MIRAGEN THERAPEUTICS, INC.
Form 10-K
March 24, 2017

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, 2016

OR

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

For the transition period from to

Commission File Number: 001-36483

MIRAGEN THERAPEUTICS, INC.

(Exact name of registrant as specified in its charter)

Delaware	**47-1187261**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification Number)**

6200 Lookout Road, Boulder, CO 80301
(Address of principal executive offices) (Zip Code)

Registrant's telephone number, including area code: (303) 531-5952

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

Title of each class	**Name of each exchange on which registered**
Common Stock, $0.01 par value	**The NASDAQ Capital Market**

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

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

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

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

Indicate by check mark whether the registrant has submitted electronically 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 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.

1

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer or a smaller reporting company. See definitions of “large accelerated filer”, “accelerated filer” and “smaller reporting 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 filer

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

The aggregate market value of the voting stock held by non-affiliates of the registrant, based upon the closing sale price of the Common Stock on June 30, 2016 as reported on The NASDAQ Capital Market, was $3.4 million. Shares of Common Stock held by each executive officer and director and by each person who owns 10% or more of the outstanding Common Stock have been excluded in that such persons may be deemed to be affiliates. This determination of affiliate status is not necessarily a conclusive determination for other purposes.

As of March 17, 2017, there were 21,370,063 shares of the registrant's Common Stock outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

None.

MIRAGEN THERAPEUTICS, INC.

INDEX

FORWARD-LOOKING STATEMENTS

This Annual Report on Form 10-K, or this Annual Report, contains forward-looking statements that involve substantial risks and uncertainties for purposes of the safe harbor provided by the Private Securities Litigation Reform Act of 1995. All statements contained in this Annual Report other than statements of historical fact, including statements regarding our strategy, future operations, future financial position, future revenue, projected expenses, prospects, plans and objectives of management are forward-looking statements. The words “believe,” “may,” “will,” “estimate,” “continue,” “anticipate,” “intend,” “plan,” “expect,” “predict,” “potential,” “opportunity,” “goals,” or “should,” and expressions are intended to identify forward-looking statements.

Such statements are based on management’s current expectations and involve risks and uncertainties. Actual results and performance could differ materially from those projected in the forward-looking statements as a result of many factors, including, without limitation:

- We have incurred losses since our inception, have a limited operating history on which to assess our business, and anticipate that we will continue to incur significant losses for the foreseeable future.
- We have never generated any revenue from product sales and may never be profitable.
- Raising additional capital may cause dilution to our stockholders, restrict our operations or require us to relinquish rights.
- Clinical trials are costly, time consuming and inherently risky, and we may fail to demonstrate safety and efficacy to the satisfaction of applicable regulatory authorities.
- The approach we are taking to discover and develop novel therapeutics using microRNA is unproven and may never lead to marketable products.
- Our microRNA therapeutic product candidates are based on a relatively novel technology, which makes it difficult to predict the time and cost of development and of subsequently obtaining regulatory approval, if at all. To date, no microRNA therapeutics have been approved for marketing in the United States.
- We may not be able to develop or identify technology that can effectively deliver MRG-106, MRG-201 or any other of our microRNA-targeted product candidates to the intended diseased cells or tissues, and any failure in such delivery technology could adversely affect and delay the development of MRG-106, MRG-201 and our other product candidates.
- Our product candidates may cause undesirable side effects or have other properties that could delay or prevent the regulatory approval, limit the commercial viability of an approved label, or result in significant negative consequences following marketing approval, if any.

We have based these forward-looking statements largely on our current expectations and projections about future events and trends that we believe may affect our financial condition, results of operations, business strategy, short-term and long-term business operations and objectives, and financial needs. These forward-looking statements are subject to a number of risks, uncertainties and assumptions, including those described in Part I, Item 1A, "Risk Factors" in this Annual Report. Moreover, we operate in a very competitive and rapidly changing environment. New risks emerge from time to time. It is not possible for our management to predict all risks, nor can we assess the impact of all factors on our business or the extent to which any factor, or combination of factors, may cause actual results to differ materially from those contained in any forward-looking statements we may make. In light of these risks,

uncertainties and assumptions, the future events and trends discussed in this Annual Report may not occur and actual results could differ materially and adversely from those anticipated or implied in the forward-looking statements.

We undertake no obligation to revise or publicly release the results of any revision to these forward-looking statements, except as required by law. Given these risks and uncertainties, readers are cautioned not to place undue reliance on such forward-looking statements. All forward-looking statements are qualified in their entirety by this cautionary statement.

PART I

Item 1. Business

Merger of Signal Genetics, Inc. and Miragen Therapeutics, Inc.

On February 13, 2017 Signal Genetics, Inc., or Signal, and privately-held Miragen Therapeutics, Inc., or Private Miragen, completed the merger and reorganization, or the Merger, in accordance with the terms of the Agreement and Plan of Merger and Reorganization, dated October 31, 2016, or the Merger Agreement, whereby Signal merged with and into Private Miragen, with Private Miragen surviving as a wholly owned subsidiary of Signal. Immediately following the Merger, Signal changed its name to “Miragen Therapeutics, Inc.,” the post-Merger company is referred to in this Annual Report as Miragen. In connection with the closing of the Merger, our common stock began trading on The NASDAQ Capital Market under the ticker symbol “MGEN” on February 14, 2017. Additionally, on February 13, 2017, in connection with the Merger, we completed the sale of all of our intellectual property assets relating to our MyPRS test, or collectively, the MyPRS Assets, a microarray-based gene expression profile assay, pursuant to an Intellectual Property Purchase Agreement, or the IP Purchase Agreement, with Quest Diagnostics Investments LLC, or Quest, dated November 29, 2016. As consideration for the sale of the MyPRS Assets, Quest paid us $0.8 million, plus an additional $0.1 million, as consideration for exercising its right to require us to operate our lab beyond December 31, 2016 and an additional $21,000 for reimbursement of certain amounts paid by us to the University of Texas M.D. Anderson Cancer Center.

Prior to the Merger, Signal was founded in New York as a Delaware limited liability company in January 2010 under the name Myeloma Health LLC. Signal Genetics LLC was formed as a Delaware limited liability company in December 2010. Effective January 1, 2011, substantially all of the member interests in Myeloma Health LLC were exchanged for member interests in Signal Genetics LLC and Myeloma Health LLC became a subsidiary of Signal Genetics LLC. Immediately prior to the pricing of our initial public offering, on June 17, 2014, Signal Genetics LLC converted from a Delaware limited liability company to a Delaware corporation, or the Corporate Conversion. In connection with the Corporate Conversion, each unit of Signal Genetics LLC was converted into a share of common stock of Signal, the members of Signal Genetics LLC became stockholders of Signal and Signal succeeded to the business of Signal Genetics LLC and its consolidated subsidiaries. As used in this report, the words “we,” “us,” “our,” the “Company,” and “Miragen” refer to Miragen Therapeutics, Inc.

Overview

Prior to the Merger, we were a commercial-stage, molecular genetic diagnostic company historically focused on providing innovative diagnostic services that helped physicians make better-informed decisions concerning the care of their patients suffering from cancer.

After the Merger, we are a clinical-stage biopharmaceutical company discovering and developing proprietary RNA-targeted therapeutics with a specific focus on microRNAs and their role in diseases where there is a high unmet medical need. microRNAs are short RNA molecules, or oligonucleotides, that regulate gene expression or activity and play a vital role in influencing the pathways responsible for many disease processes. We believe our experience in microRNA biology and chemistry, drug discovery, bioinformatics, and translational medicine provide it with a potential competitive advantage to identify and develop microRNA-targeted drugs designed to regulate gene pathways to result in disease modification. We use our expertise in systems biology and oligonucleotide chemistry to discover and develop a pipeline of product candidates. Our two lead product candidates, MRG-106 and MRG-201, are currently in Phase 1 clinical trials. Our clinical product candidate for the treatment of certain cancers, MRG-106, is an inhibitor of microRNA-155, or miR-155, which is found at abnormally high levels in several blood cancers. Our clinical product candidate for the treatment of pathological fibrosis, MRG-201, is a replacement for miR-29, which is found at abnormally low levels in a number of pathological fibrotic conditions, including cardiac, renal, hepatic, and pulmonary fibrosis, as well as systemic sclerosis. In addition to our clinical programs, we continue to discover and develop a pipeline of pre-clinical product candidates. The goal of our translational medicine strategy is to progress rapidly to first in human studies once it has established the pharmacokinetics (the movement of drug into, through, and out of the body), pharmacodynamics (the effect and mechanism of action of a drug), safety and manufacturability of the product candidate in preclinical studies.

In February 2016, we administered MRG-106 to the first patient in a multi-site, open-label, dose-ranging Phase 1 clinical trial that seeks to enroll up to 50 patients with a confirmed diagnosis of mycosis fungoides, or MF, which is a subtype of cutaneous T-cell lymphoma, or CTCL, in which malignant T-cells move to the skin and form patches (palpable flat lesions) or plaques and tumors. MRG-106 has been generally safe and well tolerated in the six patients who received the product candidate in Part A, with no significant injection site reactions or dose limiting toxicities. In addition, molecular analyses of patient tissue samples demonstrated changes in gene expression in the tumors consistent with what we believe is the expected mechanism of action of MRG-106 in CTCL lesions. We believe that

these data demonstrate the potential of MRG-106 to regulate appropriate gene pathways to provide clinical benefit in MF patients. Part B of the clinical trial is currently ongoing. As of March 13, 2017, a total of nine patients had completed at least one cycle of dosing in Part B of the clinical trial. One of the nine patients had the drug withheld after the third of six doses but otherwise completed the cycle, including an end of study visit. As of March 13, 2017, MRG-106 had been generally safe and well tolerated in eight of the nine patients who have received the product candidate in Part B. As of March 13, 2017, an additional three patients had started their first cycle of dosing with 300 mg of MRG-106 administered intravenously.

In November 2015, we initiated a single-center Phase 1, double-blind, placebo-controlled, single and multiple dose-escalation clinical trial of MRG-201 enrolling up to 70 healthy volunteers. As of March 13, 2017, 54 volunteers had enrolled in the trial, 47 of whom had received MRG-201. MRG-201 has been generally safe and well tolerated in all volunteers, with no significant injection site reactions. Biomarker analysis demonstrated on-target molecular activity for MRG-201 in human skin, with an apparent dose-dependent effect after a single dose. Preliminary histological analysis indicates that incisions treated with multiple administrations of MRG-201 showed a decrease in formation of fibrous tissue, or fibroplasia, with no apparent detrimental effect on wound healing. We believe these data suggest that MRG-201 may be able to reduce pathological fibrosis and scar formation in human skin.

In addition to MRG-106 and MRG-201, we have a pipeline of wholly-owned, pre-clinical product candidates that target individual microRNAs thought to be at abnormally high or low levels in particular diseases. We believe our experience in microRNA biology and chemistry, drug discovery, bioinformatics, and translational medicine allows us to identify and develop RNA-targeted drugs that are designed to regulate gene pathways to return diseased cells to a healthy state. We believe that our drug discovery and development strategy will enable us to progress our product candidates from pre-clinical discovery to confirmation of mechanism of action in humans quickly and efficiently. The elements of this strategy include identification of biomarkers that may predict clinical benefit and monitoring outcomes in early-stage clinical trials to help guide later clinical development.

The following table illustrates our most advanced programs:

Product Candidate	**Target**	Disease Area	Development Status
Clinical			
MRG-106	miR-155	Blood Cancers	Phase 1 clinical trial
MRG-201	miR-29	Pathological Fibrosis	Phase 1 clinical trial
Pre-Clinical			
MRG-107	miR-155	Neuro-Inflammation	IND Enabling
MRG-110	miR-92	Revascularization	IND Enabling

Our Strategy

We seek to use our expertise and understanding of microRNA biology, oligonucleotide chemistry and product development to create novel products that have the potential to transform the treatment of patients with serious diseases. The key components of our strategy are as follows:

- **Continue to develop MRG-106 in blood cancers.** Our ongoing Phase 1 clinical trial of MRG-106 for the treatment of patients with MF is designed to deliver the necessary data, including mechanistic proof-of-concept as well as appropriate doses and dose schedule to support further development of miR-155 inhibitor, MRG-106, in multiple cancer indications in which elevated levels of miR-155 has been observed. We plan to expand our clinical program to explore the broader utility of MRG-106 in patients with other blood cancers, such as diffuse large B cell lymphoma, leukemia, and virally induced lymphomas. We also intend to initiate a Phase 2 clinical trial of MRG-106 in CTCL using a dose, schedule and route of administration selected based on results obtained in the Phase 1 clinical trial.

- **Continue to develop MRG-201 in pathological fibrosis.** Our ongoing Phase 1 clinical trial of MRG-201 in healthy volunteers, in addition to being a safety and tolerability trial, is designed to serve as a human mechanistic proof-of-concept assessment that helps reduce the risk associated with further development of the product candidate for other forms of pathological fibrosis such as pulmonary, retinal, hepatic and renal fibrosis. This clinical trial is designed to serve as a prelude to a Phase 2 clinical trial in skin or other tissue manifestations of pathological fibrosis. We may pursue additional development of MRG-201 independently or through a strategic alliance.

- **Utilize rare disease development pathways at the FDA and comparable foreign regulatory agencies, where appropriate, to accelerate progression to late stage development and early approval.** For wholly-owned programs, we intend to focus on rare and genetic diseases where RNA modulation may produce clinical benefit so that we can take advantage of regulatory programs intended to expedite drug development. We plan to apply for the regulatory programs for orphan drug designation, fast track, breakthrough therapy designation, and/or priority review when available to potentially reduce clinical trial expense and increase speed to commercialization.

- **Collaborate with other biotechnology and pharmaceutical companies to develop additional product candidates.** We intend to seek out collaborations for additional microRNA targets and development of compounds in our pipeline that require larger clinical trials or extensive commercial infrastructure. For example, we have a multi-target strategic collaboration with Les Laboratoires Servier and the Institut de Recherches Servier, or Servier,

to develop product candidates for the treatment of cardiovascular diseases.

- **Use in-house research and translational expertise to further develop our product candidate pipeline.** Our in-house research team investigates novel microRNA targets identified through internal efforts and academic collaborations. We then seek to establish evidence that the microRNA is implicated in certain diseases. We believe that this internal research and expertise could provide a foundation to develop product candidates for the treatment of a variety of diseases in which microRNA is implicated.

- **Selectively build focused commercial capabilities and establish commercial collaborations to maximize the value of our pipeline.** To date, we have retained all U.S. and Japanese rights to our product candidates in the strategic collaboration with Servier and global rights in all other programs. While we have not yet defined our sales, marketing or product distribution strategy for MRG-106, MRG-201 or any of our other product candidates, our commercial strategy may include the use of strategic alliances, distributors, a contract sales force, or the establishment of our own commercial and specialty sales force to maximize the value of our pipeline.

Our Product Candidates

MRG-106

MRG-106 is an inhibitor of miR-155. We are conducting a Phase 1 clinical trial of MRG-106 in patients with MF. Data reported in scientific literature identifies miR-155 as a cancer-causing microRNA, or oncomiR, with a central role in the development of multiple blood cancers. miR-155 controls a number of validated cancer-related disease targets, including Bruton's Tyrosine Kinase and nuclear factor kappa-light-chain-enhancer of activated B cells. In certain B-cell lymphomas, improvement of clinical outcomes has been associated with normalization of miR-155 levels, and poor prognosis, resistance to treatment and recurrence of the disease are associated with elevated levels of miR-155. In addition to playing a role in B-cell malignancies, miR-155 is elevated in another group of malignant white blood cells, called T-cells, found in skin lesions of patients with MF. We screened a library of locked nucleic acid modified oligonucleotides, and identified MRG-106 as having what we believed was the best potential efficacy and drug-like properties including improved pharmacodynamics in human T- and B-cell lymphoma cell lines.

Mycosis Fungoides

MF is the most common form of a type of blood cancer called CTCL. CTCL occurs when certain types of T-cells become cancerous. These malignant T-cells then form specific types of skin lesions. Although the skin is involved, the skin cells themselves are not cancerous. According to the National Institutes of Health, or NIH, MF usually occurs in adults over age 50, although the disease may occur at any age including in children.

We believe the total population of patients with cutaneous lymphoma in the United States and Canada is approximately 30,000. In a 2012 publication, the Lymphoma Research Foundation estimated the prevalence of MF to be 16,000-20,000 cases in the United States. According to the Leukemia and Lymphoma Society in a 2014 publication, approximately 70% to 80% of patients are diagnosed with early stage MF that impacts only the skin. In these patients, the disease typically has a slow progression, but is accompanied by serious quality of life detriments such as severe itchiness, pain and disfiguration. The five-year survival rate for newly diagnosed patients with CTCL is approximately 90%. In later stage MF and in some early stage patients whose disease progresses, the cancer may involve the lymph nodes, blood and internal organs. The five-year survival rate in later stage patients with CTCL (stages IIB, III, IV) is approximately 20-60% depending on stage.

There are currently no curative therapies for CTCL, and concurrent and consecutive treatments, many with significant adverse effects, tend to be given until loss of response. There is a need for new and improved therapies in CTCL to treat the disease and eliminate symptoms such as itchiness and painful skin lesions and to prolong survival in patients with aggressive disease. Most drugs for CTCL have response rates between 30% and 40%, and response durations tend to be less than a year.

There is no universally accepted standard of care for treatment of MF. Treatment is dependent on stage of disease and responsiveness to previous therapy and is divided into skin-directed therapy and whole body treatments. For certain patients with advanced disease, allogeneic stem cell transplantation may offer prolonged survival, but the five-year survival is only around 50%.

In addition to MF, elevation of miR-155 has been associated with several other blood cancers and certain solid tumors. We believe there is a potential opportunity to develop a companion diagnostic that could detect and quantify levels of miR-155 in circulating blood or malignant cells. We believe this approach may then allow for the selection of patients with elevated miR-155 levels who may be more likely to benefit from MRG-106 treatment and allow the drug to be used selectively in multiple cancers. There are several types of cancer in which high levels of miR-155 have been discovered, including subsets of diffuse large B-cell lymphoma, acute myeloid leukemia, certain virally induced lymphomas such as HTLV-1 associated lymphoma and Burkitt's Lymphoma, Down Syndrome-associated acute lymphocytic leukemia, and other types of cancer. We plan to evaluate additional types of lymphoma and leukemia in Phase 1 clinical trials and intend to explore other potential applications for MRG-106 through additional clinical studies in other tumor types.

MRG-106 Phase 1 Clinical Trial

Trial Design

We are conducting a multi-site, open-label, dose-ranging Phase 1 clinical trial of MRG-106 for the treatment of MF at 11 U.S.-based clinical sites. This clinical trial consists of two parts and is expected to enroll up to 50 patients with MF. Patients may be allowed to be on other medications or background therapies so long as they have had no change in treatment regimen for CTCL, including drug and dose, for more than four weeks prior to enrollment and, in the opinion of the investigator, the patient is currently clinically stable and is likely to remain clinically stable for a minimum of three months after screening.

The primary objectives of this clinical trial are safety and tolerability. Secondary objectives include pharmacokinetic assessments, including measurement of absorption and clearance of MRG-106 from the blood. Additionally, there are several exploratory measures to assess any changes in lesion severity before and after treatment as well as pharmacodynamic and histology assessments. The clinical trial utilizes two validated measures of lesion severity: (i) Composite Assessment of Index Lesion Severity Score, or CAILS, which is a composite measure that assesses the severity of one or more lesions on a patient and (ii) modified Severity Weighted Assessment Tool, or mSWAT, which is an assessment tool that is used to analyze the disease severity over a patient's entire body.

Part A of the clinical trial tested the effect of direct injections of 75 mg of MRG-106 intratumorally. Part A of the clinical trial enrolled six patients, five of whom completed dosing. One patient discontinued the trial due to baseline disease that exceeded trial entry criteria, which was discovered during the first week of the trial and the decision was made to withdraw the patient. In four patients, saline placebo was injected into a separate skin lesion at the same time. After eight to 14 days of treatment, in five patients, injections sites were biopsied and analyzed for drug concentration, molecular evidence of drug activity on target gene expression, and histological evidence of alterations in malignant cell numbers and other immune cell populations. Additionally, as an exploratory endpoint, CAILS scoring was used to assess clinical response.

