, Purdue had an obligation to invest in a qualified equity financing of the Company if such financing was completed before June 2, 2017. The Company did not complete such qualified equity financing before June 2, 2017.

In accordance with ASC 605-25, the Company identified the following deliverables at the inception of the Purdue Collaboration agreement: (1) exclusive rights to the TNF- α target, (2) the obligation to participate in a joint research committee, (3) the provision of research and development activities based on a prescribed full-time employee rate per year, (4) a non-voting board of director observer role, (5) Purdue’s right to participate in a future qualified equity financing of the Company if such financing occurs prior to June 2, 2017 or the pricing of the initial public offering of shares of the Company’s common stock, (6) the option for an exclusive development and commercialization license to AST-005 or a TNF- α development candidate other than AST-005, (7) the option to select and develop three additional collaboration targets, and (8) the option for an exclusive development and commercialization license to any developed therapeutic candidate targeting the three additional collaboration targets. The Company determined that deliverables (2), (4), (5), and (6) do not have stand-alone value to Purdue, and accordingly, deliverables (2), (4), (5) and (6) were combined with deliverables (1) and (3) as a single unit of accounting. The Company concluded that, at the inception of the agreement, deliverables (7) and (8) are substantive options and do not contain a significant or incremental discount; as a result, no portion of the upfront \$10,000 is allocated to deliverables (7) and (8).

The upfront payment of \$10,000 was allocated to the single unit of accounting consisting of deliverables (1), (2), (3), (4), (5), and (6) above and was recorded as deferred revenue and is being recognized on a ratable basis over the estimated performance period of the relevant research and development activities of 14.5 months.

The Purdue Collaboration agreement includes contingent payments related to specified research, development and regulatory milestones and sales-based milestones. Each contingent and milestone payment is evaluated to determine whether it is substantive and at risk to both parties. The Company recognizes any payment that is contingent upon the achievement of a substantive milestone entirely in the period in which the milestone is achieved. Any payments that are contingent upon achievement of a non-substantive milestone are recognized as revenue prospectively, when such payments become due and collectible, over the remaining expected performance period under the arrangement, which is generally the remaining period over which the research and development

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services are expected to be provided. To date, the Company has not recognized any contingent payments in connection with the Purdue Collaboration as revenue.

During the years ended December 31, 2017 and 2016, the Company recognized collaboration revenue of \$9,719 and \$690, respectively, which included \$1,443 and zero, respectively, of research and development activities that have been or will be reimbursed by Purdue and is presented on a gross basis in the accompanying statement of operations. As of December 31, 2017 and 2016, deferred revenue relating to the Purdue Collaboration was \$1,034 and \$9,310, respectively, of which \$1,034 and \$8,276, respectively, is classified as current portion of deferred revenue in the accompanying balance sheet.

4. Supplemental Balance Sheet Information

Property and equipment, net

	December 31,	
	2017	2016
Scientific equipment	\$ 1,797	\$ 993
Leasehold improvements	192	57
Furniture and fixtures	31	27
Computers and software	26	26
Construction in process	120	17
Property and equipment, gross	2,166	1,120
Less: accumulated depreciation	(849)	(617)
Property and equipment, net	\$ 1,317	\$ 503

Depreciation and amortization expense was \$232 and \$180 for the years ended December 31, 2017 and 2016, respectively.

Accrued expenses and other current liabilities

	December 31,	
	2017	2016
Accrued Northwestern University License Agreements fee (Note 11)	\$ —	\$ 1,500
Accrued legal expenses	251	123
Accrued payroll-related expenses	718	423
Other accrued expenses	400	114
Accrued expenses and other current liabilities	\$ 1,369	\$ 2,160

5. Debt

On February 17, 2016, the Company closed a \$10,000 loan facility, with an initial advance against this loan facility of \$6,000, with Hercules Technology Growth Capital ("Hercules"). The loan bears a floating interest rate equal to the greater of either (i) 9.95% or (ii) the sum of 9.95% plus the United States prime rate minus 3.50%. Total proceeds net of fees and issuance costs were \$5,839. Fees and issuance costs of \$161, as well as fees of \$231 that are payable to the lender at maturity, are recorded as a reduction in the carrying amount of long-term debt on our balance sheet and will be amortized to interest expense through the maturity date of September 1, 2019 using the effective interest method. Interest amounts were payable monthly beginning on March 1, 2016 through the maturity date of September 1, 2019. Initially, principal amounts were payable monthly beginning on April 1, 2017 through

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the maturity date. In 2016, the Company met certain terms in the loan agreement so that principal amounts became payable monthly beginning on July 1, 2017. Pursuant to an amendment dated January 15, 2018, amortization payments due for the thirteen (13) consecutive months commencing on December 1, 2017 through and including December 1, 2018 were deferred. Commencing on January 1, 2019, and continuing on the first business day of each month thereafter, the loan, including the deferred payments, shall begin amortizing in equal monthly installments of principal and interest based upon an amortization schedule equal to eighteen (18) consecutive months. The loan is collateralized by a security interest in all tangible assets. In addition, the Company is subject to certain financial reporting requirements and certain negative covenants requiring lender consent. Additionally, Hercules shall have the right to participate in a future financing of up to \$1,000 under the same terms and conditions and pricing afforded to other participants in that future financing. Hercules has not yet exercised this right to participate.

In connection with the February 2016 Hercules loan, Hercules also had the right to purchase 80,000 shares of Series C preferred stock at \$3.00 per share under the terms of a warrant agreement with the Company. The preferred stock warrant liability was recorded at fair value at the date of issuance of February 17, 2016 in the amount of \$134 and recorded as a reduction in the carrying amount of long-term debt on our balance sheet. This discount of \$134 will be amortized to interest expense through the loan maturity date of September 1, 2019 using the effective interest method. The Company estimated the fair value of the preferred stock warrant liability at the end of each reporting period using the Black-Scholes model and recorded any changes in fair value to other income (expense), net on its statement of operations. See Note 10, *Fair Value Measurements*, for more information on the fair value of the preferred stock warrant liability. The warrant agreement to purchase shares of preferred stock was terminated on September 26, 2017 in connection with the Merger.

At December 31, 2017 and 2016, the carrying value of long-term debt is \$4,855 and \$5,667, respectively.

At December 31, 2017, the principal maturities of the long-term debt were as follows:

	December 31, 2017
2018	\$ —
2019	4,999
Principal balance outstanding	4,999
less: unamortized discount	(129)
less: unamortized debt issuance costs	(15)
Long-term debt	4,855
Current portion	—
Noncurrent portion	4,855

The Company paid interest on debt of \$611 and \$478 during the years ended December 31, 2017 and 2016, respectively.