Part B of the clinical trial is enrolling patients and is designed to assess whole body administration of MRG-106. The first group, or cohort, of patients in Part B started receiving doses of MRG-106 in August 2016 as a subcutaneous injection of 300 mg/dose for four weeks. The next cohorts of three patients each received subcutaneous injections of 600 mg or 900 mg of MRG-106. As of March 13, 2017, three patients had started their first cycle of intravenous dosing with 300 mg of MRG-106. Three patients have received MRG-106 in the extension protocol, two of whom were still receiving MRG-106 in the extension protocol as of March 13, 2017. Additional patients will also be dosed intravenously. Dose escalation is planned to occur adaptively in increments from 100 mg to 300 mg, depending on the safety results observed at each dose level tested. In addition, some patients may receive the drug by a combination of routes, including subcutaneous, intravenous or intratumoral injection. Additional patients may be enrolled at any dose level based on safety and tolerability; however, no more than three patients who are within 28 days of their first dose may be in the study at one time. In addition to safety, tolerability and pharmacokinetics, exploratory pharmacodynamic endpoint assessments and clinical scoring using CAILS and mSWAT is being performed.

Safety, Pharmacokinetics and Pharmacodynamics

As of March 13, 2017, 18 MF patients had received at least one dose of MRG-106. MRG-106 was generally safe and well tolerated at all dose levels tested, with no significant injection site reactions. One patient did not receive all the scheduled treatments due to baseline disease that exceeded trial entry criteria as noted above. A second patient discontinued dosing due to worsening of their skin lesions associated with increased itching, which resolved in response to treatment with prednisone. No drug-related serious adverse events have been reported to date.

Six patients in Part A were administered MRG-106 intratumorally, with up to five 75 mg doses of MRG-106 administered to the same tumor over a period of up to two weeks. Four of these patients were simultaneously treated in a second lesion with a saline placebo solution. All patients who received MRG-106 generally tolerated the administrations well with only minimal redness of the skin at the site of injection noted in one patient. One patient was discontinued from the trial after receiving three doses of MRG-106 due to rapid progression of disease, which began shortly before the initiation of dosing and was considered unrelated to MRG-106. The remaining five patients have completed the dosing and follow-up periods. Adverse events for these patients noted by the treating physician as possibly or definitely related to MRG-106, included redness of the skin, pain, burning or tingling at the injection site, skin inflammation and a hand sore. All possibly or definitely related adverse events were judged as mild or moderate in severity. Abnormal lab values possibly related to use of the product candidate were observed in two patients and included moderate neutropenia and prolonged partial thromboplastin time, both of which resolved while continuing MRG-106.

In Part B of the clinical trial, three patients each in the 300 mg, 600 mg and 900 mg dose cohorts were to receive a total of six subcutaneous doses of MRG-106 administered over a 26-day period. All three dose levels were generally well tolerated in the eight patients that completed dosing. The treating physicians for these patients noted the following adverse events, which were possibly or definitely related to MRG-106: (i) five patients experienced mild to moderate pain or irritation at the site of injections on six occasions (ii) one patient experienced a rash at multiple injection sites; (iii) one patient experienced tenderness and bruising at multiple injection sites, as well as intermittent blurred vision (without objective evidence of visual disturbance upon examination by an ophthalmologist) and intermittent diarrhea; and (iv) one patient experienced redness of the skin around an injection site. One patient in the 900 mg dose cohort had worsening of their skin lesions associated with increased itching, which changed from mild to severe after receiving three doses of 900 mg. This patient stopped receiving MRG-106 and was treated with prednisone, and the patient's skin lesions and itching improved. No serious adverse events have been reported in Part B. Abnormal lab values possibly related to the administration of MRG-106 included mild, transient increases in liver enzymes in one patient dosed at the 600 mg dose level, transient increases in creatine kinase (an indicator of muscle stress) in one patient each at the 600 and 900 mg dose levels, increased creatinine and decreased lymphocyte count in one patient at the 900 mg dose level, and transient neutropenia in one patient dosed at the 900 mg dose level. The change in these lab values was transient during the course of dosing with MRG-106 and returned to normal by the end of the dosing period.

Pharmacokinetic analysis of the plasma collected from Part A of the clinical trial indicated that MRG-106 was quickly absorbed into the systemic circulation with the highest concentrations being observed 10 minutes to one hour after MRG-106 administration. Preliminary pharmacokinetic data from Part B of the clinical trial in the first nine patients dosed subcutaneously with 300 mg, 600 mg, or 900 mg of MRG-106 demonstrate this route of administration affects the time required to reach maximal concentrations of drug in the systemic circulation (approximately three to six hours) compared to intratumoral administration. Systemic exposure in the patients increased in a proportional manner to the increased dose levels administered.

In Part A of the clinical trial, high levels of MRG-106 (48 -204 µg per gram of tissue) were detected in injected tumors. We also observed accumulation of MRG-106 in a lesion distant from the site of injection at low levels (4 µg per gram of tissue). Preliminary analysis of injected tumors also indicated an increased expression of several direct targets of miR-155, suggesting that the drug is inhibiting its intended molecular target. The assessment of the pharmacodynamic effect of MRG-106 in skin lesions of Part B patients is ongoing.

Efficacy

All patients who received MRG-106 in Part A of the clinical trial demonstrated a beneficial clinical response. Intratumoral injection resulted in significant absorption in to the systemic circulation. Exploratory assessment of clinical response to therapy was performed for both MRG-106-treated and saline-treated lesions based on the change from baseline in the CAILS scores. Four of the five patients who completed dosing had their scores evaluated in the MRG-106 treated lesions. In the fifth patient, CAILS scores were monitored in two untreated lesions, instead of the treated lesions. The treated lesions in the four patients showed a 50% or greater reduction in the baseline CAILS score, which was maintained to the end of study visit (either 28 days or 35 days after the first dose). A greater than 50% reduction was observed in one saline injected lesion. The CAILS scores for patients in Part A of the clinical trial are set forth below.

Part A: Lesion CAILS

				MRG-106 Treated Lesions			Untreated or Saline Treated Lesions		
Patient Number	Number of Doses	Dose	Duration of Treatment (Days)	First CAILS Score	Lowest CAILS Score	Maximal % Reduction in CAILS	First CAILS Score	Lowest CAILS Score	Maximal % Reduction in CAILS
1 (early termination)	3	75 mg	9	18	12	33 %	18	14	22 %
2	4	75 mg	8	16	8	50 %	NA	NA	NA
3	4	75 mg	8	12	6	50 %	8	5	37 %
4 Lesion 1	4	75 mg	8	NA	NA	NA	15	8	47 %
4 Lesion 2	4	75 mg	8	NA	NA	NA	36	25	31 %

5	5	75 mg	15	26	6	77	%	20	5	75	%
6	5	75 mg	15	12	4	67	%	9	5	44	%

Histological examination of pre-treatment and post-treatment tumor biopsies of the same lesion injected with MRG-106 was conducted in five patients. At baseline, these biopsies typically showed evidence of cancer and high cancer cell density. After treatment, histology revealed fewer cancerous cells or a reduction in cancer cell density or depth in most patients. One patient who received MRG-106 injections in a small tumor showed a complete absence of cancerous T-cells in the post-treatment biopsy. Another patient had a lower percentage of CD30+ large atypical cells after MRG-106 treatment, which is indicative of a reduction in the number of cells with malignant characteristics.

Part B of the clinical trial has enrolled nine patients in the subcutaneous dosing cohorts, three in each of the 300 mg, 600 mg and 900 mg dose levels, eight of whom received six doses of MRG-106 over a 26-day period. Patients in the 300 mg and 600 mg dose cohorts have completed the clinical trial, including a follow-up visit on the 56th day of the clinical trial. Three patients completed the first cycle of dosing and then continued on to the optional extension part of the protocol; as of March 13, 2017, two of those three patients continued to receive MRG-106. The extension protocol provides continued observation of safety and clinical response for longer durations which may allow for a better understanding of potential adverse effects as well as beneficial dose and dose response.

Exploratory assessment of clinical response to therapy in Part B was performed by assessing the CAILS score for up to five lesions for each patient (one patient had only one lesion). The mSWAT and CAILS scores for each patient are shown in the table below. Two patients from the 300 mg dose group and one patient in the 600 mg dose group demonstrated reductions in their baseline mSWAT of 50% or greater and two of these patients also had reduction of 50% or greater in their CAILS scores. Additional patients have shown lesser improvements in CAILS and mSWAT scores as demonstrated in the table below.

Part B: CAILS and mSWAT

Patient Number	Number of Doses	Dose	Days on Trial Extension		Combined CAILS Score				mSWAT Score			
					First CAILS Score	Lowest CAILS Score	Maximal % Reduction in CAILS		First mSWAT Score	Lowest mSWAT Score	Maximal % Reduction in mSWAT	
1	6	300 mg	—		10	9	10	%	2	1	50	%
2	6	300 mg	—		40	10	75	%	47	23	51	%
3	6	300 mg	—		44	40	9	%	1.5	1.1	27	%
4	14	600 mg	60	**	45	21	53	%	22	10	55	%
5	6	600 mg	—		58	49	16	%	20.3	18.8	7	%
6	6	600 mg	—		82	70	15	%	42.7	40.1	6	%
7	13	900 mg	49	**	68	51	25	%	17.2	10	42	%
8	9	900 mg	44		18	21	NR		5.75	6.25	NR	
9	3	900 mg	—		*30	*34	*NR		*103	*97	*6	%

* Patient 9 received three doses prior to discontinuation of dosing.
** Days on trial extension as of March 13, 2017; patient dosing is ongoing.
NR No Reduction

Biomarker Analysis

Biomarkers were analyzed to assess the ability of MRG-106 to regulate the expression of gene pathways that are associated with elevated levels of miR-155 in MF. We identified a set of biomarkers based on MRG-106 activity in cell lines derived from MF patients. In Part A of the clinical trial, we assessed the expression of these biomarker genes in lesions before and after treatment with MRG-106. Retrospective analysis of a subset of the genes from the cell line data demonstrated that MRG-106 treatment decreased expression of some genes associated with cellular proliferation and increased expression of some genes associated with cell death. The expression of these genes appears to correspond to the level of drug measured in the lesion biopsy. We also believe these data illustrate the potential of its approach to identify molecular biomarkers that translate from pre-clinical studies to predict product candidate activity in clinical trials.

MRG-201

MRG-201 is a replacement for miR-29 that is intended to increase miR-29-like activity in the setting of fibrotic disease. We are currently studying MRG-201 in a single-center, Phase 1, double-blind, placebo-controlled, single and multiple dose-escalation clinical trial enrolling up to 70 healthy volunteers.

We believe that the miR-29 family of miRNAs is consistently present at abnormally low levels during fibrotic disease progression. We initially discovered the role of miR-29 in pathological cardiac fibrosis. Since this initial discovery, miR-29 has been implicated in pathological fibrosis in multiple organs including the skin, eye, lung, liver and kidney. miR-29 is understood by the scientific community to play a role in the regulation of certain processes that contribute to fibrosis, including the initiation and maintenance of fibrosis through transforming growth factor beta, or TGF-ß, signaling and the deposition of the components that make up fibrotic tissue, including collagen and extracellular matrix, or ECM, proteins. Furthermore, both fibrotic ECM and TGF-ß are believed to down-regulate miR-29 levels, leading to continuously increased TGF-ß expression and uncontrolled ECM production. miR-29 levels are abnormally low in multiple fibrotic indications, and lower levels of miR-29 are correlated with increased severity of fibrosis. Although various fibrotic indications are potentially distinct, they share a number of features, including the activation of the cells that initiate the deposition of fibrotic tissue or fibroblast activation, excessive deposition of collagen and other fibrosis-associated pathways, and resulting organ dysfunction. We believe the functions and biomarkers regulated by miR-29 might be shared among multiple fibrotic indications and increasing miR-29-like activity may provide potential benefit in any of these.

To demonstrate mechanistic proof-of-concept and as a potential initial indication, we are currently focused on skin fibrosis. We believe the data derived from skin fibrosis trials may facilitate development of a product candidate intended for the treatment for Idiopathic Pulmonary Fibrosis, or IPF, and other major organ pathological fibrosis.

There are three primary objectives that we intend to address prior to initiating a trial in a major organ fibrosis disease, such as lung or liver fibrosis:

- Demonstrate mechanistic proof of concept in humans for MRG-201. In our Phase 1 clinical trial of MRG-201, skin fibrosis was induced by making incisions in the volunteers' skin and biomarkers of fibrosis, including collagens and other fibrosis-associated genes were monitored to measure active gene regulation by MRG-201. Skin manifestation of pathological fibrosis, such as keloids that are abnormal proliferation of scar tissue that can form at the site of a skin injury and other forms of raised or hypertrophic scarring, may be an area in which we conduct additional development work, depending on the data from the Phase 1 clinical trial.
- Confirm the correlation of biological pathways between skin fibrosis and other major organ fibrosis. We have identified a subset of biomarker genes that we believe are regulated by MRG-201 in pre-clinical models of skin fibrosis, including mouse, rat, and rabbit, as well as in human skin fibroblasts in culture. This subset of biomarker genes includes multiple collagens and additional fibrosis-associated genes that appear to be implicated in fibrosis. The expression of these genes is generally increased in pathological fibrosis in humans, including skin fibrosis (an example of which is scleroderma) and pulmonary fibrosis (an example of which is IPF or systemic sclerosis). This gene signature appears to be regulated in common in skin fibrosis and IPF.

- Develop strategies for delivery of miR-29 replacements to allow for treatment of the lung and other major organs. We are collaborating with the Lovelace Respiratory Research Institute and a laboratory at Yale University under a grant from NIH to evaluate and develop potential inhaled delivery of MRG-201. Inhaled delivery has the potential to deliver more active drug to the lung. In pre-clinical models, we delivered MRG-201 to the lung and demonstrated reversal of pulmonary fibrosis in rodents which was induced by the administration of bleomycin, a chemotherapy agent known to induce lung fibrosis. In addition, MRG-201 was able to reduce pulmonary fibrosis that was induced in rodents by TGF-ß over-expression. Furthermore, a recently published study demonstrated the ability to reverse liver fibrosis in rodents through the use of an engineered virus that expresses miR-29. The viral expression of miR-29 in the study occurred in the chief functional cells of the liver. We have shown in pre-clinical testing that miR-29 replacements, delivered using two different methods reduced the expression of biomarkers of fibrosis in the post-exposure animal model of liver fibrosis induced by carbon tetrachloride. Finally, we believe injecting a miR-29 mimic into the eye may allow a local administration of MRG-201 to reduce retinal fibrosis.

Pathological Fibrosis

Fibrosis describes the development of fibrous connective tissue as a response to injury or damage. Fibrosis may refer to the deposition of connective tissue that occurs as part of normal healing or to the excess tissue deposition that occurs as a disease process. When fibrosis occurs in response to injury, the term “scarring” is used. Pathological fibrosis can occur in many tissues of the body as a result of inflammation or damage. In pathological fibrosis, collagen build up occurs, which can result in scarring of vital organs such as the skin, lung, liver, eye, kidney and heart leading to irreparable damage and eventual organ failure. We believe there is a significant need for additional clinically satisfactory therapeutic approaches to treating pathological fibrosis.

Below is a description of several types of pathological fibrosis that we may seek to develop a product candidate based on a replacement for miR-29:

Type of Pathological Fibrosis	Description
Skin Fibrosis	• Scarring is a result of an over production of collagen in a healing wound. Scarring may continue to thicken for up to six months or may overgrow the site of the wound, even after the wound has healed. • Hypertrophic scars and keloids are abnormal wound responses, and represent an excessive connective tissue response to skin trauma, inflammation, surgery, or burns. • Hypertrophic scars and keloids are characterized by local fibroblast proliferation and overproduction of collagen. Both hypertrophic scars and keloids are diseases that tend to be painful and itchy, restrict mobility, and are resistant to treatment.
Pulmonary Fibrosis	• Pulmonary fibrosis, also known as lung fibrosis, refers to a number of conditions that cause lung damage in the tissue between and supporting the air sacs or

interstitial tissue, followed by fibrosis and eventually loss of lung elasticity. These conditions lead to symptoms such as persistent cough, chest pain, difficulty breathing and fatigue. Pulmonary fibrosis may occur as a secondary condition in various other diseases, but in many cases the underlying cause is not clear, and is referred to as IPF.

- IPF is a chronic, progressive lung disease which ultimately leads to death in many of the patients. This condition causes scar tissue to build up in the lungs, which makes the lungs unable to transport oxygen into the bloodstream effectively.

11

Type of Pathological Fibrosis	Description
Liver Fibrosis	• Liver fibrosis refers to the scar tissue and nodules that replace liver tissue and disrupt liver function. Major causes of liver fibrosis are alcohol, chronic hepatitis B virus, hepatitis C virus infection along with the metabolic disorders non-alcoholic fatty liver disease and non-alcoholic steatohepatitis. Liver fibrosis is a major global problem driven by increasing rates of obesity and diabetes.
Eye Fibrosis	• Infection or inflammation of the eye results in impairment of visual function. Chronic inflammation can ultimately lead to fibrosis. • Eye fibrosis diseases include retinal fibrosis such as diabetic retinopathy and proliferative vitreoretinopathy, corneal fibrosis, glaucoma trabeculectomy, age related macular degeneration, and Fuch's endothelial corneal dystrophy.

MRG-201 Phase 1 Clinical Trial

Trial Design

We are conducting a single-center Phase 1, double-blind, placebo-controlled, single and multiple dose-escalation clinical trial of MRG-201. MRG-201 is designed to mimic the activity of a molecule called miR-29 that has been shown to decrease the expression of collagen and other proteins that are involved in scar formation. MRG-201 is being studied to determine if it can limit the formation of fibrous scar tissue that leads to pathologic fibrosis. This four-part clinical trial is expected to enroll up to 70 healthy volunteers in which:

- Part A studied the expression of biomarker genes in skin at different time points following an incision, and was performed without product candidate administration;
- Part B studied a single ascending dose of 0.5 to 14 mg of MRG-201 in intact skin;
- Part C studied a single ascending dose of 4, 7 or 14mg of MRG-201 administered around skin incisions; and
- Part D is studying multiple ascending doses of MRG-201 ranging from 4 mg to 14 mg administered around skin incisions.

The primary objectives in this clinical trial are safety and tolerability of MRG-201 injected into the skin via intradermal injections. A secondary objective is to characterize local skin and systemic exposure to MRG-201 following intradermal injection. Exploratory endpoints include the pharmacodynamic effects of MRG-201 on the

expression of miR-29 gene targets in skin wound biopsies and to evaluate changes in histology from skin wounds treated with MRG-201.

Safety and Pharmacokinetics

As of March 13, 2017, 54 volunteers have participated in the clinical trial, 47 of whom have been administered MRG-201 and seven of whom have been incised without receiving a dose of MRG-201.

Nineteen volunteers in Part B received a single dose of 0.5 mg, 1 mg, 2 mg, 4 mg, 7 mg or 14 mg of MRG-201 in unincised skin. In these volunteers, MRG-201 was generally well tolerated. Three incidents of injection site reactions were reported, which were generally moderate. Additional adverse events of mild severity were reported as possibly related to receiving MRG-201, and included redness of the skin, a tingling sensation and sensations of warmth at a patient's injection site, and sensations of warmth on a patient's limbs and back, all of which resolved within 24 hours, as well as fatigue, which resolved in less than a week.

Nine volunteers in Part C received a single dose of either 4 mg, 7 mg or 14 mg of MRG-201 around an incision (three volunteers per group). In these volunteers, MRG-201 was generally well tolerated at all dose levels evaluated. One incident of injection site reaction was reported, which was moderate and resolved within approximately 48 hours.

Nine volunteers in the dose-escalation portion of Part D received six total doses each of 4 mg, 7 mg or 14 mg of MRG-201 around an incision. In these volunteers, MRG-201 was generally well tolerated at all dose levels evaluated. There were two injection site reactions of moderate severity reported. Five adverse events of mild severity reported by the treating physicians as possibly or definitely related to receiving MRG-201 included itching or pain at the injection site, fatigue, headache, and microscopic hematuria (blood in the urine), which had all resolved by the end of the study.

An additional 10 volunteers were enrolled in Part D to understand drug diffusion. Volunteers received six total doses each of 14 mg of MRG-201 at one end of a 4 cm incision. The other end of the incision is untreated. Both ends of the incision will be biopsied to measure the potential for diffusion and pharmacodynamic activity of MRG-201 away from the site of injection. In these volunteers, MRG-201 was generally well tolerated at all dose levels evaluated. One volunteer had an injection site reaction of mild severity and one had an injection site reaction of moderate severity. Three adverse events of mild severity reported by the treating physicians as possibly related to receiving MRG-201 included chills, weakness, and localized edema and itchiness around a patient's injection site.

Preliminary pharmacokinetic analysis of plasma collected from the MRG-201 volunteers in Part B, Part C, and Part D (data available for first 12 subjects only) of the clinical trial revealed that very little drug (less than 150 ng/mL) is generally detectable in the blood when MRG-201 is injected intradermally into the skin.

Biomarker Analysis and Histopathology

In Part A of the clinical trial in which volunteers were incised without receiving any product candidate or placebo, molecular analysis confirmed that miR-29 expression decreased in incised skin compared to unincised skin, as expected for fibrosis. In addition, gene expression of miR-29/MRG-201 biomarkers, including collagens and fibrosis-related genes, was increased approximately two-to-20-fold in incised skin, and was correlated with the decrease in miR-29 expression. The magnitude of the change in the expression of miR-29 and the biomarker genes was approximately 30-85% greater 16 days after administration than it was nine days after administration, indicating a time-dependent effect on gene expression. We believe these data indicate the role of miR-29 in potentially regulating the biological pathways implicated in fibrosis in human skin.

In Part C of the clinical trial, biomarkers were analyzed to assess the ability of MRG-201 to regulate the expression of genes that are associated with reduced miR-29 expression in human skin. We identified a set of biomarkers based on MRG-201 activity in pre-clinical models of skin fibrosis, including mouse, rat, and rabbit skin in vivo, as well as human skin fibroblasts in vitro. The biomarker panel consists of direct targets for miR-29 and downstream genes we believe are indicative of an impact on miR-29 expression in wound healing and fibrosis, particularly collagens and other genes important in fibrosis. We assessed the expression of these biomarkers in biopsies taken from the site of the incision 24 hours after a single MRG-201 dose compared to saline-treated lesions. Analysis of the biomarker data indicated that MRG-201 decreased expression of collagens and fibrosis-associated genes, consistent with the role we believe miR-29 plays in regulating these fibrosis-related genes. The change in expression of collagens and fibrosis-related genes appeared to be correlated with the amount of MRG-201 administered. We believe these data demonstrate an effect of MRG-201 on fibrosis-associated genes, and provide an indication that MRG-201 has the potential to reduce fibrosis and scar formation in human skin. We also believe these data highlight the potential of our approach to identify molecular biomarkers that translate from pre-clinical studies to assessing the activity of MRG-201 in human clinical trials.

Part D of the clinical trial is currently in progress. Three cohorts of three volunteers each received six total doses of 4 mg, 7 mg or 14 mg of MRG-201 and have completed dosing and the follow-up process, and a final cohort of 10 volunteers are undergoing dosing and follow up at the 14 mg dose level. Based on biomarker analysis, the collagen and fibrosis-related genes were decreased in eight of the nine drug-treated incisions compared to the saline control that have been analyzed to date. Additionally, histological analysis indicated that incisions treated with multiple administrations of MRG-201 showed a statistically significant reduction in the area and depth of fibroplasia, a marker of fibrosis or scar formation. Furthermore, we observed that the magnitude of fibroplasia prevention corresponds to the magnitude of biomarker regulation. We believe these data may suggest that MRG-201 has the potential to reduce fibrosis and scar formation in human skin. The collagens and extracellular matrix genes regulated by MRG-201 in human skin have also been implicated in pulmonary fibrosis, including IPF. We believe the molecular and histological

data for MRG-201 in human skin support additional development of a miR-29 mimic for IPF and additional fibrotic indications.

MRG-201 Pre-Clinical Activities

Correlation of Biological Pathways Between Skin Fibrosis and Other Major Organ Fibrosis

The biomarkers that we believe are regulated by MRG-201 in human skin represent biological pathways that are associated with skin fibrosis, but are also fundamental processes involved in pathologic fibrosis in general. Increased expression of collagens and additional fibrosis-associated genes that we believe are down-regulated by MRG-201 have been associated with multiple fibrotic indications, including scleroderma, keloids, hypertrophic scarring, IPF, systemic sclerosis, pulmonary fibrosis, fibrosis of the eye (retinal and corneal fibrosis), kidney fibrosis, and cardiac fibrosis. We believe the that the documented ability of MRG-201 to reduce the expression of these fibrosis-associated biomarkers in human skin suggests that a miR-29 mimic could also provide anti-fibrotic activity in multiple fibrotic indications.

Work done by us, as well as published data indicate that a set of biomarkers showing increased expression in response to incision-induced fibrosis in human skin also show increased expression in multiple fibrotic indications including pulmonary fibrosis.

Delivery of miR-29 Mimic to the Lung

Together with Yale University and Lovelace Respiratory Research Institute, we were awarded a Centers for Advanced Diagnostics and Experimental Therapeutics in Lung Disease Stage II Grant from the NIH in 2014. The objective of the grant is to develop miR-29 mimicry as an efficient and personalized anti-fibrotic therapy. The collaboration is currently in year three of the five-year grant. During the first two years of the grant, the group compared intravenous and aerosolized delivery routes for the amount of miR-29 mimic that enters circulation, distribution, pharmacokinetics, pharmacodynamics, and efficacy. In one of its laboratories, Yale University also established a blood assay for miR-29 detection in IPF patients. During years three through five of the grant, we plan to perform potential IND-enabling activities including additional development of an aerosolized formulation and dose of miR-29 mimic, good manufacturing practice, or GMP, manufacturing of the product candidate, and complete good laboratory practice, or GLP, toxicology studies. In addition, the collaboration plans to further develop its blood miR-29 diagnostic and assess correlations to tissue and lung cells collected through a procedure called bronchoalveolar lavage.

Delivery of miR-29 Mimic to the Liver

miR-29 family members are expressed at less than normal levels in pre-clinical models of liver fibrosis as well as in biopsies from human fibrotic livers. Delivery of miR-29 to liver cells using Adeno-Associated Virus, or AAV, has been shown to reverse liver fibrosis induced by carbon tetrachloride in a rodent model. We are currently assessing liver delivery of several miR-29 replacements with varying conjugates. Initial data from such assessments has shown liver delivery in rodent models. We are studying multiple compounds in an efficacy study in rodents with the AAV-delivered miR-29 in a carbon tetrachloride model of liver fibrosis. We believe the results of these studies will assist our potential compound selection for IND-enabling activities with novel miR-29 replacements or the use of AAV for the delivery of miR-29 in hepatic fibrosis.

Delivery of miR-29 Mimic to the Eye

We are exploring miR-29 as a therapeutic for ocular indications including ocular fibrosis. RNA-based therapeutics can be administered to the eye via eye drops for diseases affecting the front of the eye (e.g., the cornea and anterior chamber), and via injection into the eye for diseases affecting the back of the eye (which is commonly referred to as the retina). Both routes of administration have been established to be generally well-tolerated for oligonucleotide therapeutics. We believe that the direct application of our microRNA therapeutic candidate to the eye may have the advantage of a greater than one-week duration, as the posterior chamber of the eye is a closed compartment, and is devoid of the usual clearance mechanisms present in the rest of the body. Historically, this mode of drug delivery potentially allows infrequent dosing, and also provides the potential advantage of reduced systemic exposure. Preliminary pre-clinical studies investigated direct injection into the eye of a double-stranded RNA molecule structurally similar to the design of MRG-201, and demonstrated decreased expression of the targeted gene. These data demonstrated functional delivery of double-stranded RNA molecules to the retina in the absence of a delivery vehicle.

Cardiovascular Disease

We are also developing RNA-based therapeutics in three cardiovascular programs through our collaboration with Servier. Under this collaboration, we granted Servier exclusive licenses to commercialize three cardiovascular product candidates in all countries except the United States and Japan. Servier may fund development through Phase 2 clinical trials, while we retain all commercial rights to these programs in the United States and Japan.

We have additional pre-clinical cardiovascular programs in which it is collaborating with academic institutions. In 2015, we were designated as a collaborating institution for a grant that provides more than €2 million over a three-year period (2015-2017) funded by the German Federal Ministry of Education and Research.

Other Pre-Clinical Programs

In 2016, we were awarded a milestone-driven grant by The ALS Association of up to $0.4 million to advance the development of MRG-107. MRG-107 is an inhibitor of miR-155 intended to be developed for the treatment of amyotrophic lateral sclerosis, or ALS.

We are also evaluating and developing additional microRNA-targeted, pre-clinical product candidates in a variety of disease indications where an abnormal level of one or more microRNAs has been implicated in disease pathology. Our inhibitor programs, including these product candidates, were created using the locked nucleic acid technology that we exclusively licensed from Santaris Pharma A/S (now a wholly-owned subsidiary of F. Hoffmann-La Roche Ltd, or Roche), on a target-by-target basis. We believe combining this technology with our internal expertise may allow us to create unique product candidates that possess desirable drug-like properties capable of entering diseased cells without the need for additional delivery technologies. We have a broad patent portfolio intended to protect these product candidates.

Background on microRNA

microRNAs are transcribed from the genome and unlike messenger RNA, or mRNA, they do not encode proteins. microRNAs function by preventing the translation of mRNAs into proteins and/or by triggering degradation of these mRNAs. Studies have shown that microRNA gene regulation is often not a decisive on and off switch but a subtle function that fine-tunes cellular phenotypes that becomes more pronounced during stress or disease conditions. microRNAs were first discovered in 1993 and have since been found in nearly every biological system examined since that time. They are highly conserved across species, demonstrating their importance to biological functions and cellular processes. According to the Sanger Institute, over 1,000 microRNAs have been identified in humans.

A body of evidence has shown that inappropriate levels of particular microRNAs are directly linked to a range of serious diseases, many of which are poorly served by existing therapies. microRNAs can affect the balance of protein expression and serve as “command and control” nodes that directly coordinate multiple critical systems simultaneously. This effect on systems biology is a naturally occurring homeostatic process that becomes disrupted in certain disease states. As a result, developing microRNA therapeutics is fundamentally different from the single-protein, single-target approach that is the foundation of traditional small and large molecule drugs.

Our Approach to Drug Discovery and Development

We believe that our drug discovery and development strategy will enable us to progress our product candidates from pre-clinical discovery to achievement of a plausible link to clinical benefit in humans relatively quickly and efficiently. In supporting this strategy, we incurred $13.7 million and $13.3 million in research and development activities for the years ended December 31, 2016 and 2015, respectively.

Discovery

Although there are over 1,000 identified human microRNAs, not all of them have been shown to be causal in disease. Our approach to drug discovery and development begins with the identification of potentially pathological microRNAs.

We apply three general approaches to the identification of potentially pathological, or disease causing, microRNAs (i) profiling of microRNA expression in diseased tissue versus normal tissue to identify microRNAs that are found at abnormally high or low levels (ii) identification of microRNAs that are located within genes (typically in non-protein coding segments) of validated disease relevant genes and thus simultaneously expressed with the disease associated gene and (iii) evaluation of microRNAs that are predicted to directly modulate the expression of specific disease relevant genes.

We have focused our programs to develop therapeutic microRNA inhibitors as opposed to microRNA replacements. We believe the inhibitor candidates face lower delivery hurdles and have better drug-like properties in regards to affinity to their target, stability, drug distribution and pharmacodynamics. To improve their therapeutic potential, we chemically modify these compounds with changes such as locked nucleic acid (known as LNA) substitution of the ribose sugar in many of the nucleosides and deoxyribonucleoside (known as DNA).

In conditions where a deficit in microRNA expression has been identified as disease causing, microRNA replacements, which are modified double-stranded RNA structures that are recognized by the RNA-induced silencing complex, or RISC, can serve as chemically synthesized replacements for microRNAs.

Historically, the delivery of double stranded RNAs, such as microRNA replacements, has been a significant hurdle to overcome for drug development because these molecules are very rapidly degraded, and because uptake into cells can be inefficient. Our delivery approach for microRNA replacements is to append a conjugate to the molecule to enhance cellular uptake. The selection of the conjugate is dependent on the intended therapeutic use. We have deployed

hydrophobic conjugates, such as cholesterol that are able to improve pharmacokinetics and allow for enhanced cellular uptake. We are also exploring a range of conjugates that help in targeting specific tissues and cells. Our strategy with microRNA replacements has centered on opportunities for efficient delivery of the molecules with an emphasis on local and topical applications, such as injections in the skin or lung, respectively. For organs where topical or local applications are not feasible, such as the liver, we have employed conjugates that have demonstrated successful delivery after systemic administration.

Development

Our approach to translational medicine is focused on rapidly testing the molecular hypothesis in human cell lines and animal models to demonstrate safety and measure pharmacokinetics and pharmacodynamics, and finally designing and conducting small, efficient and targeted human Phase 1 clinical trials. We typically select an initial indication that is genetically defined or is a rare disease where abnormal levels of a microRNA have been implicated. These early stage Phase 1 clinical trials are designed to test the mechanistic relevance or develop mechanistic proof-of-concept in humans in a setting that provides the opportunity to develop a biomarker toolkit for a mechanism of action that we believe has broader disease relevance.

The mechanistic proof-of-concept studies are designed to provide relevant information that helps to reduce development risks in humans. Our aim is to demonstrate that the expression levels of the microRNA could potentially serve as a diagnostic indicator that allows for better patient selection for later clinical trials and in additional indications. At the same time, we seek to confirm molecular activity of the drug.

By measuring the pharmacodynamics of target engagement, we are able to show that the product candidate effectively enters the appropriate cell and binds to its intended target. This process is particularly important for oligonucleotide drugs. We can also measure the effects on a series of downstream genes that create a plausible link between target engagement and a mechanism of disease.

For some diseases, we believe that local administration allows it to achieve a variety of concentrations of drug at the site of action and facilitates the development of dose / response relationships. We believe understanding the dose necessary to show target engagement, with concomitant surrogate marker alterations provides the basis for which a systemic dose can be defined that will be necessary to potentially achieve a therapeutic effect.

Exploratory endpoints can provide us with verification of the pharmacodynamic effects of the drug based on biomarker readouts and morphological alterations. This translational strategy allows us to answer many questions about the drug target pair and provides improved confidence that the molecular basis of drug action is relevant in humans. Having built confidence in the drug mechanism and demonstrated an acceptable safety profile, later stage clinical trials will be designed to establish appropriate dose and therapeutic efficacy.

Our Strategic Collaborations and License Agreements

Strategic Alliance and Collaboration with Servier

In October 2011, we entered into a strategic alliance with Servier for the research, development, and commercialization of RNA-targeting therapeutics in cardiovascular disease, or the Servier Collaboration Agreement, which was subsequently amended in May 2013, May 2014, May 2015 and September 2016. Under the Servier Collaboration Agreement, we granted Servier an exclusive license to research, develop, and commercialize RNA-targeting therapeutics for three targets in the cardiovascular field. As of December 31, 2016, three named targets exist under the Servier Collaboration Agreement.

Servier's rights to each of the targets are limited to therapeutics in the cardiovascular field in their territory, which is worldwide except for the United States and Japan. We retain all rights for each named target in the United States and Japan.

In connection with entering into the strategic alliance with Servier, we received a nonrefundable upfront payment of $8.4 million (€6.0 million) in 2011 and an additional $4.0 million (€3.0 million) in 2013 when Servier exercised their right to name a third target under the agreement. We are also eligible to receive development milestone payments of €5.8 million to €13.8 million ($6.1 million to $14.5 million as of December 31, 2016) and regulatory milestone payments of €10.0 million to €40.0 million ($10.5 million to $42.1 million as of December 31, 2016) for each target. Additionally, we may receive up to €175 million ($184.1 million as of December 31, 2016) in commercialization milestones as well as quarterly royalty payments between the low-double digits to the mid-teens (subject to reductions for patent expiration, generic competition, third-party royalty and costs of goods) on the net sales of any licensed product commercialized by Servier. Additionally, if we undergo a change of control in specified circumstances, Servier has agreed to increase this royalty by up to an additional percentage in the low-single digits if it seeks to obtain an exclusive license to certain of the acquirer's intellectual property for the development and sales of product candidates under the Servier Collaboration Agreement. Servier is obligated to make any such royalty payment for a specified period under the Servier Collaboration Agreement.

As part of the Servier Collaboration Agreement, we established a multiple-year research collaboration, under which we jointly perform agreed upon research activities directed to the identification and characterization of named targets and oligonucleotides in the cardiovascular field, which we refer to as the Research Collaboration. The initial three-year term of the Research Collaboration was extended by two additional years in May 2014 and again by one additional year in September 2016 through October 2017. Servier is responsible for funding all of the costs of the Research Collaboration, as defined under the Servier Collaboration Agreement. During the years ended December 31, 2016 and 2015, we recognized as revenue amounts reimbursable to us under the Servier Collaboration Agreement for research and development activities of $2.3 million and $3.8 million, respectively.

The development of each product candidate (commencing with registration enabling toxicology studies) under the Servier Collaboration Agreement is performed pursuant to a mutually agreed upon development plan to be conducted by the parties as necessary to generate data useful for both parties to obtain regulatory approval of such product candidates. Servier is responsible for a specified percentage of the cost of research and development activities under the development plan through the completion of one or more Phase 2 clinical trials and will reimburse us for a specified portion of such costs that we incur. The costs of Phase 3 clinical trials for each product candidate will be allocated between the parties at one of several specified percentages of costs. The applicable percentage for each product candidate will be based upon whether certain events under the Servier Collaboration Agreement occur, including if we enter into a third-party agreement for the development and/or commercialization of the product in the United States at least 180 days before the initiation of the first Phase 3 clinical trial or if we subsequently enter into a U.S. partner agreement or if we do not enter into a U.S. partner agreement, but file for approval in the United States using data from the Phase 3 clinical trial. We are responsible, by ourself or through a third-party manufacturer, for the manufacture and supply of all licensed oligonucleotides during the pre-clinical phase of development under the Sevier Collaboration Agreement while Servier is primarily responsible for manufacture and supply of all licensed oligonucleotides and product during the clinical phase of development under the Servier Collaboration Agreement. Each party is responsible for the commercial supply of any licensed product to be sold in its territory under the Servier Collaboration Agreement.

Under the Servier Collaboration Agreement, we also granted Servier a royalty-free, non-exclusive license to develop a companion diagnostic for any therapeutic product which may be developed by Servier under the Servier Collaboration Agreement. We also granted Servier an exclusive, royalty free license to commercialize such a companion diagnostic in our territory for use in connection with the development and commercialization of such therapeutic product in its territory.

The Servier Collaboration Agreement will expire as to each underlying product candidate when Servier’s royalty obligations as to such product candidate have expired. Servier may also terminate the Servier Collaboration Agreement for (i) convenience upon a specified number of days’ prior notice to us or (ii) upon determination of a safety issue relating to development under the agreement upon a specified number of days’ prior notice to us. Either party may terminate the Servier Collaboration Agreement upon a material breach by the other party which is not cured within a specified number of days. We may also terminate the agreement if Servier challenges any of the patents licensed by us to Servier.

License Agreements with the University of Texas

As of December 31, 2016, we had five exclusive patent license agreements, or the UT License Agreements, with the Board of Regents of The University of Texas System, or the University of Texas. Under each of the UT License Agreements, the University of Texas granted us exclusive and nonexclusive licenses to certain patent and technology rights. The University of Texas is one of our minority stockholders.

In consideration of rights granted by the University of Texas, we agreed to (i) pay a nonrefundable upfront license documentation fee in the amount of $10 thousand per license, (ii) pay an annual license maintenance fee in the amount of $10 thousand per license starting one year from the date of each agreement, (iii) reimburse the University of Texas for actual costs incurred in conjunction with the filing, prosecution, enforcement, and maintenance of patent rights prior to the effective date, and (iv) bear all future costs of and manage the filing, prosecution, and maintenance of patent rights. In 2016 and 2015, we incurred upfront and maintenance fees under the UT License Agreements totaling $0.1 million, and recorded the amounts as research and development expense. All costs related to the filing, prosecution, enforcement, and maintenance of patent and technology rights are recorded as general and administrative expense when incurred.

Under the terms of the UT License Agreements, we may be obligated to make the following future milestone payments for each licensed product candidate: (i) up to approximately $0.6 million upon the initiation of defined clinical trials, (ii) $2.0 million upon regulatory approval in the United States, and (iii) $0.5 million per region upon regulatory approval in other specified regions. Additionally, if we or our sublicensees successfully commercializes any product candidate subject to the UT License Agreements, we are responsible for royalty payments in the low-single digits based upon net sales of such licensed products and payments at a percentage in the mid-teens of any sublicense income, subject to specified exceptions. UT's right to the royalty payments will expire as to each license agreement upon the expiration of the last patent claim subject to the applicable UT License Agreement.