6. Stockholders' Equity

On September 26, 2017, in connection with the Merger, each share of Exicure OpCo common and preferred stock (other than shares of Exicure OpCo's Series C preferred stock) issued and outstanding immediately prior to the closing of the Merger was converted into 0.49649 shares of Max-1's common stock, and each share of Exicure OpCo's Series C preferred stock issued and outstanding immediately prior to the closing of the Merger was converted into 0.7666652 shares of Max-1's common stock. As a result, an aggregate of 26,666,627 shares of the Max-1's common stock were issued to the holders of Exicure OpCo's capital stock, which is incremental to the 2,080,000 shares of Max-1's common stock that were outstanding immediately prior to the Merger. In addition, pursuant to the Merger Agreement options to purchase 7,414,115 shares of Exicure OpCo common stock issued and

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outstanding immediately prior to the closing of the Merger were assumed by Max-1 and converted into options to purchase 3,680,997 shares of the Max-1's common stock.

Common Stock

As of December 31, 2017, the Company had 200,000,000 shares of common stock, par value \$0.0001 authorized and 39,300,823 shares issued and outstanding.

The holders of shares of the Company's common stock are entitled to one vote per share on all matters to be voted upon by Exicure stockholders and there are no cumulative rights. Subject to preferences that may be applicable to any outstanding preferred stock, the holders of shares of the Company's common stock are entitled to receive ratably any dividends that may be declared from time to time by Exicure's board of directors (the "Board") out of funds legally available for that purpose. In the event of the Company's liquidation, dissolution or winding up, the holders of shares of Exicure common stock are entitled to share ratably in all assets remaining after payment of liabilities, subject to prior distribution rights of preferred stock then outstanding. Exicure common stock has no preemptive or conversion rights or other subscription rights. There are no redemption or sinking fund provisions applicable to Exicure common stock. The outstanding shares of Exicure common stock are fully paid and non-assessable.

Preferred Stock

As of December 31, 2017, the Company had 10,000,000 shares of preferred stock, par value \$0.0001 authorized and no shares issued and outstanding.

Private Placement Offering

On September 26, 2017, following the Effective Time of the Merger, the Company sold 6,767,360 shares of Exicure, Inc. common stock pursuant to an initial closing of a private placement offering (the "Offering") for up to 13,333,333 shares of Exicure, Inc. common stock at a purchase price of \$3.00 per share (the "Offering Price"). The aggregate net proceeds from the initial closing of the Offering (after deducting placement agent fees and expenses of the initial offering of \$3,037) were \$17,235 .

On October 27, 2017 and November 2, 2017, Exicure entered into subscription agreements (the "Subscription Agreements") with several accredited investors (the "Investors") pursuant to which the Company agreed to issue and sell a total of 3,736,836 shares of the Company's common stock, par value \$0.0001 per share (the "Shares") resulting in approximately \$11,211 in gross proceeds to the Company. These shares were issued in Subsequent Closings of the Offering for up to 13,333,333 shares of common stock (the "Maximum Amount") at a purchase price of \$3.00 per share (the "Sale Price").

The Company has sold a total of 10,504,196 shares of common stock for a total of approximately \$31,513 in connection with all closings of the Offering (before deducting placement agent fees and expenses which are estimated at \$3,966). Placement Agents have received an aggregate of \$1,968 in cash placement fees and have received warrants to purchase an aggregate of 413,320 shares of Exicure common stock (the "Warrants") in connection with all closings of the Offering. The Warrants expire on March 27, 2021, have an exercise price of \$3.00 per share, and have been issued on the same terms in all closings of the Offering. The warrants to purchase common stock are classified as a liability and presented as a dividend that offsets the gross proceeds of the Offering within the accompanying consolidated statement of equity. The common stock warrant liability will be remeasured each period at fair value. See Note 10, *Fair Value Measurements* for more information on the common stock warrant liability. The Placement Agents also received 50,000 shares of Exicure common stock in connection with all closings of the Offering.

Subject to certain customary exceptions, investors in the Offering have anti-dilution protection with respect to the shares of common stock sold in the Offering such that if within eighteen (18) months after the initial closing of

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the Offering the Company issues certain additional shares of common stock or common stock equivalents for a consideration per share less than the Offering Price (the “Lower Price”), each such investor will be entitled to receive from the Company additional shares of common stock in an amount such that, when added to the number of shares of common stock initially purchased by such investor in the Offering and still held of record and beneficially owned by such investor at the time of the dilutive issuance (the “Held Shares”), will equal the number of shares of common stock that such investor’s aggregate purchase price for the Held Shares would have purchased at the Lower Price. Either (i) holders of a majority of the then Held Shares or (ii) a representative of the holders of the then Held Shares, which representative shall be appointed by the three investors who then hold the largest number of Held Shares, may waive the anti-dilution rights of all Offering investors with respect to a particular issuance by the Company.

This price-based anti-dilution protection will automatically terminate upon the earlier date of our receipt of gross proceeds of \$40,000 or more in one or more related closings in a bona fide transaction in which we issue shares of common stock or certain common stock equivalents or March 26, 2020.

The Offering was exempt from registration under Section 4(a)(2) of the Securities Act of 1933, as amended (the “Securities Act”), and Rule 506 of Regulation D promulgated by the SEC. The common stock in the Offering was sold to “accredited investors,” as defined in Regulation D, and was conducted on a “reasonable best efforts” basis.

Registration Rights

In connection with the Merger and the Offering, the Company entered into a Registration Rights Agreement, pursuant to which the Company has agreed that promptly, but no later than 60 calendar days from the final closing of the Offering, the Company will file a registration statement with the SEC, or the Registration Statement. Each Investor in the Subsequent Closing also entered into the same registration rights agreement signed by investors in the initial closing of the Offering, which requires that the Company file a “resale” registration statement with the SEC covering the shares of common stock and warrants issued in the Offering, certain other shares of common stock issued in connection with the Company’s recently closed reverse merger, and shares held by the Company’s pre-merger stockholders, within 60 calendar days from the final closing of the Offering. The Company filed and caused to become effective a registration statement with the SEC on February 6, 2018 registering the resale of 39,714,143 shares of our common stock issued in connection with the Reverse Merger and the Private Placement.

Capitalization Prior to the Merger

All share and per share figures herein are retrospectively adjusted to reflect the conversion of each share of Exicure OpCo common and preferred stock (other than shares of Exicure OpCo’s Series C preferred stock), preferred stock warrant liability, and common stock options issued and outstanding immediately prior to the closing of the Merger into 0.49649 shares of the Company’s common stock, and each share of Exicure OpCo’s Series C preferred stock issued and outstanding immediately prior to the closing of the Merger into 0.7666652 shares of the Company’s common stock.

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On July 9, 2015, Exicure OpCo converted from a limited liability company into a C corporation. In connection with the corporate conversion, each common unit, Class A unit, Class B-1 unit, Class B-2 unit and Class C unit of AuraSense Therapeutics, LLC issued and outstanding immediately prior to the effectiveness of the corporate conversion was converted into one share of common stock, Series A preferred stock, Series B-1 preferred stock, Series B-2 preferred stock and Series C preferred stock of Exicure OpCo, respectively. Fractional units of AuraSense Therapeutics, LLC that were outstanding prior to the corporate conversion were not converted to shares of stock in Exicure OpCo, resulting in 46 less aggregate shares of outstanding preferred stock of Exicure OpCo as compared to aggregate outstanding preferred units of AuraSense Therapeutics, LLC in connection with the corporate conversion. Each outstanding option to purchase one common unit of AuraSense Therapeutics, LLC was converted into an option to purchase one share of common stock of Exicure OpCo.