The license term extends on a product by product and country by country basis until the expiration of the last to expire of the licensed patents that covers such product in such country. Upon expiration of the royalty payment obligation, we will have a fully paid license in such country. We may also terminate each UT License Agreement for convenience upon a specified number of days' prior notice to the University of Texas. The University of Texas also has the right to earlier terminate the UT License Agreements after a defined date under specified circumstances where we have effectively abandoned our research and development efforts or have no sales. The UT License Agreements will terminate under customary termination provisions including automatic termination upon our bankruptcy or insolvency, upon notice of an uncured material breach, and upon mutual written consent. We have expensed all charges incurred under the UT License Agreements to date, due to the uncertainty as to future economic benefit from the acquired rights.

License Agreement with Roche Innovation Center Copenhagen A/S (formerly Santaris Pharma A/S)

In June 2010, we entered into a license agreement with the Santaris Pharma A/S, which subsequently changed its name to Roche Innovation Center Copenhagen A/S, or RICC, which was subsequently amended in October 2011 and amended and restated in December 2012, or the RICC License Agreement. In 2014, Santaris Pharma A/S was acquired by Roche and has become a wholly-owned subsidiary of Roche.

Under the RICC License Agreement, we received exclusive and nonexclusive licenses from RICC to use specified technology of RICC, or the RICC Technology, for specified uses including research, development, and commercialization of pharmaceutical products using this technology worldwide. Under the RICC License Agreement, we have the right to develop and commercialize the RICC Technology directed to four specified targets and the option to obtain exclusive product licenses for up to six additional targets. The acquisition of Santaris Pharma A/S by Roche was considered a change-of-control under the RICC License Agreement, and as such, certain terms and conditions of the RICC License Agreement changed, as contemplated and in accordance with the RICC License Agreement. These changes primarily relate to milestone payments reflected in the disclosures below. As consideration for the grant of the license and option, we previously paid RICC $2.3 million and issued RICC 856,806 shares of our Series A convertible preferred stock, which are now owned by Roche Finance Ltd, an affiliate of Roche, and, in 2017, were converted into 602,420 shares of our common stock as a result of the Merger. If we exercise our option to obtain additional product licenses or to replace the target families, we will be required to make additional payments to RICC.

Under the terms of the RICC License Agreement, milestone payments were previously decreased by a specified percentage as a result of the change of control by RICC referenced above. We are obligated to make future milestone payments for each licensed product for up to $5.2 million, which is inclusive of a potential product license option fee. Certain of these milestones will be increased by a specified percentage if we undergo a change in control during the term of the RICC License Agreement. If we grant a third party a sublicense to the RICC Technology, we are required to remit to Roche a specified percentage of the upfront and milestone and other specified payments that we receive under its sublicense, and if such sublicense covers use of the RICC Technology in the United States or the entire European Union, we will not have any further obligation to pay the fixed milestone payments noted above.

If we or our sublicensee successfully commercializes any product candidate subject to the RICC License Agreements, then RICC is entitled to royalty payments in the mid-single digits on the net sales of such product, provided that if such net sales are made by a sublicensee under the RICC License Agreement, RICC is entitled to royalty payments equal to the lesser of a percentage in the mid-single digits on the net sales of such product or a specified percentage of the royalties paid to us by such sublicensee, subject to specified restrictions. We are obligated to make any such royalty payments until the later of (i) a specified anniversary of the first commercial sale of the applicable product or (ii) the expiration of the last valid patent claim licensed by RICC under the RICC License Agreement underlying such product. Upon the occurrence of specified events, the royalty owed to RICC will be decreased by a specified percentage.

The RICC License Agreement will terminate upon the latest of the expiration of all of RICC's royalty rights, the termination of the last Miragen target or the expiration of its right to obtain a product license for a new target under the RICC License Agreement. We may also terminate the RICC License Agreement for convenience upon a specified number of days' prior notice to RICC, subject to specified terms and conditions. Either party may terminate the RICC License Agreement upon an uncured material breach by the other party and RICC may terminate the RICC License Agreement upon the occurrence of other specified events immediately or after such event is not cured within a specified number of days, as applicable.

License Agreements with the t2cure GmbH

In October 2010, we entered into a license and collaboration agreement, or the t2cure Agreement, with t2cure GmbH, or t2cure, which was subsequently amended in July 2014. Under the t2cure Agreement, we received a worldwide, royalty bearing, and exclusive license to specified patent and technology rights to develop and commercialize product candidates targeted at miR-92.

In consideration of rights granted by t2cure, we paid a onetime upfront fee of $46 thousand and agreed to: (i) pay an annual license maintenance fee in the amount of €3 thousand ($3 thousand at December 31, 2016), and (ii) reimburse t2cure for 100% of actual costs incurred in conjunction with the filing, prosecution, enforcement, and maintenance of patent rights. All costs related to the filing, prosecution, enforcement, and maintenance of patent and technology rights are recorded as general and administrative expense when incurred.

Under the terms of the t2cure Agreement, we are obligated to make the following future milestone payments for each licensed product: (i) up to approximately $0.7 million upon the initiation of certain defined clinical trials, (ii) $2.5 million upon regulatory approval in the United States and (iii) up to $1.5 million per region upon regulatory approval in the European Union or Japan. Additionally, if we or our sublicensees successfully commercialize any product candidate subject to the t2cure Agreement, we are responsible for royalty payments in the low-single digits upon net sales of licensed products and sublicense fees equal to a percentage in the low-twenties of sublicense income received by us. We are obligated to make any such royalty payment until the later of (i) the tenth anniversary of the first

commercial sale of the applicable product or (ii) the expiration of the last valid claim to a patent licensed by t2cure under the t2cure Agreement covering such product. If such patent claims expire prior to the end of the ten-year term, then the royalty owed to t2cure will be decreased by a specified percentage. We also have the right to decrease our royalty payments by a specified percentage for royalties paid to third parties for licenses to certain third-party intellectual property.

The license term extends on a country by country basis until the later of: (i) the tenth anniversary of the first commercial sale of a licensed product in a country, and (ii) the expiration of the last to expire valid claim that claims such licensed product in such country. Upon expiration of the royalty payment obligation, we will have a fully paid license in such country. We have the right to terminate the t2cure Agreement at will, on a country-by-country basis, after 60 days' written notice. The t2cure Agreement will also automatically terminate upon our bankruptcy or insolvency or upon notice of an uncured material breach.

Patent License Agreement with The Brigham and Women's Hospital

In May 2016, we entered into an exclusive patent license agreement, or the BWH License Agreement, with The Brigham and Women's Hospital, or BWH.

Under the BWH License Agreement, BWH granted us an exclusive, worldwide license, including a right to sublicense, to specified patent rights and a non-exclusive, worldwide license, including a right to sublicense, to specified technology of BWH. As consideration for this license, we paid BWH a specified issue fee and are obligated to pay a specified annual license fee. BWH is also entitled to milestone payments of up to approximately $2.6 million for each of our product candidates developed based on the patent rights subject to the BWH License Agreement plus a one-time sales milestone payment of $0.25 million for all product candidates developed based on the patent rights subject to the BWH License Agreement. If we successfully commercialize any product candidate subject to the BWH License Agreement, then BWH is entitled to royalty payments in the low-single digits on the net sales of such product. BWH's right to these royalty payments will expire on a product by product and country by country basis upon the expiration of the last patent claim in such country that is subject to BWH License Agreement and covers the product, and our license to such product in such country will become fully paid at such time. BWH is also entitled to a percentage in the low-double digits of any sublicense income from such product, subject to specified exceptions. We are also responsible for all costs associated with the preparation, filing, prosecution and maintenance of the patent rights subject to the BWH License Agreement.

Additionally, we are obligated to use commercially reasonable efforts to develop a product under the BWH License Agreement and to meet specified diligence milestones thereunder.

The BWH License Agreement will terminate upon the expiration of all issued patents and patent applications subject to the patent rights under the agreement. We may also terminate the BWH License Agreement for convenience upon a specified number of days' prior notice to BWH. BWH may terminate the BWH License Agreement upon a breach by us of our payment obligations and upon the occurrence of other specified events that are not cured within a specified number of days, provided that such termination is automatic upon our bankruptcy or insolvency.

Subcontract Agreement with Yale University

In October 2014, we entered into a subcontract agreement in October 2013 and into a subaward agreement in March 2015 with Yale, or the Yale Agreements. The subaward agreement was subsequently amended in February 2016, November 2016 and January 2017. Under the Yale Agreements, we agreed to provide specified services regarding the development of a proprietary compound that targets miR-29 in the indication of idiopathic pulmonary fibrosis. Yale entered into the Yale Agreements in connection with a grant that Yale received from the NIH for the development a miR-29 mimicry as a potential therapy for pulmonary fibrosis.

In consideration of our services under the Yale Agreements, Yale has agreed to pay us up to $1.1 million over five years. Under the terms of the Yale Agreements, we retain all rights to any and all intellectual property developed solely by us in connection with the Yale Agreements. Yale has also agreed to provide us with an exclusive option to negotiate in good faith for an exclusive, royalty-bearing license from Yale for any intellectual property developed by Yale or jointly by the parties under the Yale Agreements. Yale is responsible for filing, prosecuting and maintaining foreign and domestic patent applications and patents on all inventions jointly developed by the parties under the Yale Agreements.

The Yale Agreements terminates automatically on the date that Yale delivers its final research report to the NIH under the terms of the grant underlying the Yale Agreements. Each party may also terminate the Yale Agreements upon a specified number of days' notice in the event that the NIH's grant funding is reduced or terminated or upon material breach by the other party.

Manufacturing

We do not own or operate manufacturing facilities for the production of MRG-106, MRG-201 or other product candidates that we develop, nor do we have plans to develop our own manufacturing operations in the foreseeable future. We currently depend on third-party contract manufacturers for all of our required raw materials, active pharmaceutical ingredients, and finished product candidates for our clinical trials. We do not have any current contractual arrangements for the manufacture of commercial supplies of MRG-106, MRG-201 or any other product candidates that we develop. We currently employ internal resources and third-party consultants to manage our manufacturing contractors.

Sales and Marketing

We have not yet defined our sales, marketing or product distribution strategy for MRG-106, MRG-201 or any of our other product candidates because our product candidates are still in pre-clinical or early-stage clinical development. Our commercial strategy may include the use of strategic partners, distributors, a contract sale force, or the establishment of our own commercial and specialty sales force. We plan to further evaluate these alternatives as we approach approval for one of our product candidates.

Intellectual Property

We are actively building an intellectual property portfolio around our clinical-stage product candidates and discovery programs. A key component of this portfolio strategy is to seek patent protection in the United States and in major market countries that we consider important to the development of our business worldwide. As of February 28, 2017, we had a portfolio of 217 patents and patent applications of which 113 are issued or allowed and 104 are pending applications. This portfolio includes methods of use and composition patents, and patent applications on our two lead product candidates, MRG-106 and MRG-201. Our success depends in part on our ability to obtain and maintain proprietary protection for our product candidates and other discoveries, inventions, trade secrets and know-how that are critical to our business operations. Our success also depends in part on our ability to operate without infringing the proprietary rights of others, and in part, on our ability to prevent others from infringing our proprietary rights. A comprehensive discussion on risks relating to intellectual property is provided under "*Risk Factors*" under the subsection "*Risks Related to our Intellectual Property*".

We have filed composition of matter patent applications covering MRG-106 in June of 2016 in the United States as U.S. 15/173,368 and a PCT application as PCT/US2016/035865 to access foreign countries.

We expect this U.S. patent will issue in the next two to three years with an expiration year of 2036 if we continue to pay the maintenance fees and annuities when due, with the possibility of additional terms from the USPTO prosecution delays and from patent term extensions that may be granted due to administrative delays in the FDA. We also have pending applications that cover methods of administration and therapeutic uses of MRG-106 and related compositions. Collectively, these patents, if they issue, would have patent expirations from 2036 if we continue to pay the maintenance fees and annuities when due, not including any possible additional terms for patent term adjustments or patent term extensions. We do not know if any patent will issue from any of these applications and, if any issue, we do not know whether the issued patents will provide significant proprietary protection or commercial advantage against our competitors or generics. Even if they are issued, our patents may be circumvented, challenged, opposed and found to be invalid or unenforceable.

We filed a composition of matter patent application covering MRG-201 in September 2015 in the United States as U.S. 14/848,085 and a PCT application PCT/US2015/49018 to access foreign countries. The U.S. patent application issued as U.S. 9,376,681 on June 28, 2016, which will expire in September of 2035 if we continue to pay the maintenance fees and annuities when due, with the possibility of Patent Term Extension that may be granted by the USPTO due to administrative delays in the FDA. Prior to the issue of this application, we filed a continuation application in June 2016 also directed to compositions of matter in the United States, as U.S. 15/175,636, and this application is currently pending. We also have issued patents and pending applications that cover various therapeutic uses and generic compositions comprising MRG-201. Collectively, these patents and patent applications, if they issue, would have patent expirations ranging from 2028 to 2035 if we continue to pay the maintenance fees and annuities when due, not including any possible additional terms for patent term adjustments or patent term extensions. We do not know if any patent will issue from any of the pending applications and, if any issue, we do not know whether the issued patents will provide significant proprietary protection or commercial advantage against our competitors or generics. Even if they are issued, our patents may be circumvented, challenged, opposed and found to be invalid or unenforceable.

For our earlier stage product candidates, we have filed compositions of matter and methods of use patent applications in the United States, under the Patent Cooperation Treaty, or the PCT.

In addition to patent protection, we seek to rely on trade secret protection, trademark protection and know-how to expand our proprietary position around our chemistry, technology and other discoveries and inventions that we consider important to our business. We also seek to protect our intellectual property in part by entering into confidentiality agreements with our employees, consultants, scientific advisors, clinical investigators and other contractors and also by requiring our employees, commercial contractors, and certain consultants and investigators, to enter into invention assignment agreements that grant us ownership of any discoveries or inventions made by them. Further, we seek trademark protection in the United States and internationally where available and when we deem appropriate. We have obtained registrations for the Miragen trademark, which we use in connection with our

pharmaceutical research and development services as well as our clinical-stage product candidates. We currently have such registrations for Miragen in the United States, Canada, Japan and the European Union.

Competition

The biotechnology and pharmaceutical industries are characterized by intense and rapidly changing competition to develop new technologies and proprietary products. Our clinical and pre-clinical product candidates may address multiple markets. Ultimately, the diseases our product candidates target for which we may receive marketing authorization will determine our competition. We believe that for most or all of our product development programs, there will be one or more competing programs under development by other companies. Any products that we may commercialize will have to compete with existing therapies and new therapies that may become available in the future. We face potential competition from many different sources, including larger and better-funded biotechnology and pharmaceutical companies. In many cases, the companies with competing programs will have access to greater resources and expertise than we do and may be more advanced in those programs.

We believe that our current and future competition for resources and eventually for customers can be grouped into three broad categories:

- companies working to develop microRNA targeted products, including Regulus Therapeutics Inc., Mirna Therapeutics, Inc., Microlin Bio, Inc., and InteRNA Technologies B.V.;
- companies working to develop other types of oligonucleotide therapeutic products, including Ionis Pharmaceuticals, Inc., Alnylam Pharmaceuticals, Inc., Arrowhead Pharmaceuticals, Inc., Dicerna Pharmaceuticals, Inc., RaNa Therapeutics, Inc., RXi Pharmaceuticals Corporation, and Silence Therapeutics AG; and
- companies with marketed products and development programs for therapeutics that treat the same diseases for which we may also be developing potential treatments.

- The following companies have therapeutics marketed or in development for CTCL: Actelion Ltd, Bristol-Myers Squibb Company, Celgene Corporation, Merck & Co., Inc., Mylan Pharmaceuticals Inc., Novartis International AG, Spectrum Pharmaceuticals, Inc., Seattle Genetics, Inc., Takeda Pharmaceutical Company Ltd, and Valeant Pharmaceuticals International, Inc.

- The following companies have marketed therapeutics for pulmonary fibrosis: Boehringer Ingelheim GmbH, F. Hoffmann-La Roche Ltd.

We believe that the key competitive factors that will affect the success of any of our product candidates, if commercialized, are likely to be their efficacy, safety, convenience, price and the availability of reimbursement from government and other third-party payors relative to such competing products. Our commercial opportunity could be reduced or eliminated if our competitors have products that are superior in one or more of these categories.

Government Regulation

FDA Drug Approval Process

In the United States, pharmaceutical products are subject to extensive regulation by the U.S. Food and Drug Administration, or the FDA. The Federal Food, Drug, and Cosmetic Act, and other federal and state statutes and regulations, govern, among other things, the research, development, testing, manufacture, storage, recordkeeping, approval, labeling, promotion and marketing, distribution, post-approval monitoring and reporting, sampling and import and export of pharmaceutical products. Failure to comply with applicable U.S. requirements at any time during the product development process may subject a company to a variety of administrative or judicial sanctions, such as imposition of clinical hold, FDA refusal to approve pending new drug applications, or NDAs, warning or untitled letters, withdrawal of approval, product recalls, product seizures, total or partial suspension of production or distribution, injunctions, fines, civil penalties and criminal prosecution.

We cannot market a drug product candidate in the United States until the drug has received FDA approval. The steps required before a drug may be marketed in the United States generally include the following:

- completion of extensive pre-clinical laboratory tests, animal studies, and formulation studies in accordance with the FDA's good laboratory practices, or GLP, regulations;

- submission to the FDA of an investigational new drug application, or IND, for human clinical testing, which must become effective before human clinical trials may begin;

- approval by an independent institutional review board, or IRB, at each clinical site before each trial may be initiated at that site;

- performance of adequate and well-controlled human clinical trials in accordance with good clinical practice, or GCP, requirements to establish the safety and efficacy of the drug for each proposed indication;

- submission to the FDA of an NDA after completion of all pivotal clinical trials;

- satisfactory completion of an FDA advisory committee review, if applicable

- satisfactory completion of an FDA pre-approval inspection of the manufacturing facility or facilities at which the active pharmaceutical ingredient, or API, and finished drug product are produced and tested to assess compliance with current good manufacturing practices, or cGMPs; and

- FDA review and approval of the NDA prior to any commercial marketing or sale of the drug in the United States.

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

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

A 30-day waiting period after the submission of each IND is required prior to the commencement of clinical testing in humans. If the FDA has neither commented on nor questioned the IND within this 30-day period, the clinical trial proposed in the IND may begin if all other requirements, including IRB review and approval, have been met. If the FDA raises concerns or questions about the conduct of the trial, such as whether human research subjects will be exposed to an unreasonable health risk, the IND sponsor and the FDA must resolve any outstanding FDA concerns or questions before clinical trials can proceed.

Clinical trials involve the administration of the investigational new drug to healthy volunteers or patients under the supervision of a qualified investigator. Clinical trials must be conducted in compliance with federal regulations, including GCP requirements, which include the requirement that all research subjects provide their informed consent in writing for their participation in any clinical trial. Clinical trials are conducted under protocols detailing the

objectives of the trial, the parameters to be used in monitoring safety and the effectiveness criteria to be evaluated. Each protocol and subsequent protocol amendments must be submitted to the FDA as part of the IND.

The FDA may order the temporary, or permanent, discontinuation of a clinical trial at any time, or impose other sanctions, if it believes that the clinical trial either is not being conducted in accordance with FDA requirements or presents an unacceptable risk to the clinical trial patients. The study protocol and informed consent information for patients in clinical trials must also be submitted to an IRB, for approval at each site at which the clinical trial will be conducted. An IRB may also require the clinical trial at the site to be halted, either temporarily or permanently, for failure to comply with the IRB's requirements, or may impose other conditions. Information about certain clinical trials must be submitted within specific timeframes to the NIH, for public dissemination on their *www.clinicaltrials.gov* website.