Class A Units/Series A Preferred Stock

On December 12, 2011, the Company entered into agreements with AuraSense, LLC: the Bill of Sale, Assignment and Assumption Agreement and the Partial Assignment of License Agreement. In exchange for the contribution of certain assets and agreeing to certain undertakings, the Company provided to AuraSense, LLC 11,381,611 of its Class A units.

For purposes of determining the value of its initial capital contribution, the members of AuraSense Therapeutics, LLC agreed that the Class A units provided to AuraSense, LLC were to be valued at \$2.22 per unit or an aggregate value of \$25,217. For accounting purposes, however, as the Company and AuraSense, LLC were under common control, the assets and liabilities transferred and the Class A equity contributions were valued at AuraSense, LLC's net book value. The net book value of AuraSense, LLC's contribution at inception was \$135.

As further discussed above, in connection with the corporate conversion, 11,381,611 Class A units were converted to 11,381,640 shares of Exicure OpCo Series A preferred stock.

Liquidation preference. The Class A units/Series A preferred stock were senior in right of payment only to the common units until such time as they have received aggregate distributions equal to their unreturned cash contribution.

Class B Units/Series B Preferred Stock

The Class B units/Series B preferred stock were divided into two tranches and have been issued in two series: Class B-1/Series B-1 and Class B-2/Series B-2.

Class B-1/Series B-1. On December 12, 2011, the Company sold 2,451,571 of its Class B-1 units at a price per unit of \$2.22. Total gross proceeds raised thereby were \$5,432 including a receivable of \$500 for 225,677 of the sold units. The receivable was collected in 2012. Net proceeds after associated costs and expenses of \$61 were \$5,371.

Class B-2/Series B-2. On June 27, 2013, the Company sold 1,403,995 of its Class B-2 units at a price per unit of \$2.62. Total gross proceeds raised thereby were \$3,676 and proceeds net of \$35 in financing costs were \$3,641.

As further discussed above, in connection with the corporate conversion, 2,451,571 Class B-1 units and 1,403,995 Class B-2 units were converted to 2,451,560 and 1,403,984 shares of Exicure OpCo Series B-1 and Series B-2 preferred stock, respectively.

Liquidation preference. The Class B units/Series B preferred stock were senior to the Class A units/Series A preferred stock and common units/stock in their right to payment until such time as they have received aggregate distributions equal to their unreturned cash contribution.

EXICURE, INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (in thousands, except unit, share, per unit, and per share data)

Class C Units/Series C Preferred Stock

On June 13, 2014, the Company sold 4,532,112 of its Class C units at a price per unit of \$3.00 . Total gross proceeds raised thereby were \$13,596 . Net proceeds after associated costs and expenses of \$117 were \$13,479 .

On February 6, 2015, the Company sold 1,541,168 of its Class C units at a price of \$3.00 per unit. Total gross proceeds raised thereby were \$4,624 . Net proceeds after associated costs and expenses of \$43 were \$4,581 .

As further discussed above, in connection with the corporate conversion, 6,073,280 Class C units were converted to 6,073,226 shares of Exicure OpCo Series C preferred stock.

In October 2015, the Company sold 5,016,134 shares of its Series C preferred stock at a price of \$3.00 per share. Total gross proceeds raised thereby were \$15,048 . Net proceeds after associated costs and expenses of \$69 were \$14,979 .

On January 11, 2016, the Company sold 149,999 shares of its Series C preferred stock at a price of \$3.00 per share. Total gross proceeds raised thereby were \$450 . Net proceeds after associated costs and expenses of \$6 were \$444 .

Liquidation preference . The Class C units/Series C preferred stock were senior to the Class A and Class B units/preferred stock and common units/stock in rights and privileges as established in the Exicure OpCo Operating Agreement. Principal among the rights of Class C units/preferred stock was the creation of the Class C liquidation preference whereby, in the event of a liquidation event (i.e., a liquidation, dissolution or winding up of the Company or a sale of the Company), the Class C preferred unit/stock holders were entitled to receive 1.5 times the aggregate cash contribution of all holders of Class C preferred units/stock.

7. Equity-Based Compensation

On September 22, 2017, the Board adopted and Exicure's stockholders approved the Exicure, Inc. 2017 Equity Incentive Plan (the "2017 Plan"), which became effective on November 15, 2017. The 2017 Plan provides for the issuance of incentive awards of up to 5,842,525 shares of Exicure common stock, which includes 2,169,905 shares of Exicure common stock to be issued to officers, employees, consultants and directors, plus a number of shares not to exceed 3,683,817 that are subject to issued and outstanding awards under the Exicure OpCo 2015 Equity Incentive Plan (the "2015 Plan") and were assumed in the Merger. Awards that may be awarded under the 2017 Plan include non-qualified and incentive stock options, stock appreciation rights, bonus shares, restricted stock, restricted stock units, performance units and cash-based awards. The 2017 Plan also provides that the number of shares reserved for issuance thereunder will be increased annually on the first day of each year beginning in 2020 by the least of 4,600,000 shares, five percent (5%) of the shares of Exicure common stock outstanding on the last day of the immediately preceding year, or a lesser number of shares as determined by the Company's compensation committee. No future awards will be made under the 2015 Plan upon the effectiveness of the 2017 Plan. The aggregate number of common stock options available for grant under the 2017 Plan was 2,169,905 as of December 31, 2017.

On October 6, 2015, the Exicure OpCo board of directors adopted the 2015 Plan, subject to approval by the Company's stockholders. Such stockholders approval was received on October 13, 2015. The 2015 Plan replaced the 2014 Plan and all outstanding options as of October 13, 2015 became subject to the terms of the 2015 Plan. Prior to October 6, 2015, the Company had granted common unit options to employees, directors, and consultants under the terms of the Equity Incentive Plan which was adopted on September 1, 2011 and subsequently amended and restated on June 13, 2014 (the "2014 Plan"). In connection with the corporate conversion (see Note 1), each outstanding common unit option became an option to purchase one share of Exicure OpCo common stock.

The common stock options are contingent on the participants' continued employment or provision of non-employee services and are subject to forfeiture if employment or continued service terminates for any reason. The initial stock option grant to an employee, director or consultant vests 25% on the first 12-month anniversary of the

EXICURE, INC.

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grant date and vests 1/48th monthly thereafter until fully vested at the end of 48 months . Subsequent stock option grants vest 1/48th monthly until fully vested at the end of 48 months . The term of common stock option grants is ten years unless terminated earlier as described above.

Equity-based compensation expense is classified in the statements of operations as follows:

	Year Ended December 31,	
	2017	2016
Research and development expense	\$ 172	\$ 160
General and administrative expense	1,290	522
	\$ 1,462	\$ 682

Unamortized equity-based compensation expense at December 31, 2017 was \$2,023 , which is expected to be amortized over a weighted-average period of 2.4 years .

The Company utilizes the Black-Scholes option-pricing model to determine the fair value of common stock option grants. The Black-Scholes option-pricing model was developed for use in estimating the fair value of traded options that have no vesting restrictions and are fully transferable. The model also requires the input of highly subjective assumptions. In addition to an assumption on the expected term of the option grants as discussed below, application of the Black-Scholes model requires additional inputs for which we have assumed the values described in the table below:

	Year Ended December 31,	
	2017	2016
Expected term	5.3 to 6.5 years	5.0 to 7.0 years
Risk-free interest rate	1.97% to 2.17%; weighted avg. 2.07%	1.01% to 2.24%; weighted avg. 1.58%
Expected volatility	80.8% to 83.1%; weighted avg. 81.0%	79.2% to 83.6%; weighted avg. 79.9%
Forfeiture rate	5%	5%
Expected dividend yield	—%	—%

The expected term is based upon the “simplified method” as described in Staff Accounting Bulletin Topic 14.D.2. Currently, the Company does not have sufficient experience to provide a reasonable estimate of an expected term of its common stock options. The Company will continue to use the “simplified method” until there is sufficient experience to provide a more reasonable estimate in conformance with ASC 718-10-30-25 through 30-26. The risk-free interest rate assumptions were based on the U.S. Treasury bond rate appropriate for the expected term in effect at the time of grant. The expected volatility is based on calculated enterprise value volatilities for publicly traded companies in the same industry and general stage of development. The estimated forfeiture rates were based on historical experience for similar classes of employees. The dividend yield was based on expected dividends at the time of grant.

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The fair value of the underlying common stock and the exercise price for the common stock options granted during the years ended December 31, 2017 and 2016 are summarized in the table below:

Common Stock Options Granted During Period Ended:	Fair Value of Underlying Common Stock	Exercise Price of Common Stock Option
Year ended December 31, 2017	\$4.21	\$4.21
Year ended December 31, 2016	\$1.91 to \$2.42; weighted avg. \$2.30	\$1.91 to \$2.42; weighted avg. \$2.30

The Company's common stock has not yet been publicly traded, therefore the Company estimates the fair value of its common stock underlying its common stock options. The grant date fair value of the Company's common stock has been determined by the Board exercising their judgment in the consideration of a variety of factors. For financial reporting purposes, the Company has periodically estimated the per share fair value of Exicure OpCo's common stock at various dates using valuations performed in accordance with the guidance outlined in the American Institute of Certified Public Accountants Practice Aid, Valuation of Privately-Held Company Equity Securities Issued as Compensation (Practice Aid). At December 31, 2017, for financial reporting purposes and principally to aid Exicure in the revaluation of certain common stock option awards to non-employees and certain warrant liabilities, Exicure estimated the per share fair value of its common stock to be \$3.00, which is the per share price paid by outside investors in the Offering on September 26, 2017, October 27, 2017, and November 2, 2017.

The weighted-average grant date fair value of common stock options granted in the years ended December 31, 2017 and 2016 was \$2.92 and \$0.90 per common stock option, respectively.

A summary of common stock option activity as of the periods indicated is as follows:

	Options	Weighted-Average Exercise Price	Weighted-Average Remaining Contractual Term (years)	Aggregate Intrinsic Value (thousands)
Outstanding - December 31, 2016	3,089,352	\$ 1.25	8.2	\$ 9,143
Granted	657,843	4.21		
Exercised	(58,440)	0.75		
Forfeited	(16,135)	0.92		
Outstanding - December 31, 2017	3,672,620	\$ 1.79	7.5	\$ 5,221
Exercisable - December 31, 2017	2,361,725	\$ 1.45	7.2	\$ 3,972
Vested and Expected to Vest - December 31, 2017	3,596,344	\$ 1.78	7.5	\$ 5,177

The aggregate intrinsic value of common stock options exercised during the years ended December 31, 2017 and 2016 was \$202 and \$63, respectively.

8. Income Taxes

Pretax loss before income taxes was \$12,039 and \$16,941 for the years ended December 31, 2017 and 2016, respectively, which consists entirely of losses in the U.S. and resulted in no provision for income tax expense during the years then ended.

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The differences between income taxes computed using the U.S. federal income tax rate and the provision for income taxes are as follows:

	Year Ended December 31,			
	2017		2016	
Federal income tax expense at statutory rate	\$ (4,093)	34.0 %	\$ (5,760)	(34.0)%
State income tax expense at statutory rate	(610)	5.1	(860)	(5.1)
Permanent differences	(125)	1.0	43	0.3
Impact of Tax Reform Act	3,760	(31.2)	—	—
Other	(10)	0.1	7	—
Change in valuation allowance	1,078	(9.0)	6,570	38.8
	\$ —	— %	\$ —	— %

The Company's effective income tax rate for the years ended December 31, 2017 and 2016 is 0% because the Company has generated tax losses and has provided a full valuation allowance against its deferred tax assets to an amount that is more likely than not to be realized.

The significant components of the Company's net deferred tax assets are as follows:

	December 31,	
	2017	2016
Deferred Tax Assets		
Net operating losses	\$ 8,748	\$ 8,107
Fixed assets	—	57
Intangibles	205	306
Accrued expenses	198	184
Equity-based compensation	728	436
Deferred revenue	295	—
Less: Valuation allowance	(10,166)	(9,088)
Total deferred tax assets	8	2
Deferred Tax Liabilities		
Deferred rent and other	(8)	(2)
Total deferred tax liabilities	(8)	(2)
Deferred taxes, net	\$ —	\$ —

The Company has recorded a full valuation allowance against its deferred tax assets to an amount that is more likely than not to be realized at December 31, 2017 and 2016. This determination is based on significant negative evidence, including:

- *Cumulative losses:* The Company has been in a significant cumulative loss position since its inception in 2011.
- *Projected realization of net operating loss carry forward amounts:* Projections of future pre-tax book loss and taxable losses based on the Company's recent actual performance and current industry data indicate it is more likely than not that the benefits will not be recognized.

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On December 22, 2017, the President of the United States signed into law the Tax Reform Act. The legislation significantly changes U.S. tax law by, among other things, lowering corporate income tax rates, implementing a modified territorial tax system and imposing a repatriation tax on deemed repatriated earnings of foreign subsidiaries. The Tax Reform Act permanently reduces the U.S. corporate income tax rate from a maximum of 35% to a flat 21% rate, effective January 1, 2018. The Company's U.S. deferred tax assets, net of deferred tax liabilities, were remeasured at December 31, 2017 and reduced by \$3,760, entirely offset by a valuation allowance reduction. As a result, the remeasurement of the Company's deferred tax assets, net of deferred tax liabilities, including the valuation allowance, did not impact the Company's income tax expense or net loss.

At December 31, 2017, the Company had a federal net operating loss carryforward of \$30,689, which will begin to expire in 2035. The Company has \$30,689 of state net operating loss carryforwards which will begin to expire in 2027.