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

After completion of the required clinical testing, an NDA is prepared and submitted to the FDA. FDA approval of the NDA is required before marketing of the product may begin in the United States. The NDA must include the results of all pre-clinical, clinical and other testing and a compilation of data relating to the product's pharmacology, chemistry, manufacture and controls. The cost of preparing and submitting an NDA is substantial. The submission of most NDAs is additionally subject to a substantial application user fee, and the manufacturer and/or sponsor under an approved NDA are also subject to annual product and establishment user fees. These fees are typically increased annually. Under the Prescription Drug User Fee Act, or PDUFA, guidelines that are currently in effect, the FDA has a goal of ten months from the date of "filing" of a standard NDA for a new molecular entity to review and act on the submission. This review typically takes twelve months from the date the NDA is submitted to FDA because the FDA has 60 days from its receipt of an NDA to determine whether the application will be accepted for filing based on the agency's threshold determination that it is sufficiently complete to permit substantive review. Once the submission is accepted for filing, the FDA begins an in-depth review. The FDA may request additional information rather than accept an NDA for filing. In this event, the application must be resubmitted with the additional information. The resubmitted application is also subject to review before the FDA accepts it for filing. The FDA reviews an NDA to determine, among other things, whether the drug is safe and effective and whether the facility in which it is manufactured, processed, packaged or held meets standards designed to assure the product's continued safety, quality and purity.

The FDA may also refer applications for novel drug products, or drug products that present difficult questions of safety or efficacy, to an advisory committee—typically a panel that includes clinicians and other experts—for review, evaluation and a recommendation as to whether the application should be approved. The FDA is not bound by the recommendation of an advisory committee, but it generally follows such recommendations. Before approving an NDA, the FDA will typically inspect one or more clinical sites to assure compliance with GCPs. Additionally, the FDA will inspect the facility or the facilities at which the drug is manufactured. The FDA will not approve the product unless compliance with cGMPs, is satisfactory and the NDA contains data that provide substantial evidence that the drug is safe and effective in the indication studied.

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

An approval letter authorizes commercial marketing of the drug with specific prescribing information for specific indications. Even if the FDA approves a product, it may limit the approved indications for use of the product, require that contraindications, warnings or precautions be included in the product labeling, require that post-approval studies, including Phase 4 clinical trials, be conducted to further assess a drug's safety after approval, require testing and surveillance programs to monitor the product after commercialization, or impose other conditions, including distribution and use restrictions or other risk management mechanisms under a Risk Evaluation and Mitigation Strategy, or REMS, to ensure that the benefits of the drug outweigh the potential risks.

A REMS can include a medication guide, a communication plan for healthcare professionals and elements to assure safe use, such as special training and certification requirements for individuals who prescribe or dispense the drug, requirements that patients enroll in a registry and other measures that the FDA deems necessary to assure the safe use of the drug. The requirement for a REMS can materially affect the potential market and profitability of the drug. The FDA may prevent or limit further marketing of a product based on the results of post-marketing studies or surveillance programs. Once granted, product approvals may be withdrawn if compliance with regulatory standards is not maintained or problems are identified following initial marketing.

Changes to some of the conditions established in an approved application, including changes in indications, labeling, or manufacturing processes or facilities, require submission and FDA approval of a new NDA or NDA supplement before the change can be implemented. An NDA supplement for a new indication typically requires clinical data similar to that in the original application, and the FDA uses the same procedures and actions in reviewing NDA supplements as it does in reviewing NDAs. Such supplements are typically reviewed within 10 months of receipt.

Expedited Development and Review Programs

The FDA has a Fast Track program that is intended to expedite or facilitate the process for development and review of new drug products that meet certain criteria. Specifically, new drug products are eligible for Fast Track designation if they are intended to treat a serious or life-threatening disease or condition and demonstrate the potential to address unmet medical needs for the disease or condition. Fast Track designation applies to the combination of the product and the specific indication for which it is being studied. The sponsor of a new drug may request that the FDA designate the drug as a Fast Track product at any time during the clinical development of the product. For a Fast Track-designated product, the FDA may consider for review sections of the marketing application on a rolling basis before the complete application is submitted, if the sponsor provides a schedule for the submission of the sections of the application, the FDA agrees to accept sections of the application and determines that the schedule is acceptable, and the sponsor pays any required user fees upon submission of the first section of the application.

Any product submitted to the FDA for marketing, including under a Fast Track program, may be eligible for other types of FDA programs intended to expedite development and review, such as priority review and accelerated approval. Any product is eligible for priority review if it has the potential to provide safe and effective therapy where no satisfactory alternative therapy exists or a significant improvement in the treatment, diagnosis or prevention of a disease compared to marketed products. The FDA will attempt to direct additional resources to the evaluation of an application for a new drug product designated for priority review in an effort to facilitate the review. Additionally, a product may be eligible for accelerated approval. Drug products studied for their safety and effectiveness in treating serious or life-threatening illnesses and that provide meaningful therapeutic benefit over existing treatments may be eligible for accelerated approval, which means that they may be approved on the basis of adequate and well-controlled clinical trials establishing that the product has an effect on a surrogate endpoint that is reasonably likely to predict a clinical benefit, or on the basis of an effect on a clinical endpoint other than survival or irreversible morbidity or mortality or other clinical benefit, taking into account the severity, rarity, or prevalence of the condition and the availability or lack of alternative treatments. As a condition of approval, the FDA may require that a sponsor of a drug

product subject to accelerated approval perform adequate and well-controlled post-marketing clinical trials. In addition, the FDA currently requires as a condition for accelerated approval pre-approval of promotional materials, which could adversely impact the timing of the commercial launch of the product.

In addition, under the provisions of the Food and Drug Administration Safety and Innovation Act, or FDASIA, the FDA established the Breakthrough Therapy Designation which is intended to expedite the development and review of products that treat serious or life-threatening diseases or conditions. A breakthrough therapy is defined as a drug that is intended, alone or in combination with one or more other drugs, to treat a serious or life-threatening disease or condition, and preliminary clinical evidence indicates that the drug may demonstrate substantial improvement over existing therapies on one or more clinically significant endpoints, such as substantial treatment effects observed early in clinical development. The designation includes all of the features of Fast Track designation, as well as more intensive FDA interaction and guidance. The Breakthrough Therapy Designation is distinct from both accelerated approval and priority review, but these can also be granted to the same product candidate if the relevant criteria are met. The FDA must take certain actions, such as holding timely meetings and providing advice, intended to expedite the development and review of an application for approval of a breakthrough therapy. Requests for breakthrough therapy designation will be reviewed within 60 days of receipt, and FDA will either grant or deny the request.

Fast Track designation, priority review, accelerated approval and breakthrough therapy designation do not change the standards for approval but may expedite the development or approval process by allowing for approval based on a surrogate endpoint likely to predict clinical benefit of the underlying drug, rather than through a direct measure of clinical benefit. Even if we receive one of these designations for our product candidates, the FDA may later decide that our product candidates no longer meet the conditions for qualification. In addition, these designations may not provide us with a material commercial advantage.

Post-Approval Requirements

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

Adverse event reporting and submission of periodic reports is required following FDA approval of an NDA. The FDA also may require post-marketing testing, known as Phase 4 testing, REMS, surveillance to monitor the effects of an approved product, or restrictions on the distribution or use of the product. In addition, quality-control, drug manufacture, packaging and labeling procedures must continue to conform to cGMPs after approval. Drug manufacturers and certain of their subcontractors are required to register their establishments with the FDA and certain state agencies. Registration with the FDA subjects entities to periodic unannounced inspections by the FDA, during which the agency inspects manufacturing facilities to assess compliance with cGMPs. Accordingly, manufacturers must continue to expend time, money and effort in the areas of production and quality-control to maintain compliance with cGMPs. Later discovery of previously unknown problems with a product, including adverse events of unanticipated severity or frequency, or failure to comply with regulatory requirements, may result in mandatory revisions to the approved labeling to add new safety information, imposition of post-market studies or clinical trials to assess new safety risks or imposition of distribution or other restrictions under a REMS program. Other potential consequences include, among other things:

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

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

Foreign Regulation

In order to market any product outside of the United States, we would need to comply with numerous and varying regulatory requirements of other countries and jurisdictions regarding quality, safety and efficacy and governing, among other things, clinical trials, marketing authorization, commercial sales and distribution of our products. Whether or not we obtain FDA approval for a product, we would need to obtain the necessary approvals by the comparable foreign regulatory authorities before we can commence clinical trials or marketing of the product in foreign countries and jurisdictions.

Some countries outside of the United States have a similar process that requires the submission of a clinical trial application, or CTA, much like the IND prior to the commencement of human clinical trials. In Europe, for example, a CTA must be submitted to each country's national health authority and an independent ethics committee, much like the FDA and IRB, respectively. Once the CTA is approved in accordance with a country's requirements, a clinical trial may proceed in that country. To obtain regulatory approval to commercialize a new drug under European Union regulatory systems, we must submit a marketing authorization application, or MAA. The MAA is similar to the NDA, with the exception of, among other things, country-specific document requirements.

In Canada, biopharmaceutical product candidates are regulated by the Food and Drugs Act and the rules and regulations promulgated thereunder, which are enforced by the Therapeutic Products Directorate of Health Canada, or TPD. Before commencing clinical trials in Canada, an applicant must complete pre-clinical studies and file a CTA with the TPD. After filing a CTA, the applicant must receive different clearance authorizations to proceed with Phase 1 clinical trials, which can then lead to Phase 2 and Phase 3 clinical trials. To obtain regulatory approval to commercialize a new drug in Canada, a new drug submission, or NDS, must be filed with the TPD. If the NDS demonstrates that the product was developed in accordance with the regulatory authorities' rules, regulations and guidelines and demonstrates favorable safety and efficacy and receives a favorable risk/benefit analysis, the TPD issues a notice of compliance which allows the applicant to market the product.

Other Healthcare Laws

Although we currently do not have any products on the market, our current and future business operations may be subject to additional healthcare regulation and enforcement by the federal government and by authorities in the states and foreign jurisdictions in which we conduct our business. Such laws include, without limitation, state and federal anti-kickback, fraud and abuse, false claims, privacy and security, price reporting and physician sunshine laws. Some of our pre-commercial activities are subject to some of these laws.

The federal Anti-Kickback Statute makes it illegal for any person or entity, including a prescription drug manufacturer or a party acting on its behalf to knowingly and willfully, directly or indirectly, solicit, receive, offer, or pay any remuneration that is intended to induce the referral of business, including the purchase, order, lease of any good, facility, item or service for which payment may be made under a federal healthcare program, such as Medicare or Medicaid. The term “remuneration” has been broadly interpreted to include anything of value. The Anti-Kickback Statute has been interpreted to apply to arrangements between pharmaceutical manufacturers on one hand and prescribers, purchasers, formulary managers, and beneficiaries on the other. Although there are a number of statutory exceptions and regulatory safe harbors protecting some common activities from prosecution, the exceptions and safe harbors are drawn narrowly. Practices that involve remuneration that may be alleged to be intended to induce prescribing, purchases or recommendations may be subject to scrutiny if they do not qualify for an exception or safe harbor. Failure to meet all of the requirements of a particular applicable statutory exception or regulatory safe harbor does not make the conduct per se illegal under the Anti-Kickback Statute. Instead, the legality of the arrangement will be evaluated on a case-by-case basis based on a cumulative review of all its facts and circumstances. Several courts have interpreted the statute’s intent requirement to mean that if any one purpose of an arrangement involving remuneration is to induce referrals of federal healthcare covered business, the Anti-Kickback Statute has been violated. In addition, a person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation. Violations of this law are punishable by up to five years in prison, and can also result in criminal fines, civil money penalties and exclusion from participation in federal healthcare programs.

Moreover, a claim including items or services resulting from a violation of the federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the federal civil False Claims Act.

The federal civil False Claims Act prohibits, among other things, any person or entity from knowingly presenting, or causing to be presented, for payment to, or approval by, federal programs, including Medicare and Medicaid, claims for items or services, including drugs, that are false or fraudulent or not provided as claimed. Persons and entities can be held liable under these laws if they are deemed to “cause” the submission of false or fraudulent claims by, for example, providing inaccurate billing or coding information to customers or promoting a product off-label. In addition, our future activities relating to the reporting of wholesaler or estimated retail prices for our products, the reporting of prices used to calculate Medicaid rebate information and other information affecting federal, state and third-party reimbursement for our products, and the sale and marketing of our products, are subject to scrutiny under this law. Penalties for federal civil False Claims Act violations may include up to three times the actual damages

sustained by the government, plus mandatory civil penalties of between $10,781.40 and $21,652.80 for each separate false claim, the potential for exclusion from participation in federal healthcare programs, and, although the federal False Claims Act is a civil statute, False Claims Act violations may also implicate various federal criminal statutes.

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

The civil monetary penalties statute imposes penalties against any person or entity that, among other things, is determined to have presented or caused to be presented a claim to a federal health program that the person knows or should know is for an item or service that was not provided as claimed or is false or fraudulent.

Also, many states have similar fraud and abuse statutes or regulations that may be broader in scope and may apply regardless of payor, in addition to items and services reimbursed under Medicaid and other state programs. Additionally, to the extent that any of our products are sold in a foreign country, we may be subject to similar foreign laws.

HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act, or HITECH, and their implementing regulations, mandates, among other things, the adoption of uniform standards for the electronic exchange of information in common healthcare transactions, as well as standards relating to the privacy and security of individually identifiable health information, which require the adoption of administrative, physical and technical safeguards to protect such information. Among other things, HITECH makes HIPAA’s security standards directly applicable to business associates, defined as independent contractors or agents of covered entities that create, receive or obtain 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 and business associates, and gave state attorneys general new authority to file civil actions for damages or injunctions in federal courts to enforce the federal HIPAA laws and seek attorney’s fees and costs associated with pursuing federal civil actions. In addition, certain state laws govern the privacy and security of health information in certain circumstances, some of which are more stringent than HIPAA and many of which differ from each other in significant ways and may not have the same effect, thus complicating compliance efforts. Failure to comply with these laws, where applicable, can result in the imposition of significant civil and/or criminal penalties.

The Physician Payments Sunshine Act, created as part of the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act, or the Affordable Care Act, imposed, among other things, new annual reporting requirements for covered manufacturers for certain payments and other transfers of value provided to physicians and teaching hospitals, as well as certain ownership and investment interests held by physicians and their immediate family members. Failure to submit timely, accurately and completely the required information for all payments, transfers of value and ownership or investment interests may result in civil monetary penalties of up to an aggregate of $150,000 per year and up to an aggregate of $1 million per year for "knowing failures." 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.

Because we intend to commercialize products that could be reimbursed under a federal healthcare program and other governmental healthcare programs, we intend to develop a comprehensive compliance program that establishes internal control to facilitate adherence to the rules and program requirements to which we will or may become subject. Although the development and implementation of compliance programs designed to establish internal control and facilitate compliance can mitigate the risk of investigation, prosecution, and penalties assessed for violations of these laws, the risks cannot be entirely eliminated.

If our operations are found to be in violation of any of such laws or any other governmental regulations that apply to us, we may be subject to penalties, including, without limitation, administrative, civil and criminal penalties, damages, fines, disgorgement, contractual damages, reputational harm, diminished profits and future earnings, individual imprisonment, additional reporting requirements and/or oversight if we become subject to a corporate integrity agreement or similar agreement to resolve allegations of non-compliance with these laws, the curtailment or restructuring of our operations, exclusion from participation in federal and state healthcare programs and individual imprisonment, any of which could adversely affect our ability to operate our business and our financial results.

Health Reform

In the United States and foreign jurisdictions, there have been a number of legislative and regulatory changes to the healthcare system that could affect our future results of operations. There have been and continue to be a number of initiatives at the U.S. federal and state levels that seek to reduce healthcare costs.

In particular, the Affordable Care Act has had a significant impact on the healthcare industry. The Affordable Care Act was designed to expand coverage for the uninsured while at the same time containing overall healthcare costs. With regard to pharmaceutical products, among other things, the Affordable Care Act revised the definition of "average manufacturer price" for calculating and reporting Medicaid drug rebates on outpatient prescription drug prices and imposed a significant annual fee on companies that manufacture or import certain branded prescription drug products. Substantial new provisions affecting compliance have also been enacted, which may require us to modify our business practices with healthcare providers and entities.

Since its enactment, certain aspects of the Affordable Care Act have faced Congressional and judicial challenges. In January 2017, Congress voted to adopt a budget resolution for fiscal year 2017, or the Budget Resolution, that authorizes the implementation of legislation that would repeal portions of the Affordable Care Act. The Budget Resolution is not a law; however, it is widely viewed as the first step toward the passage of repeal legislation. Further, on January 20, 2017, President Trump signed an Executive Order directing federal agencies with authorities and responsibilities under the Affordable Care Act to waive, defer, grant exemptions from, or delay the implementation of any provision of the Affordable Care Act that would impose a fiscal or regulatory burden on states, individuals, healthcare providers, health insurers, or manufacturers of pharmaceuticals or medical devices. Congress also could consider subsequent legislation to replace elements of the Affordable Care Act that are repealed. In the coming years, additional legislative and regulatory changes could be made to governmental health programs that could significantly impact pharmaceutical companies and the success of its product candidate.

In addition, other legislative changes have been proposed and adopted since the Affordable Care Act was enacted. In August 2011, the President signed into law the Budget Control Act of 2011, which, among other things, created the Joint Select Committee on Deficit Reduction to recommend to Congress proposals in spending reductions. The Joint Select Committee did not achieve a targeted deficit reduction of at least $1.2 trillion for the years 2013 through 2021, triggering the legislation’s automatic reduction to several government programs. These included reductions to Medicare payments to providers of 2% per fiscal year, which went into effect on April 1, 2013 and, due to subsequent legislative amendments to the statute, will stay in effect through 2025 unless additional Congressional action is taken. Additionally, in January 2013, the American Taxpayer Relief Act of 2012 was signed into law, which, among other things, further reduced Medicare payments to several providers and increased the statute of limitations period for the government to recover overpayments to providers from three to five years.

Moreover, the Drug Supply Chain Security Act, imposes new obligations on manufacturers of pharmaceutical products, among others, related to product tracking and tracing. Among its requirements, manufacturers will need to provide certain information regarding the drug product to individuals and entities to which product ownership is transferred, label drug product with a product identifier, and keep certain records regarding the drug product. The transfer of information to subsequent product owners by manufacturers will eventually be required to be done electronically. Manufacturers will also be required to verify that purchasers of the manufacturers' products are appropriately licensed. Further, manufacturers will have drug product investigation, quarantine, disposition, and notification responsibilities related to counterfeit, diverted, stolen, and intentionally adulterated products, as well as products that are the subject of fraudulent transactions or which are otherwise unfit for distribution such that they would be reasonably likely to result in serious health consequences or death.

Further, there has been increasing legislative and enforcement interest in the United States with respect to specialty drug pricing practices. Specifically, there have been several recent U.S. Congressional inquiries and proposed bills designed to, among other things, bring more transparency to drug pricing, reduce the cost of prescription drugs under Medicare, review the relationship between pricing and manufacturer patient programs, and reform government program reimbursement methodologies for drugs.

Coverage and Reimbursement

Sales of our product candidates, once approved, will depend, in part, on the extent to which the costs of our products will be covered by third-party payors, such as government health programs, private health insurers and managed care organizations. Third-party payors generally decide which drugs they will cover and establish certain reimbursement levels for such drugs. In particular, in the United States, private health insurers and other third-party payors often provide reimbursement for products and services based on the level at which the government (through the Medicare or Medicaid programs) provides reimbursement for such treatments. Patients who are prescribed treatments for their conditions and providers performing the prescribed services generally rely on third-party payors to reimburse all or part of the associated healthcare costs. Patients are unlikely to use its products unless coverage is provided and reimbursement is adequate to cover a significant portion of the cost of its products. Sales of our product candidates, and any future product candidates, will therefore depend substantially on the extent to which the costs of our product candidates, and any future product candidates, will be paid by third-party payors. Additionally, the market for our product candidates, and any future product candidates, will depend significantly on access to third-party payors' formularies without prior authorization, step therapy, or other limitations such as approved lists of treatments for which third-party payors provide coverage and reimbursement. Additionally, coverage and reimbursement for therapeutic products can differ significantly from payor to payor. One third-party payor's decision to cover a particular medical product or service does not ensure that other payors will also provide coverage for the medical product or service, or will provide coverage at an adequate reimbursement rate. As a result, the coverage determination process will require us to provide scientific and clinical support for the use of our products to each payor separately and will be a costly and time-consuming process.