At December 31, 2017 and 2016, the Company had no unrecognized tax benefits. The Company's estimate of the potential outcome of any uncertain tax position is subject to management's assessment of relevant risks, facts and circumstances existing at that time. The Company evaluates uncertain tax positions to determine if it is more-likely-than-not that they would be sustained upon examination. The Company recognizes interest and penalties related to unrecognized tax benefits in the provision for income taxes.

The Company is subject to taxation in the U.S. and various state jurisdictions. The Company remains subject to examination by U.S. federal and state tax authorities for the years 2014 through 2017. There are no pending examinations in any jurisdiction.

9. Loss Per Common Share

Basic loss per common share is calculated by dividing net loss by the weighted-average number of shares of common stock outstanding during the period. Diluted loss per common share is calculated using the treasury share method by giving effect to all potentially dilutive securities that were outstanding. Potentially dilutive options and warrants to purchase common stock that were outstanding during the periods presented were excluded from the diluted loss per share calculation because such shares had an anti-dilutive effect due to the net loss reported in those periods. Therefore, basic and diluted loss per common share is the same for each of the years ended December 31, 2017 and 2016.

The following is the computation of loss per common share for the years ended December 31, 2017 and 2016:

	Year Ended December 31,	
	2017	2016
Net loss	\$ (12,039)	\$ (16,941)
Weighted-average basic and diluted common shares outstanding	10,119,569	113,418
Loss per share - basic and diluted	\$ (1.19)	\$ (149.37)

The outstanding securities presented below were excluded from the calculation of net loss per common share, because such securities would have been anti-dilutive due to the Company's net loss per share during the periods ending on the dates presented:

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	December 31,	
	2017	2016
Options to purchase common stock	3,672,620	3,089,352
Warrants to purchase common stock	413,320	—

10. Fair Value Measurements

ASC Topic 820, *Fair Value Measurement*, establishes a three-tier fair value hierarchy, which prioritizes the inputs used in measuring fair value, as follows: Level 1 Inputs - unadjusted quoted prices in active markets for identical assets or liabilities accessible to the reporting entity at the measurement date; Level 2 Inputs - other than quoted prices included in Level 1 inputs that are observable for the asset or liability, either directly or indirectly, for substantially the full term of the asset or liability; and Level 3 Inputs - unobservable inputs for the asset or liability used to measure fair value to the extent that observable inputs are not available, thereby allowing for situations in which there is little, if any, market activity for the asset or liability at measurement date.

The Company uses the market approach and Level 1 inputs to value its cash equivalents.

The Company's long-term debt bore interest at the prevailing market rates for instruments with similar characteristics and, accordingly, the carrying value for this instrument also approximates its fair value and the financial measurement is also classified within Level 2 of the fair value hierarchy.

The Company's preferred stock warrant liability and common stock warrant liability are classified within Level 3 of the fair value hierarchy. The fair value of the preferred stock warrant liability and common stock warrant liability was determined using the Black-Scholes option-pricing model.

The fair value of the preferred stock warrant liability was based significantly on the fair value of the Series C preferred stock, which was developed using unobservable inputs, which are classified within Level 3. At the date of issuance, the preferred stock warrant liability was determined using the following assumptions: expected term of 5.0 years, risk-free interest rate of 1.26%, expected volatility of 62.99%, and no expected dividends. In connection with the Merger, the warrants to purchase preferred stock were terminated and therefore the related liability was reduced to zero.

The fair value of the common stock warrant liability is based significantly on the fair value of the Company's common stock. At the date of issuance, the common stock warrant liability was determined using the following weighted-average assumptions: expected term of 2.0 years, risk-free interest rate of 1.53%, expected volatility of 78.97%, and no expected dividends.

The following weighted-average assumptions were used to estimate the fair value of the common stock warrant liability at December 31, 2017:

	December 31, 2017
Expected term	1.9 years
Risk-free interest rate	1.87%
Expected volatility	78.43%
Expected dividend yield	—%

A 10% change in the estimate of expected volatility at December 31, 2017 would increase or decrease the fair value of the common stock warrant liability in the amount of \$45. A 10% change in the estimate of fair value of the

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common stock at December 31, 2017 would increase or decrease the fair value of the common stock warrant liability in the amount of \$87 .

The following is a reconciliation of the Company's liabilities measured at fair value on a recurring basis using unobservable inputs (Level 3) for the year ended December 31, 2017:

	Fair Value Measurements Using Significant Unobservable Inputs (Level 3)		
	Preferred Stock Warrant Liability	Common Stock Warrant Liability	Total
Balance at January 1, 2017	\$ 201	\$ —	\$ 201
Additions	—	536	536
Gain included in other income (expense), net	(201)	(13)	(214)
Balance at December 31, 2017	\$ —	\$ 523	\$ 523

11. Commitments and Contingencies

Leases

The Company conducts all operations in a facility under an operating lease which commenced in March 2012 and was originally scheduled to end in February 2015. During the first quarter of 2014, the lease was extended for an additional six years through February 2021, and includes a renewal option. During the second quarter of 2016, the Company amended the lease agreement to include additional space to be used primarily for administrative functions effective in May 2016. Lease payments include a fixed payment amount as well as contingent payments related to a proportionate share of operating and real estate expenses. At the inception of the lease, the lessor paid for leasehold improvements totaling \$52 which has been capitalized and is being amortized over the lease term. The fixed payment amounts, including those in connection with the amended lease agreement in the second quarter of 2016, increase over the term of the lease but rent expense is recognized on a straight-line basis resulting in the recognition of deferred rent liability of \$48 and \$50 as of December 31, 2017 and 2016, respectively, calculated on the basis of the extended lease agreement.

Rent expense consisted of the following:

	Year Ended December 31,	
	2017	2016
Straight-line rent expense	\$ 332	\$ 299
Contingent rent expense	281	266
Total rent expense	\$ 613	\$ 565

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Future minimum lease payments as of December 31, 2017 are as follows:

Years ending December 31,	Operating Leases
2018	341
2019	347
2020	353
2021	59
Thereafter	—
Total	\$ 1,100

Northwestern University license agreements

On December 12, 2011, (1) AuraSense, LLC assigned to the Company all of its worldwide rights and interests under AuraSense, LLC’s 2009 license agreement with Northwestern University (“NU”) in the field of the use of nanoparticles, nanotechnology, microtechnology or nanomaterial-based constructs as therapeutics or accompanying therapeutics as a means of delivery, but expressly excluding diagnostics (the “assigned field”); (2) in accordance with the terms and conditions of this assignment, the Company assumed all liabilities and obligations of AuraSense, LLC as set forth in its license agreement in the assigned field; and (3) in order to secure this assignment and the patent rights from NU, the Company agreed (i) to pay NU an annual license fee, which may be credited against any royalties due to NU in the same year, (ii) to reimburse NU for expenses associated with the prosecution and maintenance of the license patent rights, (iii) to pay NU royalties based on any net revenue generated by the Company’s sale or transfer of any licensed product, and (iv) to pay NU, in the event the Company grants a sublicense under the licensed patent rights, the greater of a percentage of all sublicensee royalties or a percentage of any net revenue generated by a sublicensee’s sale or transfer of any licensed product. In August 2015, we entered into a restated license agreement with NU (the “restated license agreement”). In February 2016, we obtained exclusive license as to NU’s rights in certain SNA technology we jointly own with NU (the “February 2016 license agreement”). Our license to NU’s rights is limited to the assigned field, however we have no such limitation as to our own rights in this jointly owned technology. In June 2016, we entered into an exclusive license with NU to obtain worldwide rights to certain inhibitors of glucosylceramide synthase and their use in wound healing in diabetes (the “June 2016 license agreement”). Our rights and obligations in these 2016 agreements are substantially the same as in the restated license agreement from August 2015 (collectively referred to as “the Northwestern University License Agreements”). As of December 31, 2017, the Company has paid to NU an aggregate of \$3,419 in consideration of each of the obligations described above.