Third-party payors are developing increasingly sophisticated methods of controlling healthcare costs and increasingly challenging the prices charged for medical products and services. Additionally, the containment of healthcare costs has become a priority of federal and state governments and the prices of drugs 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 and transparency requirements, 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 limit our net revenue and results. If these third-party payors do not consider our products to be cost-effective compared to other therapies, they may not cover our products once approved as a benefit under their plans or, if they do, the level of reimbursement may not be sufficient to allow us to sell our products on a profitable basis. Decreases in third-party reimbursement for our products once approved or a decision by a third-party payor to not cover our products could reduce or eliminate utilization of our products and have an adverse effect on our sales, results of operations and financial condition. In addition, state and federal healthcare reform measures have been and will be adopted in the future, any of which could limit the amounts that federal and state governments will pay for healthcare products and services, which could result in reduced demand for our products once approved or additional pricing pressures.

Employees

As of December 31, 2016, we employed 45 employees, of which 44 were full-time employees. We have never had a work stoppage, and none of our employees is represented by a labor organization or under any collective bargaining arrangements. We consider our employee relations to be good.

Corporate Information

In February 2017, Signal merged with and into Private Miragen and changed its name to Miragen Therapeutics, Inc. Our principal executive offices are located at 6200 Lookout Road, Boulder, CO 80301 and our telephone number is (303) 531-5952. Our corporate website address is *http://www.miragentherapeutics.com*. Our Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K, and amendments to reports filed pursuant to Sections 13(a) and 15(d) of the Securities Exchange Act of 1934, as amended, or the Exchange Act, will be made available free of charge on our website as soon as reasonably practicable after we electronically file such material with, or furnish it to, the U.S. Securities and Exchange Commission, or the SEC. The contents of our website are not incorporated into this Annual Report and our reference to the URL for our website is intended to be an inactive textual reference only.

This Annual Report contains references to our trademarks and to trademarks belonging to other entities. Solely for convenience, trademarks and trade names referred to in this Annual Report, including logos, artwork and other visual displays, may appear without the ® or TM symbols, but such references are not intended to indicate, in any way, that we will not assert, to the fullest extent under applicable law, our rights or the rights of the applicable licensor to these trademarks and trade names. We do not intend our use or display of other companies' trade names or trademarks to imply a relationship with, or endorsement or sponsorship of us by, any other company.

We are an "emerging growth company," as defined in the Jumpstart Our Business Startups Act of 2012. We will remain an emerging growth company until the earlier of (1) the last day of the fiscal year (a) following the fifth anniversary of the completion of our initial public offering in June 2014, (b) in which we have total annual gross revenue of at least $1.0 billion, or (c) in which we are deemed to be a large accelerated filer, which means the market value of our common stock that is held by non-affiliates exceeded $700.0 million as of the prior June 30th, and (2) the date on which we have issued more than $1.0 billion in non-convertible debt during the prior three-year period. We refer to the Jumpstart Our Business Startups Act of 2012 in this Annual Report as the "JOBS Act," and references to "emerging growth company" have the meaning associated with it in the JOBS Act.

28

Item 1A. Risk Factors

The business, financial condition and operating results of the Company may be affected by a number of factors, whether currently known or unknown, including but not limited to those described below. Any one or more of such factors could directly or indirectly cause the Company's actual results of operations and financial condition to vary materially from past or anticipated future results of operations and financial condition. Any of these factors, in whole or in part, could materially and adversely affect the Company's business, financial condition, results of operations and stock price. The following information should be read in conjunction with Part II, Item 7, "Management's Discussion and Analysis of Financial Condition and Results of Operations" and the consolidated financial statements and related notes in Part II, Item 8, "Financial Statements and Supplementary Data" of this Annual Report.

Risks Related to Our Financial Condition and Capital Requirements

We have incurred losses since our inception, have a limited operating history on which to assess our business, and anticipate that we will continue to incur significant losses for the foreseeable future.

While Signal has incurred a cumulative net loss since inception of $30.6 million, Private Miragen has also incurred a cumulative net loss since inception. We are a clinical development-stage biopharmaceutical company with a limited operating history. We have incurred net losses in each year since our inception in 2006, including net losses of $17.3 million and $15.7 million and $5.9 million for the years ended December 31, 2016, 2015 and 2014, respectively. As of December 31, 2016, we had an accumulated deficit of $67.1 million.

As of December 31, 2016, we had cash and cash equivalents of $22.1 million. In September 2016, we received $16.1 million in financing through a follow-on sale of our Series C preferred stock. Additionally, in October 2016, we entered into a series of subscription agreements, or the Subscription Agreement, pursuant to which specified investors agreed to purchase, immediately prior to the consummation of the Merger, shares of our common stock for an aggregate purchase price of $40.7 million, a transaction that closed in February 2017. We believe that we have sufficient capital to fund our operations in the normal course of business and to meet our liquidity needs through at least the next twelve months.

We will continue to require substantial additional capital to continue our clinical development and potential commercialization activities. Accordingly, we will need to raise substantial additional capital to continue to fund our operations. The amount and timing of our future funding requirements will depend on many factors, including the pace and results of our clinical development efforts. Failure to raise capital as and when needed, on favorable terms or at all, would have a negative impact on our financial condition and our ability to develop our product candidates.

We have devoted substantially all of our financial resources to identify, acquire, and develop our product candidates, including conducting clinical trials and providing general and administrative support for our operations. To date, we have financed our operations primarily through the sale of equity securities and convertible promissory notes. The amount of our future net losses will depend, in part, on the rate of our future expenditures and our ability to obtain funding through equity or debt financings, strategic collaborations, or grants. Biopharmaceutical product development is a highly speculative undertaking and involves a substantial degree of risk. We expect our losses to increase as we complete Phase 1 development and advance into Phase 2 development our lead product candidates. We have not yet commenced pivotal clinical trials for any product candidate and it may be several years, if ever, before we complete pivotal clinical trials or have a product candidate approved for commercialization. We expect to invest significant funds into the research and development of our current product candidates to determine the potential to advance these product candidates to regulatory approval.

If we obtain regulatory approval to market a product candidate, our future revenue will depend upon the size of any markets in which our product candidates may receive approval, and our ability to achieve sufficient market acceptance, pricing, reimbursement from third-party payors, and adequate market share for our product candidates in those markets. Even if we obtain adequate market share for our product candidates, because the potential markets in which our product candidates may ultimately receive regulatory approval could be very small, we may never become profitable despite obtaining such market share and acceptance of our products.

We expect to continue to incur significant expenses and increasing operating losses for the foreseeable future and our expenses will increase substantially if and as we:

- continue the clinical development of our product candidates;
- continue efforts to discover new product candidates;
- undertake the manufacturing of our product candidates or increase volumes manufactured by third parties;
- advance our programs into larger, more expensive clinical trials;
- initiate additional pre-clinical, clinical, or other trials or studies for our product candidates;
- seek regulatory and marketing approvals and reimbursement for our product candidates;

- establish a sales, marketing, and distribution infrastructure to commercialize any products for which we may obtain marketing approval and market for ourselves;

- seek to identify, assess, acquire, and/or develop other product candidates;

- make milestone, royalty or other payments under third-party license agreements;

- seek to maintain, protect, and expand our intellectual property portfolio;

- seek to attract and retain skilled personnel; and

- experience any delays or encounter issues with the development and potential for regulatory approval of our clinical candidates such as safety issues, clinical trial accrual delays, longer follow-up for planned studies, additional major studies, or supportive studies necessary to support marketing approval.

Further, the net losses we incur may fluctuate significantly from quarter to quarter and year to year, such that a period-to-period comparison of our results of operations may not be a good indication of our future performance.

We have never generated any revenue from product sales and may never be profitable.

We have no products approved for commercialization and have never generated any revenue. Our ability to generate revenue and achieve profitability depends on our ability, alone or with strategic collaborators, to successfully complete the development of, and obtain the regulatory and marketing approvals necessary to commercialize one or more of our product candidates. We do not anticipate generating revenue from product sales for the foreseeable future. Our ability to generate future revenue from product sales depends heavily on our success in many areas, including but not limited to:

- completing research and development of our product candidates;

- obtaining regulatory and marketing approvals for our product candidates;

- manufacturing product candidates and establishing and maintaining supply and manufacturing relationships with third parties that are commercially feasible, meet regulatory requirements and our supply needs in sufficient quantities to meet market demand for our product candidates, if approved;

- marketing, launching and commercializing product candidates for which we obtain regulatory and marketing approval, either directly or with a collaborator or distributor;
- gaining market acceptance of our product candidates as treatment options;
- addressing any competing products;
- protecting and enforcing our intellectual property rights, including patents, trade secrets, and know-how;
- negotiating favorable terms in any collaboration, licensing, or other arrangements into which we may enter;
- obtaining reimbursement or pricing for our product candidates that supports profitability; and
- attracting, hiring, and retaining qualified personnel.

Even if one or more of the product candidates that we develop is approved for commercial sale, we anticipate incurring significant costs associated with commercializing any approved product candidate. Portions of our current pipeline of product candidates have been in-licensed from third parties, which make the commercial sale of such in-licensed products potentially subject to additional royalty and milestone payments to such third-parties. We will also have to develop or acquire manufacturing capabilities or continue to contract with contract manufacturers in order to continue development and potential commercialization of our product candidates. For instance, our current costs of manufacturing our drug product is not commercially feasible and we will need to develop or procure our drug product in a commercially feasible manner in order to successfully commercialize any future approved product, if any. Additionally, if we are not able to generate revenue from the sale of any approved products, we may never become profitable.

Raising additional capital may cause dilution to our stockholders, restrict our operations or require us to relinquish rights.

To the extent that we raise additional capital through the sale of equity, convertible debt or other securities convertible into equity, the ownership interest of our stockholders will be diluted, and the terms of these new securities may include liquidation or other preferences that adversely affect rights of our stockholders. Debt financing, if available, would likely involve agreements that include covenants limiting or restricting our ability to take specific actions, such as incurring additional debt, making capital expenditures, making additional product acquisitions, or declaring dividends. For instance, our loan and security agreement with Silicon Valley Bank limits our ability to enter into an asset sale, enter into any change of control, incur additional indebtedness, pay any dividends or enter into specified transactions with our affiliates. If we raise additional funds through strategic collaborations or licensing arrangements with third parties, we may have to relinquish valuable rights to our product candidates or future revenue streams or

grant licenses on terms that are not favorable to us. We cannot be assured that we will be able to obtain additional funding if and when necessary to fund our entire portfolio of product candidates to meet our projected plans. If we are unable to obtain funding on a timely basis, we may be required to delay or discontinue one or more of our development programs or the commercialization of any product candidates or be unable to expand our operations or otherwise capitalize on potential business opportunities, which could materially harm our business, financial condition, and results of operations.

We have also historically received funds from state and federal government grants for research and development. The grants have been, and any future government grants and contracts we may receive may be, subject to the risks and contingencies set forth below under the risk factor titled " Reliance on government funding for our programs may add uncertainty to our research and commercialization efforts with respect to those programs that are tied to such funding and may impose requirements that limit our ability to take specified actions, increase the costs of commercialization and production of product candidates developed under those programs and subject us to potential financial penalties, which could materially and adversely affect our business, financial condition and results of operations." Although we might apply for government contracts and grants in the future, we cannot assure you that we will be successful in obtaining additional grants for any product candidates or programs.

Risks Related to the Development of Our Product Candidates

Clinical trials are costly, time consuming and inherently risky, and we may fail to demonstrate safety and efficacy to the satisfaction of applicable regulatory authorities.

Clinical development is expensive, time consuming and involves significant risk. We cannot guarantee that any clinical trials will be conducted as planned or completed on schedule, if at all. A failure of one or more clinical trials can occur at any stage of development. Events that may prevent successful or timely completion of clinical development include but are not limited to:

- inability to generate satisfactory pre-clinical, toxicology, or other in vivo or in vitro data or diagnostics to support the initiation or continuation of clinical trials;
- delays in reaching agreement on acceptable terms with clinical research organizations, or CROs, and clinical trial sites, the terms of which can be subject to extensive negotiation and may vary significantly among different CROs and clinical trial sites;
- delays in obtaining required IRB approval at each clinical trial site;
- failure to permit the conduct of a clinical trial by regulatory authorities, after review of an investigational new drug or equivalent foreign application or amendment;
- delays in recruiting qualified patients in our clinical trials;
- failure by clinical sites or CROs or other third parties to adhere to clinical trial requirements;

- failure by our clinical sites, CROs or other third parties to perform in accordance with the good clinical practices requirements of the FDA or applicable foreign regulatory guidelines;
- patients dropping out of our clinical trials;
- adverse events or tolerability or animal toxicology issues significant enough for the FDA or other regulatory agencies to put any or all clinical trials on hold;
- occurrence of adverse events associated with our product candidates;
- changes in regulatory requirements and guidance that require amending or submitting new clinical protocols;
- the cost of clinical trials of our product candidates;
- negative or inconclusive results from our clinical trials which may result in our deciding, or regulators requiring us, to conduct additional clinical trials or abandon development programs in other ongoing or planned indications for a product candidate; and
- delays in reaching agreement on acceptable terms with third-party manufacturers and the time for manufacture of sufficient quantities of our product candidates for use in clinical trials.

Any inability to successfully complete clinical development and obtain regulatory approval for our product candidates could result in additional costs to us or impair our ability to generate revenue. In addition, if we make manufacturing or formulation changes to our product candidates, we may need to conduct additional pre-clinical trials and the results obtained from such new formulation may not be consistent with previous results obtained. Clinical trial delays could also shorten any periods during which our products have patent protection and may allow competitors to develop and bring products to market before we do, which could impair our ability to successfully commercialize our product candidates and may harm our business and results of operations.

The approach we are taking to discover and develop novel therapeutics using microRNA is unproven and may never lead to marketable products.

The scientific discoveries that form the basis for our efforts to discover and develop our product candidates are relatively recent. To date, neither we nor any other company has received regulatory approval to market therapeutics utilizing microRNA targeted molecules. The scientific evidence to support the feasibility of developing drugs based on these discoveries is both preliminary and limited. Successful development of microRNA therapeutic products by us will require solving a number of issues, including providing suitable methods of stabilizing the microRNA material and delivering it into target cells in the human body. In addition, any product candidates that we develop may not demonstrate in patients the chemical and pharmacological properties ascribed to them in laboratory and pre-clinical trials, and they may interact with human biological systems in unforeseen, ineffective or even harmful ways. For instance, our clinical and pre-clinical data to date is not validated and we have no way of knowing if after validation our clinical trial data will be complete and consistent. If we do not successfully develop and commercialize product candidates based upon this technological approach, we may not become profitable and the value of our capital stock may decline.

Further, our focus on microRNA technology for developing product candidates as opposed to multiple, more proven technologies for drug development increases the risk associated with our business. If we are not successful in developing an approved product using microRNA technology, we may not be able to identify and successfully implement an alternative product development strategy. In addition, work by other companies pursuing similar technologies may encounter setbacks and difficulties that regulators and investors may attribute to our product candidates, whether appropriately or not.

Our microRNA therapeutic product candidates are based on a relatively novel technology, which makes it difficult to predict the time and cost of development and of subsequently obtaining regulatory approval, if at all. To date, no microRNA therapeutics have been approved for marketing in the United States.

We have concentrated our research and development efforts to date on a limited number of product candidates based on our microRNA therapeutic platform and identifying our initial targeted disease indications. Our future success depends on our successful development of viable product candidates. Only two of our product candidates, MRG-106 and MRG-201, are in clinical development, and the remainder of our product candidates are in pre-clinical development. There can be no assurance that we will not experience problems or delays in developing our product candidates and that such problems or delays will not cause unanticipated costs, or that any such development problems can be solved.

Additionally, the FDA has relatively limited experience with microRNA-targeted therapeutics. No regulatory authority has granted approval to any person or entity, including us, to market or commercialize microRNA therapeutics, which may increase the complexity, uncertainty and length of the regulatory approval process for our

product candidates. If our microRNA product candidates fail to prove to be safe, effective or commercially viable, our product candidate pipeline would have little, if any, value, which would have a material adverse effect on our business, financial condition or results of operations.

The clinical trial and manufacturing requirements of the FDA, the European Medicines Agency, or the EMA, and other regulatory authorities, and the criteria these regulators use to determine the safety and efficacy of a product candidate, vary substantially according to the type, complexity, novelty and intended use and market of the product candidate. The regulatory approval process for novel product candidates such as microRNA therapeutics can be more expensive and take longer than for other, better known or more extensively studied product candidates. It is difficult to determine how long it will take or how much it will cost to obtain regulatory approvals for our product candidates in either the United States or the European Union or how long it will take to commercialize our product candidates, even if approved for marketing. Approvals by one regulatory agency may not be indicative of the approval requirements of other regulatory bodies. Delay or failure to obtain, or unexpected costs in obtaining, the regulatory approval necessary to bring a potential product candidate to market could decrease our ability to generate sufficient product revenue, and our business, financial condition, results of operations and prospects may be harmed.

We may not be able to develop or identify a technology that can effectively deliver MRG-106, MRG-201 or any other of our microRNA-targeted product candidates to the intended diseased cells or tissues, and any failure in such delivery technology could adversely affect and delay the development of MRG-106, MRG-201 and our other product candidates.

In connection with our Phase 1 clinical trials of MRG-106 and MRG-201, we have used subcutaneous and intradermal injections as the route of administration. We cannot be certain that subcutaneous or intradermal injections will be capable of delivering adequate levels of MRG-106, MRG-201 or our other product candidates to produce a therapeutic response for all indications. While we are continuing to evaluate the use of subcutaneous, intravenous and intradermal injections in different indications, and additional delivery technologies and routes of administration that might enable us to target specific cells with our product candidates, we cannot be certain whether we will be successful in developing such alternative delivery mechanisms. Our failure to effectively deliver any of our product candidates to the intended diseased cells or tissues could adversely affect and delay the development of our product candidates.

Our product candidates may cause undesirable side effects or have other properties that could delay or prevent their regulatory approval, limit the commercial viability of an approved label, or result in significant negative consequences following marketing approval, if any.

Undesirable side effects caused by our product candidates could cause us or regulatory authorities to interrupt, delay, or terminate clinical trials or even if approved, result in a restrictive label or delay regulatory approval by the FDA or comparable foreign authorities.

Our MRG-106 and MRG-201 product candidates have been studied in only a limited number of patients with a confirmed diagnosis of MF and healthy volunteers, respectfully, and the most common adverse events of any grade were injection site reactions, including pain, itchiness and swelling. We may experience a higher rate or severity of adverse events and comparable or higher rates of discontinuation in testing in our future clinical trials. There is no guarantee that additional or more severe side effects will not be identified through ongoing clinical trials of our product candidates for current and other indications. Undesirable side effects and negative results for other indications may negatively impact the development and potential for approval of our product candidates for their proposed indications.

Additionally, even if one or more of our product candidates receives marketing approval, and we or others later identify undesirable side effects caused by such products, potentially significant negative consequences could result, including but not limited to:

- regulatory authorities may withdraw approvals of such products;
- regulatory authorities may require additional warnings on the label;
- we may be required to create a REMS plan, which could include a medication guide outlining the risks of such side effects for distribution to patients, a communication plan for healthcare providers, and/or other elements to assure safe use;
- we could be sued and held liable for harm caused to patients; and
- our reputation may suffer.

Any of these events could prevent us from achieving or maintaining market acceptance of a product candidate, even if approved, and could significantly harm our business, results of operations, and prospects.

Our product development program may not uncover all possible adverse events that patients who take MRG-106, MRG-201 or our other product candidates may experience. The number of subjects exposed to MRG-106, MRG-201 or our other product candidates and the average exposure time in the clinical development program may be inadequate to detect rare adverse events, or chance findings, that may only be detected once the product is administered to more patients and for greater periods of time.

Clinical trials by their nature utilize a sample of the potential patient population. However, with a limited number of subjects and limited duration of exposure, we cannot be fully assured that rare and severe side effects of MRG-106, MRG-201 or our other product candidates will be uncovered. Such rare and severe side effects may only be uncovered with a significantly larger number of patients exposed to the drug. If such safety problems occur or are identified after MRG-106, MRG-201 or another product candidate reaches the market, the FDA may require that we amend the labeling of the product or recall the product, or may even withdraw approval for the product.

Our microRNA therapeutic approach is novel. Negative public opinion and increased regulatory scrutiny of microRNA or other nucleic acid based therapies may damage public perception of the safety of our product candidates and adversely affect our ability to conduct our business or obtain regulatory approvals for our product candidates.

MicroRNA therapy remains a novel technology, with no microRNA therapy product approved to date in the United States. Public perception may be influenced by claims that microRNA therapy is unsafe, and microRNA therapy may not gain the acceptance of the public or the medical community. In particular, our success will depend upon physicians who specialize in the treatment of the diseases targeted by our product candidates, prescribing treatments that involve the use of our product candidates in lieu of, or in addition to, existing treatments with which they are familiar and for which greater clinical data may be available. More restrictive government regulations or negative public opinion regarding microRNA or other nucleic acid based therapeutics could have an adverse effect on our business, financial condition or results of operations and may delay or impair the development and commercialization of our product candidates or demand for any products we may develop. Serious adverse events in microRNA clinical trials for our competitors' products, even if not ultimately attributable to the relevant product candidates, and the resulting publicity, could result in increased government regulation, unfavorable public perception, potential regulatory delays in the testing or approval of our product candidates, stricter labeling requirements for those product candidates that are approved and a decrease in demand for any such product candidates. For instance, in June 2016, the FDA placed a regulatory hold on the clinical trial of a microRNA or nucleic acid focused biopharmaceutical company with a microRNA product candidate for the treatment of hepatitis C virus due to serious adverse events in that trial. Another microRNA-focused biopharmaceutical company also voluntarily halted an ongoing Phase 1 clinical trial for a microRNA therapy for multiple cancers in September 2016 due to multiple immune-related severe adverse events. We cannot predict what effect, if any, these clinical holds will have on the government and public perception of our product candidates.

We are heavily dependent on the success of our product candidates, which are in the early stages of clinical development. Some of our product candidates have produced results only in pre-clinical settings, or for other indications than those for which we contemplate conducting development and seeking FDA approval, and we cannot give any assurance that we will generate data for any of our product candidates sufficiently supportive to receive regulatory approval in our planned indications, which will be required before they can be commercialized.

We have invested substantially all of our effort and financial resources to identify, acquire and develop our portfolio of product candidates. Our future success is dependent on our ability to successfully further develop, obtain regulatory approval for, and commercialize one or more product candidates. We currently generate no revenue from sales of any products, and we may never be able to develop or commercialize a product candidate.

We currently have two product candidates in Phase 1 clinical trials. Of these product candidates, MRG-106 has only been administered in volunteers with MF. This is only one of the multiple indications for which we plan to develop this product candidate. Additionally, our clinical and pre-clinical data to date is not validated and we have no way of knowing if after validation our clinical trial data will be complete and consistent. There can be no assurance that the data that we develop for our product candidates in our planned indications will be sufficiently supportive to obtain regulatory approval.

In addition, none of our product candidates have advanced into a pivotal clinical trial for our proposed indications and it may be years before any such clinical trial is initiated and completed, if at all. We are not permitted to market or promote any of our product candidates before we receive regulatory approval from the FDA or comparable foreign regulatory authorities, and we may never receive such regulatory approval for any of our product candidates. We cannot be certain that any of our product candidates will be successful in clinical trials or receive regulatory approval. Further, our product candidates may not receive regulatory approval even if they are successful in clinical trials. If we do not receive regulatory approvals for our product candidates, we may not be able to continue our operations.

Product development involves a lengthy and expensive process with an uncertain outcome, and results of earlier pre-clinical 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 during the clinical trial process. Additionally, microRNAs are a new class of drug target and as such may have some potentially unknown risks from both an efficacy and safety perspective. The results of pre-clinical trials and early clinical trials of our product candidates may not be predictive of the results of larger, later-stage controlled clinical trials. Product candidates that have shown promising results in early-stage clinical trials may still suffer significant setbacks in subsequent clinical trials. Our clinical trials to date have been conducted on a small number of patients in limited numbers of clinical sites for a limited number of indications. We will have to conduct larger, well-controlled 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 advanced clinical trials due to lack of efficacy or adverse safety profiles despite promising results in earlier, smaller clinical trials. For instance, in June 2016, the FDA placed a regulatory hold on the clinical trial of a microRNA-focused biopharmaceutical company with a microRNA product candidate for the treatment of hepatitis C virus due to serious adverse events in that trial. Another microRNA-focused biopharmaceutical company also voluntarily halted an ongoing Phase 1 clinical trial for a microRNA therapy for multiple cancers in September 2016 due to multiple immune-related severe adverse events. Moreover, clinical data are often susceptible to varying interpretations and analyses. We do not know whether any 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 drug candidates.

We may use our financial and human resources to pursue a particular research program or product candidate and fail to capitalize on programs or product candidates that may be more profitable or for which there is a greater likelihood of success.

Because we have limited financial and human resources, we may forego or delay pursuit of opportunities with some programs or product candidates or for other indications that later prove to have greater commercial potential. Our resource allocation decisions may cause us to fail to capitalize on viable commercial products or more profitable market opportunities. Our spending on current and future research and development programs and future product candidates for specific indications may not yield any commercially viable products. We may also enter into additional strategic collaboration agreements to develop and commercialize some of our programs and potential product candidates in indications with potentially large commercial markets. If we do not accurately evaluate the commercial potential or target market for a particular product candidate, we may relinquish valuable rights to that product candidate through strategic collaborations, licensing or other royalty arrangements in cases in which it would have been more advantageous for us to retain sole development and commercialization rights to such product candidate, or we may allocate internal resources to a product candidate in a therapeutic area in which it would have been more advantageous to enter into a partnering arrangement.

We may find it difficult to enroll patients in our clinical trials given the limited number of patients who have the diseases for which our product candidates are being studied. Difficulty in enrolling patients could delay or prevent clinical trials of our product candidates.

Identifying and qualifying patients to participate in clinical trials of our product candidates is essential to our success. The timing of our clinical trials depends in part on the rate at which we can recruit patients to participate in clinical trials of our product candidates, and we may experience delays in our clinical trials if we encounter difficulties in enrollment.

The eligibility criteria of our planned clinical trials may further limit the available eligible trial participants as we expect to require that patients have specific characteristics that we can measure or meet the criteria to assure their conditions are appropriate for inclusion in our clinical trials. For instance, our Phase 1 clinical trial of MRG-106 includes patients with MF. The estimated prevalence of MF is 16,000 to 20,000 cases in the United States and only a subset of this group satisfies the enrollment criteria for our MRG-106 clinical trial. We may not be able to identify, recruit, and enroll a sufficient number of patients to complete our clinical trials in a timely manner because of the perceived risks and benefits of the product candidate under study, the availability and efficacy of competing therapies and clinical trials, and the willingness of physicians to participate in our planned clinical trials. If patients are unwilling to participate in our clinical trials for any reason, the timeline for conducting trials and obtaining regulatory approval of our product candidates may be delayed.

If we experience delays in the completion of, or termination of, any clinical trials of our product candidates, the commercial prospects of our product candidates could be harmed, and our ability to generate product revenue from any of these product candidates could be delayed or prevented. In addition, any delays in completing our clinical trials would likely increase our overall costs, impair product candidate development and jeopardize our ability to obtain regulatory approval relative to our current plans. Any of these occurrences may harm our business, financial condition, and prospects significantly.

We may face potential product liability, and, if successful claims are brought against us, we may incur substantial liability and costs. If the use or misuse of our product candidates harms patients, or is perceived to harm patients even when such harm is unrelated to our product candidates, our regulatory approvals, if any, could be revoked or otherwise negatively impacted and we could be subject to costly and damaging product liability claims. If we are unable to obtain adequate insurance or are required to pay for liabilities resulting from a claim excluded from, or beyond the limits of, our insurance coverage, a material liability claim could adversely affect our financial condition.

The use or misuse of our product candidates in clinical trials and the sale of any products for which we may obtain marketing approval exposes us to the risk of potential product liability claims. Product liability claims might be brought against us by consumers, healthcare providers, pharmaceutical companies or others selling or otherwise

coming into contact with our product candidates and approved products, if any. There is a risk that our product candidates may induce adverse events. If we cannot successfully defend against product liability claims, we could incur substantial liability and costs. Some of our microRNA therapeutics have shown in clinical trials adverse events, including injection site reactions and pain at the injection site, nausea, decreased white blood cell count, neutropenia, elevated aspartate aminotransferase, alanine aminotransferase and creatine kinase levels, prolonged partial thromboplastin time, blurred vision, itchiness, fatigue, headache and microscopic hematuria, among others. There is a risk that our future product candidates may induce similar or more severe adverse events. Patients with the diseases targeted by our product candidates may already be in severe and advanced stages of disease and have both known and unknown significant preexisting and potentially life-threatening health risks. During the course of treatment, patients may suffer adverse events, including death, for reasons that may be related to our product candidates. Such events could subject us to costly litigation, require us to pay substantial amounts of money to injured patients, delay, negatively impact or end our opportunity to receive or maintain regulatory approval to market our products, or require us to suspend or abandon our commercialization efforts. Even in a circumstance in which an adverse event is unrelated to our product candidates, the investigation into the circumstance may be time-consuming or inconclusive. These investigations may delay our regulatory approval process or impact and limit the type of regulatory approvals our product candidates receive or maintain. As a result of these factors, a product liability claim, even if successfully defended, could have a material adverse effect on our business, financial condition or results of operations.

Although we have product liability insurance, which covers our clinical trials in the United States, for up to $5.0 million per occurrence, up to an aggregate limit of $5.0 million, our insurance may be insufficient to reimburse us for any expenses or losses we may suffer. We will also likely be required to increase our product liability insurance coverage for the advanced clinical trials that we plan to initiate. If we obtain marketing approval for any of our product candidates, we will need to expand our insurance coverage to include the sale of commercial products. There is no way to know if we will be able to continue to obtain product liability coverage and obtain expanded coverage if we require it, in sufficient amounts to protect us against losses due to liability, on acceptable terms, or at all. We may not have sufficient resources to pay for any liabilities resulting from a claim excluded from, or beyond the limits of, our insurance coverage. Where we have provided indemnities in favor of third parties under our agreements with them, there is also a risk that these third parties could incur liability and bring a claim under such indemnities. An individual may bring a product liability claim against us alleging that one of our product candidates causes, or is claimed to have caused, an injury or is found to be unsuitable for consumer use. Any such product liability claims may include allegations of defects in manufacturing, defects in design, a failure to warn of dangers inherent in the product, negligence, strict liability, and a breach of warranties. Claims could also be asserted under state consumer protection acts. Any product liability claim brought against us, with or without merit, could result in:

- withdrawal of clinical trial volunteers, investigators, patients or trial sites or limitations on approved indications;

- the inability to commercialize, or if commercialized, decreased demand for, our product candidates;
- if commercialized, product recalls, withdrawals of labeling, marketing or promotional restrictions or the need for product modification;
- initiation of investigations by regulators;
- loss of revenues;
- substantial costs of litigation, including monetary awards to patients or other claimants;
- liabilities that substantially exceed our product liability insurance, which we would then be required to pay ourselves;
- an increase in our product liability insurance rates or the inability to maintain insurance coverage in the future on acceptable terms, if at all;
- the diversion of management's attention from our business; and
- damage to our reputation and the reputation of our products and our technology.

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

Risks Related to Regulatory Approval of Our Product Candidates and Other Legal Compliance Matters

A potential breakthrough therapy designation by the FDA for our product candidates may not lead to a faster development or regulatory review or approval process, and it does not increase the likelihood that our product candidates will receive marketing approval.

We may seek a breakthrough therapy designation from the FDA for some of our product candidates. A breakthrough therapy is defined as a drug or biological product that is intended, alone or in combination with one or more other drugs, to treat a serious or life-threatening disease or condition, and preliminary clinical evidence indicates that the drug or biological product may demonstrate substantial improvement over existing therapies on one or more clinically

significant endpoints, such as substantial treatment effects observed early in clinical development. For drugs or biological products that have been designated as breakthrough therapies, interaction and communication between the FDA and the sponsor of the trial can help to identify the most efficient path for clinical development while minimizing the number of patients placed in ineffective control regimens. Drugs designated as breakthrough therapies by the FDA could also be eligible for accelerated approval.

Designation as a breakthrough therapy is within the discretion of the FDA. Accordingly, even if we believe one of our product candidates meets the criteria for designation as a breakthrough therapy, the FDA may disagree and instead determine not to make such designation. In any event, the receipt of a breakthrough therapy designation for a product candidate may not result in a faster development process, review or approval compared to drugs considered for approval under conventional FDA procedures and does not assure ultimate approval by the FDA. In addition, even if one or more of our product candidates qualify and are designated as breakthrough therapies, the FDA may later decide that the drugs or biological products no longer meet the conditions for designation and the designation may be rescinded.

We may seek Fast Track designation for one or more of our product candidates, but we might not receive such designation, and even if we do, such designation may not actually lead to a faster development or regulatory review or approval process.

If a product candidate is intended for the treatment of a serious condition and nonclinical or clinical data demonstrate the potential to address unmet medical need for this condition, a product sponsor may apply for FDA Fast Track designation. If we seek Fast Track designation for a product candidate, we may not receive it from the FDA. However, even if we receive Fast Track designation, Fast Track designation does not ensure that we will receive marketing approval or that approval will be granted within any particular timeframe. We may not experience a faster development or regulatory review or approval process with Fast Track designation compared to conventional FDA procedures. In addition, the FDA may withdraw Fast Track designation if it believes that the designation is no longer supported by data from our clinical development program. Fast Track designation alone does not guarantee qualification for the FDA’s priority review procedures.

Even if we obtain regulatory approval for a product, we will remain subject to ongoing regulatory requirements.

If any of our product candidates are approved, we will be subject to ongoing regulatory requirements with respect to manufacturing, labeling, packaging, storage, advertising, promotion, sampling, record-keeping, conduct of post-marketing clinical trials, and submission of safety, efficacy and other post-approval information, including both federal and state requirements in the United States and requirements of comparable foreign regulatory authorities.

Manufacturers and manufacturers' facilities are required to continuously comply with FDA and comparable foreign regulatory authority requirements, including ensuring that quality control and manufacturing procedures conform to cGMP regulations and corresponding foreign regulatory manufacturing requirements. As such, we and our contract manufacturers will be subject to continual review and inspections to assess compliance with cGMP and adherence to commitments made in any NDA or marketing authorization application.

Any regulatory approvals that we receive for our product candidates may be subject to limitations on the approved indicated uses for which the product candidate may be marketed or to the conditions of approval, or contain requirements for potentially costly post-marketing testing, including Phase 4 clinical trials, and surveillance to monitor the safety and efficacy of the product candidate. We will be required to report adverse reactions and production problems, if any, to the FDA and comparable foreign regulatory authorities. Any new legislation addressing drug safety issues could result in delays in product development or commercialization, or increased costs to assure compliance. If our original marketing approval for a product candidate was obtained through an accelerated approval pathway, we could be required to conduct a successful post-marketing clinical trial in order to confirm the clinical benefit for our products. An unsuccessful post-marketing clinical trial or failure to complete such a trial could result in the withdrawal of marketing approval.

If a regulatory agency discovers previously unknown problems with a product, such as adverse events of unanticipated severity or frequency, or problems with the facility where the product is manufactured, or disagrees with the promotion, marketing or labeling of a product, the regulatory agency may impose restrictions on that product or us, including requiring withdrawal of the product from the market. If we fail to comply with applicable regulatory requirements, a regulatory agency or enforcement authority may, among other things:

- issue warning letters;
- impose civil or criminal penalties;
- suspend or withdraw regulatory approval;

- suspend any of our ongoing clinical trials;
- refuse to approve pending applications or supplements to approved applications submitted by us;
- impose restrictions on our operations, including closing our contract manufacturers' facilities; or
- require a product recall.

Any government investigation of alleged violations of law would be expected to require us to expend significant time and resources in response and could generate adverse publicity. Any failure to comply with ongoing regulatory requirements may significantly and adversely affect our ability to develop and commercialize our products and the value of the company and our operating results would be adversely affected.

Healthcare legislative reform measures may have a material adverse effect on our business, financial condition or results of operations.

In the United States, there have been and continue to be a number of legislative initiatives to contain healthcare costs. For example, in March 2010, the Affordable Care Act was passed, which substantially changes the way health care is financed by both governmental and private insurers, and significantly impacts the U.S. pharmaceutical industry. The Affordable Care Act, among other things, addresses a new methodology by which rebates owed by manufacturers under the Medicaid Drug Rebate Program are calculated for drugs that are inhaled, infused, instilled, implanted, or injected, increases the minimum Medicaid rebates owed by manufacturers under the Medicaid Drug Rebate Program and extends the rebate program to individuals enrolled in Medicaid managed care organizations, establishes annual fees and taxes on manufacturers of specified branded prescription drugs, and promotes a new Medicare Part D coverage gap discount program.

Since its enactment certain aspects of the Affordable Care Act have faced Congressional and Judicial challenges. In January 2017, Congress voted to the Budget Resolution that authorizes the implementation of legislation that would repeal portions of the Affordable Care Act. The Budget Resolution is not a law; however, it is widely viewed as the first step toward the passage of repeal legislation. Further, on January 20, 2017, President Trump signed an Executive Order directing federal agencies with authorities and responsibilities under the Affordable Care Act to waive, defer, grant exemptions from, or delay the implementation of any provision of the Affordable Care Act that would impose a fiscal or regulatory burden on states, individuals, healthcare providers, health insurers, or manufacturers of pharmaceuticals or medical devices. Congress also could consider subsequent legislation to replace elements of the Affordable Care Act that are repealed. We cannot predict how the Affordable Care Act, its possible repeal, or any legislation Congress passes to replace the Affordable Care Act will affect our business.

In addition, other legislative changes have been proposed and adopted in the United States since the Affordable Care Act was enacted and we expect that additional state and federal healthcare reform measures will be adopted in the future, any of which could limit the amounts that federal and state governments will pay for healthcare products and services, which could result in reduced demand or lower pricing for our product candidates, or additional pricing pressures.

We may be subject, directly or indirectly, to federal and state healthcare fraud and abuse laws, false claims laws, and health information privacy and security laws. If we are unable to comply, or has not fully complied, with such laws, we could face substantial penalties.

If we obtain FDA approval for any of our product candidates and begin commercializing those products in the United States, our operations may be subject to various federal and state fraud and abuse laws, including, without limitation, the federal Anti-Kickback Statute, the federal False Claims Act, and Physician Payments Sunshine Act and regulations. These laws may impact, among other things, our relationships with principal investigators and consultants, and our proposed sales, marketing, and education programs. In addition, we may be subject to patient privacy regulation by both the federal government and the states in which we conduct our business. The laws that may affect our ability to operate include:

- the federal Anti-Kickback Statute, which prohibits, among other things, persons from knowingly and willfully soliciting, receiving, offering or paying remuneration, directly or indirectly, to induce, or in return for, the purchase or recommendation of an item or service reimbursable under a federal healthcare program, such as the Medicare and Medicaid programs;

- federal civil and criminal false claims laws and civil monetary penalties law, which prohibits, among other things, individuals or entities from knowingly presenting, or causing to be presented, claims for payment from Medicare, Medicaid, or other third-party payors that are false or fraudulent;

- HIPAA which created new federal criminal statutes that prohibit, among other things, executing a scheme to defraud any healthcare benefit program and making false statements relating to healthcare matters;

- HIPAA, as amended by HITECH, and their implementing regulations, which imposes specified obligations, including mandatory contractual terms, with respect to safeguarding the privacy, security and transmission of individually identifiable health information without the appropriate authorization, on entities subject to the law, such as healthcare providers, health plans, and healthcare clearinghouses and their respective business associates that perform services for them that involve the creation, use, maintenance or disclosure of, individually identifiable health information;

- the federal Physician Payment Sunshine Act requirements under the Affordable Care Act requires manufacturers of drugs, devices, biologics, and medical supplies to report annually to the U.S. Department of Health and Human

Services information related to payments and other transfers of value to physicians, other healthcare providers, and teaching hospitals, and ownership and investment interests held by physicians and other healthcare providers and their immediate family members and applicable group purchasing organizations; and

state law equivalents of each of the above federal laws, such as anti-kickback and false claims laws that may apply to items or services reimbursed by any third-party payor, including governmental and private payors, to comply with the pharmaceutical industry's voluntary compliance guidelines and the relevant compliance guidance promulgated by the federal government, or otherwise restrict payments that may be made to healthcare providers and other potential referral sources; state laws that require drug manufacturers to report information related to payments and other transfers of value to physicians and other healthcare providers or marketing expenditures, and state laws governing the privacy and security of health information in specified circumstances, many of which differ from each other in significant ways and may not have the same effect, thus complicating compliance efforts.