12. Related-Party Transactions

Since its inception in 2011, the Company has shared facilities, certain staff members and certain operating expenses with AuraSense, LLC, our former parent and largest stockholder. On an infrequent basis, the Company also pays certain expenses directly on behalf of AuraSense, LLC which are related to AuraSense, LLC’s grants, and AuraSense, LLC sometimes pays expenses directly on behalf of the Company. These costs are summarized and directly billed between the Company and AuraSense, LLC on a quarterly basis. In addition, certain expense and administrative activities are shared between the Company and AuraSense, LLC. Effective January 1, 2016, the Company and AuraSense, LLC amended its shared services agreement to simplify the billing arrangement. Under the amended shared services agreement, the Company bills AuraSense, LLC \$8 per quarter for indirect costs incurred by the Company plus a specified rate for hours worked by Company scientists on projects directly related to AuraSense, LLC. The amended shared services arrangement continues to require direct non-labor expenses incurred by the Company to be billed to AuraSense, LLC. Effective January 1, 2017, the Company and AuraSense, LLC further amended its shared services agreement so that the quarterly fee related to administrative activities billed by the Company to AuraSense, LLC be reduced to \$3 per quarter. This decrease is to reflect the current and expected future reduction in administrative activities to be provided by the Company to AuraSense, LLC.

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The amounts due from AuraSense, LLC in connection with the above mentioned activities were \$17 and \$15 at December 31, 2017 and 2016, respectively.

The following is a summary of amounts billed to AuraSense, LLC and recognized in the accompanying statements of operations in connection with the above mentioned activities:

	For the Year Ended December 31,	
	2017	2016
Direct labor on research activities	\$ —	\$ 3
Quarterly fee for indirect costs	12	30
Direct costs of AuraSense LLC paid by the Company or (of the Company paid by AuraSense, LLC), net	5	(4)
	\$ 17	\$ 29

The Company received consulting services from, and paid fees to, one of its co-founders who is not an employee but serves as a member of the Board of Directors of the Company. The Company paid \$100 in each of the years ended December 31, 2017 and 2016 in connection with these consulting services and these amounts are recognized as an expense in the accompanying consolidated statements of operations.

13. Subsequent Events

Hercules loan amendment

On January 15, 2018, the Company and Hercules amended its loan agreement so that amortization payments due for the thirteen (13) consecutive months commencing on December 1, 2017 through and including December 1, 2018 were deferred. Commencing on January 1, 2019, and continuing on the first business day of each month thereafter, the loan, including the deferred payments, shall begin amortizing in equal monthly installments of principal and interest based upon an amortization schedule equal to eighteen (18) consecutive months.

The Company has evaluated subsequent events which may require adjustment to or disclosure in the accompanying consolidated financial statements and has concluded that, other than the Hercules loan amendment disclosed above, there are no subsequent events or transactions that occurred subsequent to the balance sheet date that would require recognition or disclosure in the accompanying consolidated financial statements.

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 principal executive officer and principal financial officer, evaluated the effectiveness of our disclosure controls and procedures as of December 31, 2017. The term “disclosure controls and procedures,” as defined in Rules 13a-15(e) and 15d-15(e) under the Securities Exchange Act of 1934, as amended (the “Exchange Act”), means controls and other procedures of a company that are designed to ensure that information required to be disclosed by a 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 the SEC’s rules and forms. Disclosure controls and procedures include, without limitation, controls and procedures designed to ensure that information required to be disclosed by a company in the reports that it files or submits under the Exchange Act is accumulated and communicated to its management, including its principal executive and principal financial officers, as appropriate to allow timely decisions regarding required disclosure. 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 the evaluation of our disclosure controls and procedures as of December 31, 2017, our principal executive officer and principal financial officer concluded that, as of such date, our disclosure controls and procedures were effective.

Management’s Annual Report on Internal Control Over Financial Reporting.

This Annual Report on Form 10-K does not include a report of management’s assessment regarding internal control over financial reporting due to a transition period established by rules of the SEC for newly public companies.

Changes in Internal Control over Financial Reporting

There were no changes 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 fiscal quarter ended December 31, 2017 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Attestation Report of the Registered Public Accounting Firm

This Annual Report on Form 10-K does not include an attestation report of our independent registered public accounting firm as we are an “emerging growth company” as of December 31, 2017, as defined in the Jumpstart Our Business Startups Act of 2012.

Item 9B. Other Information.

None.

PART III

Item 10. Directors, Executive Officers and Corporate Governance.

The information required by this item and not set forth below will be set forth in the definitive proxy statement for our 2018 Annual Meeting of Stockholders to be filed with the SEC pursuant to Regulation 14A, or the Proxy Statement, not later than 120 days after the end of the fiscal year covered by this Annual Report on Form 10-K, and is incorporated herein by reference.

We have adopted a Code of Business Conduct and Ethics applicable to all employees, including the principal executive officer, principal financial officer and principal accounting officer or controller, or persons performing similar functions. The Code of Business Conduct and Ethics is posted on our website at www.exicuretx.com. Amendments to, and waivers from, the Code of Business Conduct and Ethics that apply to any of these officers, or persons performing similar functions, and that relate to any element of the code of ethics definition enumerated in Item 406(b) of Regulation S-K will be disclosed at the website address provided above and, to the extent required by applicable regulations, on a current report on Form 8-K.

Item 11. Executive Compensation.

The information required by this item will be set forth in our Proxy Statement and is incorporated herein by reference.

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

The information required by this item will be set forth in our Proxy Statement and is incorporated herein by reference.

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

The information required by this item will be set forth in our Proxy Statement and is incorporated herein by reference.

Item 14. Principal Accounting Fees and Services.

The information required by this item will be set forth in our Proxy Statement and is incorporated herein by reference.

PART IV

Item 15. Exhibits, Financial Statement Schedules.

(a) The following documents are filed as part of this report:

1. Financial Statements

See Index to Financial Statements on page 105 of this Annual Report on Form 10-K.

2. Financial Statement Schedules

All schedules are omitted because they are not applicable or the required information is shown in the financial statements or notes thereto.

3. Exhibits

Except as so indicated in Exhibit 32.1, the following exhibits are filed as part of, or incorporated by reference into, this Annual Report on Form 10-K.

Exhibit Number	Exhibit Description	Filed with this Report	Incorporated by Reference herein from Form or Schedule	Filing Date	SEC File/Reg. Number
2.1†	Agreement and Plan of Merger and Reorganization, dated September 26, 2017, by and among Max-1 Acquisition Corporation, Max-1 Acquisition Sub. Inc., a Delaware corporation and wholly-owned subsidiary of the Company, and Exicure OpCo, a Delaware corporation.		8-K (Exhibit 2.1)	10/2/2017	000-55764
3.1	Certificate of Merger relating to the merger of Max-1 Acquisition Sub., Inc. with and into Exicure OpCo, filed with the Secretary of State of the State of Delaware on September 26, 2017.		8-K (Exhibit 3.1)	10/2/2017	000-55764
3.2	Certificate of Amendment to Certificate of Incorporation, filed with the Secretary of State of the State of Delaware on September 26, 2017.		8-K (Exhibit 3.2)	10/2/2017	000-55764
3.3	Form of Amended and Restated Certificate of Incorporation, as filed with the Secretary of State of the State of Delaware on November 15, 2017.		8-K (Exhibit 3.3)	10/2/2017	000-55764
3.4	Amended and Restated Bylaws, as currently in effect.		8-K (Exhibit 3.4)	10/2/2017	000-55764
4.1	Form of Warrant to Purchase Shares of Common Stock issued to Placement Agent.		8-K (Exhibit 4.1)	10/2/2017	000-55764
4.2	Form of Registration Rights Agreement by and among the Company and the persons named therein.		8-K (Exhibit 4.2)	10/2/2017	000-55764
10.1+	2015 Equity Incentive Plan and forms of awards thereunder, assumed in the Merger.		8-K (Exhibit 10.1)	10/2/2017	000-55764
10.2+	2017 Equity Incentive Plan and forms of award agreements thereunder.		8-K (Exhibit 10.2)	10/2/2017	000-55764
10.3+	2017 Employee Stock Purchase Plan.		8-K (Exhibit 10.3)	10/2/2017	000-55764
10.4+	Form of Indemnification Agreement by and between the Company and each of its directors and executive officers.		8-K (Exhibit 10.4)	10/2/2017	000-55764
10.5	Form of Subscription Agreement by and between the Company and each investor in the initial closing of the Private Placement.		8-K (Exhibit 10.5)	10/2/2017	000-55764

10.6+	Form of Amended and Restated Board Member Service Agreement by and between Exicure OpCo and each of its non-executive directors.	8-K (Exhibit 10.6)	10/2/2017	000-55764
10.7+	Employment Agreement dated as of February 2, 2016 by and between Exicure OpCo and David A. Giljohann, Ph.D.	8-K (Exhibit 10.7)	10/2/2017	000-55764
10.8+	Amended and Restated Employment Agreement dated as of February 2, 2016 by and between Exicure OpCo and David S. Snyder.	8-K (Exhibit 10.8)	10/2/2017	000-55764
10.9+	Employment Offer Letter dated as of September 16, 2015 by and between Exicure OpCo and Ekambar Kandimalla, Ph.D.	8-K (Exhibit 10.9)	10/2/2017	000-55764
10.10+	First Amendment to Offer Letter dated as of January 8, 2016 by and between Exicure OpCo and Ekambar Kandimalla, Ph.D.	8-K (Exhibit 10.10)	10/2/2017	000-55764
10.11+	Consulting Agreement dated as of October 1, 2011 by and between AuraSense Therapeutics, LLC and Chad A. Mirkin, Ph.D.	8-K (Exhibit 10.11)	10/2/2017	000-55764
10.12	Lease Agreement dated as of February 13, 2012 by and between AuraSense Therapeutics, LLC and FC Skokie SPE, LLC.	8-K (Exhibit 10.12)	10/2/2017	000-55764
10.13	Letter dated as of March 12, 2012 regarding the Lease Agreement by and between AuraSense Therapeutics, LLC and FC Skokie SPE, LLC.	8-K (Exhibit 10.13)	10/2/2017	000-55764
10.14	First Amendment to Lease dated as of March 31, 2014 by and between AuraSense Therapeutics, LLC and FC Skokie PQ, LLC, as successor in interest to FC Skokie SPE, LLC.	8-K (Exhibit 10.14)	10/2/2017	000-55764
10.15	Second Amendment to Lease dated as of May 26, 2016 by and between Exicure OpCo and FC Skokie PQ, LLC, as successor in interest to FC Skokie SPE, LLC.	8-K (Exhibit 10.15)	10/2/2017	000-55764
10.16	Loan and Security Agreement dated as of February 17, 2016 by and between Exicure OpCo and Hercules.	8-K (Exhibit 10.16)	10/2/2017	000-55764
10.17	Amendment No. 1 to Loan and Security Agreement dated as of October 10, 2016 by and between Exicure OpCo and Hercules.	8-K (Exhibit 10.17)	10/2/2017	000-55764
10.17.1	Amendment No. 2 to Loan and Security Agreement dated as of January 15, 2018 by and between Exicure OpCo and Hercules.	S-1/A (Exhibit 10.17.1)	1/26/2018	333-221791
10.18+	Form of Pre-Merger Indemnity Agreement.	8-K (Exhibit 10.18)	10/2/2017	000-55764
10.19	Form of Common Stock Purchase Agreement.	8-K (Exhibit 10.1)	6/19/2017	000-55764
10.20*	Restated License Agreement between Exicure OpCo and Northwestern University dated as of August 15, 2015.	8-K/A (Exhibit 10.20)	11/7/2017	000-55764
10.21*	License Agreement between Exicure OpCo and Northwestern University dated as of February 10, 2016 and effective as of May 27, 2014.	8-K/A (Exhibit 10.21)	11/7/2017	000-55764
10.22*	License Agreement between Exicure OpCo and Northwestern University dated as of June 17, 2016.	8-K/A (Exhibit 10.22)	11/7/2017	000-55764
10.23*	Amendment One to the Amended Restated License Agreement between Exicure OpCo and Northwestern University dated as of September 27, 2016.	8-K/A (Exhibit 10.23)	11/7/2017	000-55764
10.24*	Research Collaboration, Option and License Agreement between Exicure OpCo and Purdue Pharma L.P. dated as of December 2, 2016.	8-K/A (Exhibit 10.24)	11/7/2017	000-55764
10.25	Side Agreement to Northwestern Agreements by and among Exicure OpCo, Northwestern University and Purdue Pharma L.P. dated as of October 11, 2016.	8-K/A (Exhibit 10.25)	11/7/2017	000-55764
10.26	Form of Subscription Agreement by and between the Company and each investor in connection with the subsequent closings of the Private Placement.	8-K (Exhibit 10.1)	11/2/2017	000-55764

10.27	Form of Purchaser Rights Letter to be delivered by the Company to each investor in the initial closing of the Private Placement.		8-K (Exhibit 10.2)	11/2/2017	000-55764
21.1	Subsidiaries of Exicure, Inc.	X			
23.1	Consent of KPMG LLP, independent registered public accounting firm.	X			
24.1	Power of Attorney (included on the signature page hereto).	X			
31.1	Certification of Principal Executive Officer Pursuant to Rule 13a-14(a) of the Securities Exchange Act of 1934, As Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.	X			
31.2	Certification of Principal Financial Officer Pursuant to Rule 13a-14(a) of the Securities Exchange Act of 1934, As Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.	X			
32**	Certifications of Principal Executive Officer and Principal Financial Officer Pursuant to 18 U.S.C. Section 1350, As Adopted Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.	X			
101.INS	XBRL Instance Document.	X			
101.SCH	XBRL Taxonomy Extension Schema Document.	X			
101.CAL	XBRL Taxonomy Extension Calculation Linkbase Document.	X			
101.DEF	XBRL Taxonomy Extension Definition.	X			
101.LAB	XBRL Taxonomy Extension Label Linkbase Document.	X			
101.PRE	XBRL Taxonomy Presentation Linkbase Document.	X			

† Annexes, schedules and/or exhibits have been omitted pursuant to Item 601(b)(2) of Regulation S-K. We hereby undertake to furnish supplementally a copy of any of the omitted schedules and exhibits to the SEC on a confidential basis upon request.

+ Indicates a management contract or compensatory plan.

* Portions of this exhibit have been omitted pursuant to a request for confidential treatment granted by the SEC, and omitted portions have been filed separately with the SEC.

** Furnished herewith.

Item 16. Form 10-K Summary.

None.

SIGNATURES

Pursuant to the requirements of Section 13 or Section 15(d) of the Securities Exchange Act of 1934, as amended, the registrant has duly caused this Annual Report on Form 10-K to be signed on its behalf by the undersigned, thereunto duly authorized, in the City of Skokie, State of Illinois, on March 9, 2018.

EXICURE, INC.

By: /s/ David A. Giljohann
David A. Giljohann, Ph.D.
Chief Executive Officer and Director (*principal executive officer*)

By: /s/ David S. Snyder
David S. Snyder
Chief Financial Officer
(*principal financial officer and principal accounting officer*)

POWER OF ATTORNEY

We, the undersigned directors and officers of Exicure, Inc., hereby severally constitute and appoint David A. Giljohann and David S. Snyder, and each of them singly, our true and lawful attorneys-in-fact, with full power to them, and to each of them singly, to sign for us and in our names in the capacities indicated below, any and all amendments to this Annual Report on Form 10-K and to file or cause to be filed the same, with all exhibits thereto and other documents in connection therewith, with the Securities and Exchange Commission, granting unto said attorneys-in-fact, and each of them, full power and authority to do and perform each and every act and thing requisite and necessary to be done in connection therewith, as fully to all intents and purposes as each of them might or could do in person, and hereby ratifying and confirming all that said attorneys-in-fact, and each of them, or their substitute or substitutes, shall do or cause to be done by virtue of this Power of Attorney. This Power of Attorney does not revoke any power of attorney previously granted by the undersigned, or any of them.

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

SIGNATURE	TITLE	DATE
<u>/s/ David A. Giljohann</u> David A. Giljohann, Ph.D.	Chief Executive Officer and Director (<i>principal executive officer</i>)	March 9, 2018
<u>/s/ David S. Snyder</u> David S. Snyder	Chief Financial Officer (<i>principal financial officer and principal accounting officer</i>)	March 9, 2018
<u>/s/ Chad A. Mirkin</u> Chad A. Mirkin, Ph.D.	Director and Chairman of the Board of Directors	March 9, 2018
<u>/s/ C. Shad Thaxton</u> C. Shad Thaxton, M.D., Ph.D.	Director	March 9, 2018
<u>/s/ David R. Walt</u> David R. Walt, Ph.D.	Director	March 9, 2018
<u>/s/ Jay R. Venkatesan</u> Jay R. Venkatesan, M.D.	Director	March 9, 2018
<u>/s/ Helen S. Kim</u> Helen S. Kim	Director	March 9, 2018

Subsidiaries of Exicure, Inc.

Name:
Exicure Operating Company

Jurisdiction of Organization:
Delaware

Consent of Independent Registered Public Accounting Firm

The Board of Directors
Exicure, Inc.:

We consent to the incorporation by reference in the registration statement (No. 333-222999) on Form S-8 of Exicure, Inc. and subsidiary of our report dated March 9, 2018, with respect to the balance sheets of Exicure, Inc. as of December 31, 2017 and 2016, and the related statements of operations, stockholders' equity, and cash flows for each of the years in the two-year period ended December 31, 2017, and the related financial statement schedule (collectively, the financial statements), which report appears in the December 31, 2017 annual report on Form 10-K of Exicure, Inc.

(signed) KPMG LLP

Chicago, Illinois
March 9, 2018

CERTIFICATIONS

I, David A. Giljohann, Ph.D., certify that:

1. I have reviewed this Annual Report on Form 10-K of Exicure, Inc.;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act rules 13a-15(f) and 15d-15(f)) for the registrant and have:
 - a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
 - b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, 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;
 - c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
 - d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):
 - a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and
 - b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: March 9, 2018

/s/ David A. Giljohann, Ph.D.

David A. Giljohann, Ph.D.

President and Chief Executive Officer

CERTIFICATIONS

I, David S. Snyder, certify that:

1. I have reviewed this Annual Report on Form 10-K of Exicure, Inc.;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act rules 13a-15(f) and 15d-15(f)) for the registrant and have:
 - a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
 - b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under my supervision, 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;
 - c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
 - d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):
 - a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and
 - b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: March 9, 2018

/s/ David S. Snyder

David S. Snyder
Chief Financial Officer

SECTION 1350 CERTIFICATIONS*

Pursuant to the requirement set forth in Rule 13a-14(b) of the Securities Exchange Act of 1934, as amended (the “Exchange Act”), and Section 1350 of Chapter 63 of Title 18 of the United States Code (18 U.S.C. § 1350), David A. Giljohann, Ph. D., President and Chief Executive Officer of Exicure, Inc. (the “Company”), and David S. Snyder, Chief Financial Officer of the Company, each hereby certifies that, to the best of his knowledge:

1. The Company’s Annual Report on Form 10-K for the year ended December 31, 2017, to which this Certification is attached as Exhibit 32.1 (the “Annual Report”), fully complies with the requirements of Section 13(a) or 15(d) of the Exchange Act; and
2. The information contained in the Annual Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

Dated: March 9, 2018

/s/ David A. Giljohann, Ph.D.

David A. Giljohann, Ph.D.
President and Chief Executive Officer

/s/ David S. Snyder

David S. Snyder
Chief Financial Officer

* This certification accompanies the Annual Report on Form 10-K, to which it relates, is not deemed filed with the Securities and Exchange Commission and is not to be incorporated by reference into any filing of the Company under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended (whether made before or after the date of the Annual Report on Form 10-K), irrespective of any general incorporation language contained in such filing.