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

If our operations are found to be in violation of any of the laws described above or any other governmental regulations that apply to us, we may be subject to penalties, including civil and criminal penalties, disgorgement, damages, fines, contractual damages, reputational harm, diminished profits and future earnings, exclusion from participation in government health care programs, such as Medicare and Medicaid, including imprisonment, additional reporting requirements and/or oversight if we become subject to a corporate integrity agreement or similar agreement to resolve allegations of non-compliance with these laws, and the curtailment or restructuring of our operations, any of which could adversely affect our ability to operate our business and our results of operations.

Reliance on government funding for our programs may add uncertainty to our research and commercialization efforts with respect to those programs that are tied to such funding and may impose requirements that limit our ability to take specified actions, increase the costs of commercialization and production of product candidates developed under those programs and subject us to potential financial penalties, which could materially and adversely affect our business, financial condition and results of operations.

During the course of our development of our product candidates, we have been funded in part through federal and state grants, including but not limited to the funding we received from Yale pursuant to a subcontract agreement with Yale. In addition to the funding we have received to date, we have applied and intend to continue to apply for federal and state grants to receive additional funding in the future. Contracts and grants funded by the U.S. government, state governments and their related agencies include provisions that reflect the government's substantial rights and remedies, many of which are not typically found in commercial contracts, including powers of the government to:

- require repayment of all or a portion of the grant proceeds, in specified cases with interest, in the event we violate specified covenants pertaining to various matters that include a failure to achieve
- specified milestones or to comply with terms relating to use of grant proceeds, or failure to comply with specified laws;
- terminate agreements, in whole or in part, for any reason or no reason;
- reduce or modify the government's obligations under such agreements without the consent of the other party;
- claim rights, including intellectual property rights, in products and data developed under such agreements;
- audit contract related costs and fees, including allocated indirect costs;
- suspend the contractor or grantee from receiving new contracts pending resolution of alleged violations of procurement laws or regulations;
- impose U.S. manufacturing requirements for products that embody inventions conceived or first reduced to practice under such agreements;
- impose qualifications for the engagement of manufacturers, suppliers and other contractors as well as other criteria for reimbursements;

- suspend or debar the contractor or grantee from doing future business with the government;

- control and potentially prohibit the export of products;

- pursue criminal or civil remedies under the False Claims Act, False Statements Act and similar remedy provisions specific to government agreements; and

- limit the government's financial liability to amounts appropriated by the U.S. Congress on a fiscal year basis, thereby leaving some uncertainty about the future availability of funding for a program even after we have been funded for an initial period.

In addition to those powers set forth above, the government funding we may receive could also impose requirements to make payments based upon sales of our products, if any, in the future.

We may not have the right to prohibit the U.S. government from using specified technologies developed by it, and we may not be able to prohibit third-party companies, including our competitors, from using those technologies in providing products and services to the U.S. government. The U.S. government generally takes the position that we have the right to royalty-free use of technologies that are developed under U.S. government contracts. These and other provisions of government grants may also apply to intellectual property we license now or in the future.

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

- specialized accounting systems unique to government contracts and grants;

- mandatory financial audits and potential liability for price adjustments or recoupment of government funds after such funds have been spent;

- public disclosures of some contract and grant information, which may enable competitors to gain insights into our research program; and

- mandatory socioeconomic compliance requirements, including labor standards, non-discrimination and affirmative action programs and environmental compliance requirements.

If we fail to maintain compliance with any such requirements that may apply to us now or in the future, we may be subject to potential liability and to termination of our contracts.

If we fail to comply with environmental, health and safety laws and regulations, we could become subject to fines or penalties or incur costs that could have a material adverse effect on our business, financial condition or results of operations.

Our research and development activities and our third-party manufacturers' and suppliers' activities involve the controlled storage, use, and disposal of hazardous materials, including the components of our product candidates and other hazardous compounds. We and our manufacturers and suppliers are subject to laws and regulations governing the use, manufacture, storage, handling, and disposal of these hazardous materials. In some cases, these hazardous materials and various wastes resulting from their use are stored at our and our manufacturers' facilities pending their use and disposal. We cannot eliminate the risk of contamination, which could cause an interruption of our commercialization efforts, research and development efforts and business operations, environmental damage resulting in costly clean-up and liabilities under applicable laws and regulations governing the use, storage, handling, and disposal of these materials and specified waste products. Although we believe that the safety procedures utilized by us and our third-party manufacturers for handling and disposing of these materials generally comply with the standards prescribed by these laws and regulations, we cannot guarantee that this is the case or eliminate the risk of accidental contamination or injury from these materials. In such an event, we may be held liable for any resulting damages and such liability could exceed our resources and state or federal or other applicable authorities may curtail our use of specified materials and/or interrupt our business operations. Furthermore, environmental laws and regulations are complex, change frequently, and have tended to become more stringent. We cannot predict the impact of such changes and cannot be certain of our future compliance. We do not currently carry biological or hazardous waste insurance coverage.

Risks Related to Our Intellectual Property

We may not be successful in obtaining or maintaining necessary rights to microRNA targets, product compounds and processes for our development pipeline through acquisitions and in-licenses.

Presently, we have rights to the intellectual property, through licenses from third parties and under patents and patent applications that we own, to modulate only a subset of the known microRNA targets. Because our programs may involve a range of microRNA targets, including targets that require the use of proprietary rights held by third parties, the growth of our business will likely depend in part on our ability to acquire, in-license or use these proprietary

rights. In addition, our product candidates may require specific formulations to work effectively and efficiently and these rights may be held by others. We may be unable to acquire or in-license any compositions, methods of use, processes or other third-party intellectual property rights from third parties that we identify. The licensing and acquisition of third-party intellectual property rights is a competitive area, and a number of more established companies are also pursuing strategies to license or acquire third-party intellectual property rights that we may consider attractive. These established companies may have a competitive advantage over us due to their size, cash resources and greater clinical development and commercialization capabilities.

For example, we have previously collaborated and may continue to collaborate with U.S. and foreign academic institutions to accelerate our pre-clinical research or development under written agreements with these institutions. Typically, these institutions provide an option to negotiate a license to any of the institution's rights in technology resulting from the collaboration. Regardless of such right of first negotiation for intellectual property, we may be unable to negotiate a license within the specified time frame or under terms that are acceptable to it. If we are unable to do so, the institution may offer the intellectual property rights to other parties, potentially blocking our ability to pursue our program.

In addition, companies that perceive us to be a competitor may be unwilling to assign or license rights to it. We also may be unable to license or acquire third-party intellectual property rights on terms that would allow us to make an appropriate return on our investment. If we are unable to successfully obtain rights to third-party intellectual property rights, our business, financial condition and prospects for growth could suffer.

We intend to rely on patent rights for our product candidates and any future product candidates. If we are unable to obtain or maintain exclusivity from the combination of these approaches, we may not be able to compete effectively in our markets.

We rely or will rely upon a combination of patents, trade secret protection, and confidentiality agreements to protect the intellectual property related to our technologies and product candidates. Our success depends in large part on our and our licensors' ability to obtain regulatory exclusivity and maintain patent and other intellectual property protection in the United States and in other countries with respect to our proprietary technology and products.

We have sought to protect our proprietary position by filing patent applications in the United States and abroad related to our product candidates that are important to our business. This process is expensive and time consuming, and we may not be able to file and prosecute all necessary or desirable patent applications at a reasonable cost or in a timely manner. It is also possible that we will fail to identify patentable aspects of our research and development output before it is too late to obtain patent protection.

The patent position of biotechnology and pharmaceutical companies generally is highly uncertain and involves complex legal and factual questions for which legal principles remain unsolved. The patent applications that we own or in-license may fail to result in issued patents with claims that cover our product candidates in the United States or in other foreign countries. There is no assurance that all potentially relevant prior art relating to our patents and patent applications has been found, which can invalidate a patent or prevent a patent from issuing from a pending patent application. Even if patents do successfully issue, and even if such patents cover our product candidates, third parties may challenge their validity, enforceability, or scope, which may result in such patents being narrowed, found unenforceable or invalidated. Furthermore, even if they are unchallenged, our patents and patent applications may not adequately protect our intellectual property, provide exclusivity for our product candidates, or prevent others from designing around our claims. Any of these outcomes could impair our ability to prevent competition from third parties, which may have an adverse impact on our business.

We, independently or together with our licensors, have filed several patent applications covering various aspects of our product candidates. We cannot offer any assurances about which, if any, patents will issue, the breadth of any such patent or whether any issued patents will be found invalid and unenforceable or will be threatened by third parties. Any successful opposition to these patents or any other patents owned by or licensed to us after patent issuance could deprive us of rights necessary for the successful commercialization of any product candidates that we may develop. Further, if we encounter delays in regulatory approvals, the period of time during which we could market a product candidate under patent protection could be reduced.

If we cannot obtain and maintain effective protection of exclusivity from our regulatory efforts and intellectual property rights, including patent protection or data exclusivity, for our product candidates, we may not be able to compete effectively and our business and results of operations would be harmed.

We may not have sufficient patent term protections for our product candidates to effectively protect our business.

Patents have a limited term. In the United States, the statutory expiration of a patent is generally 20 years after it is filed. Although various extensions may be available, the life of a patent, and the protection it affords, is limited. Even if patents covering our product candidates are obtained, once the patent life has expired for a product candidate, we may be open to competition from generic medications. In addition, upon issuance in the United States any patent term can be adjusted based on specified delays caused by the applicant(s) or the USPTO.

Patent term extensions under the Hatch-Waxman Act in the United States and under supplementary protection certificates in Europe may be available to extend the patent or data exclusivity terms of our product candidates. We will likely rely on patent term extensions, and we cannot provide any assurances that any such patent term extensions will be obtained and, if so, for how long. As a result, we may not be able to maintain exclusivity for our product candidates for an extended period after regulatory approval, if any, which would negatively impact our business, financial condition, results of operations and prospects. If we do not have sufficient patent terms or regulatory

exclusivity to protect our product candidates, our business and results of operations will be adversely affected.

Changes in U.S. patent law could diminish the value of patents in general, thereby impairing our ability to protect our products, and recent patent reform legislation could increase the uncertainties and costs surrounding the prosecution of our patent applications and the enforcement or defense of our issued patents.

As is the case with other biotechnology companies, our success is heavily dependent on patents. Obtaining and enforcing patents in the biotechnology industry involve both technological and legal complexity, and is therefore costly, time-consuming and inherently uncertain. In addition, the United States has recently enacted and is currently implementing wide-ranging patent reform legislation. Recent U.S. Supreme Court rulings have narrowed the scope of patent protection available in specified circumstances and weakened the rights of patent owners in specified situations. In addition to increasing uncertainty with regard to our ability to obtain patents in the future, this combination of events has created uncertainty with respect to the value of patents, once obtained. Depending on decisions by the U.S. Congress, the federal courts, and the USPTO, the laws and regulations governing patents could change in unpredictable ways that would weaken our ability to obtain new patents or to enforce our existing patents and patents that we might obtain in the future. Some of our patent claims may be affected by the recent U.S. Supreme Court decision in Association for Molecular Pathology v. Myriad Genetics. In Myriad, the Supreme Court held that unmodified isolated fragments of genomic sequences, such as the DNA constituting the BRCA1 and BRCA2 genes, are not eligible for patent protection because they constitute a product of nature. The exact boundaries of the Supreme Court’s decision remain unclear as the Supreme Court did not address other types of nucleic acids, such as isolated microRNAs.

The USPTO has issued guidance to patent examiners instructing USPTO examiners on the ramifications of the Prometheus and Myriad rulings and apply the Myriad ruling to natural products and principles including all naturally occurring nucleic acids. In addition, the USPTO continues to provide updates to its guidance and this is a developing area. The USPTO guidance could make it impossible for us to pursue similar patent claims in patent applications we may prosecute in the future.

Our patent portfolio contains claims of various types and scope, including chemically modified mimics, as well as methods of medical treatment. The presence of varying claims in our patent portfolio significantly reduces, but may not eliminate, our exposure to potential validity challenges under Myriad or future judicial decisions. However, it is not yet clear what, if any, impact this recent Supreme Court decision or future decisions will have on the operation of our business.

For our U.S. patent applications containing a claim not entitled to priority before March 16, 2013, there is a greater level of uncertainty in the patent law. On September 16, 2011, the Leahy-Smith America Invents Act, or the Leahy-Smith Act, was signed into law. The Leahy-Smith Act includes a number of significant changes to U.S. patent law. These include provisions that affect the way patent applications will be prosecuted and may also affect patent litigation. The USPTO has promulgated regulations and developed procedures to govern administration of the Leahy-Smith Act, and many of the substantive changes to patent law associated with the Leahy-Smith Act, and in particular, the first to file provisions, did not come into effect until March 16, 2013. Accordingly, it is not yet clear what, if any, impact the Leahy-Smith Act will have on the operation of our business. However, the Leahy-Smith Act and our implementation could increase the uncertainties and costs surrounding the prosecution of our patent applications and the enforcement or defense of our issued patents, all of which could have a material adverse effect on our business, financial condition or results of operations.

An important change introduced by the Leahy-Smith Act is that, as of March 16, 2013, the United States transitioned to a “first-to-file” system for deciding which party should be granted a patent when two or more patent applications are filed by different parties claiming the same invention. A third party that files a patent application in the USPTO after that date but before we could therefore be awarded a patent covering an invention of ours even if we had made the invention before it was made by the third party. This will require us to be cognizant going forward of the time from invention to filing of a patent application. Furthermore, our ability to obtain and maintain valid and enforceable patents depends on whether the differences between our technology and the prior art allow our technology to be patentable over the prior art. Since patent applications in the United States and most other countries are confidential for a period of time after filing, we cannot be certain that we were the first to either (i) file any patent application related to our product candidates or (ii) invent any of the inventions claimed in our patents or patent applications.

Among some of the other changes introduced by the Leahy-Smith Act are changes that limit where a patentee may file a patent infringement suit and new procedures providing opportunities for third parties to challenge any issued patent in the USPTO. Included in these new procedures is a process known as Inter Partes Review, or IPR, which has been generally used by many third parties over the past four years to invalidate patents. The IPR process is not limited to patents filed after the Leahy-Smith Act was enacted, and would therefore be available to a third party seeking to invalidate any of our U.S. patents, even those issued before March 16, 2013. Because of a lower evidentiary standard in USPTO proceedings compared to the evidentiary standard in U.S. federal court necessary to invalidate a patent claim, a third party could potentially provide evidence in a USPTO proceeding sufficient for the USPTO to hold a claim invalid even though the same evidence would be insufficient to invalidate the claim if first presented in a district court action. Accordingly, a third party may attempt to use the USPTO procedures to invalidate our patent claims that would not have been invalidated if first challenged by the third party as a defendant in a district court action. Additionally, the rights of review and appeal for IPR decisions is an area of law this is still developing.

If we are unable to maintain effective proprietary rights for our product candidates or any future product candidates, we may not be able to compete effectively in our proposed markets.

In addition to the protection afforded by patents, we rely on trade secret protection and confidentiality agreements to protect proprietary know-how that is not patentable or that we elect not to patent, processes for which patents are difficult to enforce and any other elements of our product candidate discovery and development processes that involve proprietary know-how, information or technology that is not covered by patents. However, trade secrets can be difficult to protect. We seek to protect our proprietary technology and processes, in part, by entering into confidentiality agreements with our employees, consultants, scientific advisors, and contractors. We also seek to preserve the integrity and confidentiality of our data and trade secrets by maintaining physical security of our premises and physical and electronic security of our information technology systems. While we have confidence in these individuals, organizations and systems, agreements or security measures may be breached, and we may not have adequate remedies for any breach. In addition, our trade secrets may otherwise become known or be independently discovered by competitors.

Although we expect all of our employees and consultants to assign their inventions to us, and all of our employees, consultants, advisors, and any third parties who have access to our proprietary know-how, information, or technology to enter into confidentiality agreements, we cannot provide any assurances that all such agreements have been duly executed or that our trade secrets and other confidential proprietary information will not be disclosed or that competitors will not otherwise gain access to our trade secrets or independently develop substantially equivalent information and techniques. Misappropriation or unauthorized disclosure of our trade secrets could impair our competitive position and may have a material adverse effect on our business, financial condition or results of operations. Additionally, if the steps taken to maintain our trade secrets are deemed inadequate, we may have insufficient recourse against third parties for misappropriating the trade secret.

Third-party claims of intellectual property infringement may prevent or delay our development and commercialization efforts.

Our commercial success depends in part on our ability to develop, manufacture, market and sell our product candidates and use our proprietary technology without infringing the patent rights of third parties. Numerous third-party U.S. and non-U.S. issued patents and pending applications exist in the area of microRNA. We are aware of U.S. and foreign patents and pending patent applications owned by third parties that cover therapeutic uses of microRNA replacements and inhibitors. We are currently monitoring these patents and patent applications. We may in the future pursue available proceedings in the U.S. and foreign patent offices to challenge the validity of these patents and patent applications. In addition, or alternatively, we may consider whether to seek to negotiate a license of rights to technology covered by one or more of such patents and patent applications. If any patents or patent applications cover our product candidates or technologies, we may not be free to manufacture or market our product candidates, including MRG-106 or MRG-201, as planned, absent such a license, which may not be available to us on commercially reasonable terms, or at all.

It is also possible that we have failed to identify relevant third-party patents or applications. For example, applications filed before November 29, 2000 and applications filed after that date that will not be filed outside the United States remain confidential until patents issue. Moreover, it is difficult for industry participants, including us, to identify all third-party patent rights that may be relevant to our product candidates and technologies because patent searching is imperfect due to differences in terminology among patents, incomplete databases and the difficulty in assessing the meaning of patent claims. We may fail to identify relevant patents or patent applications or may identify pending patent applications of potential interest but incorrectly predict the likelihood that such patent applications may issue with claims of relevance to our technology. In addition, we may be unaware of one or more issued patents that would be infringed by the manufacture, sale or use of a current or future product candidate, or we may incorrectly conclude that a third-party patent is invalid, unenforceable or not infringed by our activities. Additionally, pending patent applications that have been published can, subject to specified limitations, be later amended in a manner that could cover our technologies, our product candidates or the use of our product candidates.

There have been many lawsuits and other proceedings involving patent and other intellectual property rights in the biotechnology and pharmaceutical industries, including patent infringement lawsuits, interferences, oppositions, and reexamination proceedings before the USPTO and corresponding foreign patent offices. Numerous U.S. and foreign issued patents and pending patent applications, which are owned by third parties, exist in the fields in which we are developing product candidates. As the biotechnology and pharmaceutical industries expand and more patents are issued, the risk increases that our product candidates may be subject to claims of infringement of the patent rights of third parties.

Parties making claims against us may obtain injunctive or other equitable relief, which could effectively block our ability to further develop and commercialize one or more of our product candidates. Defense of these claims, regardless of their merit, would involve substantial litigation expense and would be a substantial diversion of employee resources from our business. In the event of a successful claim of infringement against us, we may have to

pay substantial damages, including treble damages and attorneys' fees for willful infringement, pay royalties, redesign our infringing products or obtain one or more licenses from third parties, which may be impossible or require substantial time and monetary expenditure.

We may not be successful in meeting our obligations under our existing license agreements necessary to maintain our product candidate licenses in effect. In addition, if required in order to commercialize our product candidates, we may be unsuccessful in obtaining or maintaining necessary rights to our product candidates through acquisitions and in-licenses.

We currently have rights to the intellectual property, through licenses from third parties and under patents that we do not own, to develop and commercialize our product candidates. Because our programs may require the use of proprietary rights held by third parties, the growth of our business will likely depend in part on our ability to maintain in effect these proprietary rights. Any termination of license agreements with third parties with respect to our product candidates would be expected to negatively impact our business prospects.

We may be unable to acquire or in-license any compositions, methods of use, processes, or other third-party intellectual property rights from third parties that we identify as necessary for our product candidates. The licensing and acquisition of third-party intellectual property rights is a competitive area, and a number of more established companies are also pursuing strategies to license or acquire third-party intellectual property rights that we may consider attractive. These established companies may have a competitive advantage over us due to their size, cash resources, and greater clinical development and commercialization capabilities. In addition, companies that perceive us to be a competitor may be unwilling to assign or license rights to us. Even if we are able to license or acquire third-party intellectual property rights that are necessary for our product candidates, there can be no assurance that they will be available on favorable terms.

We collaborate with U.S. and foreign academic institutions to identify product candidates, accelerate our research and conduct development. Typically, these institutions have provided us with an option to negotiate an exclusive license to any of the institution's rights in the patents or other intellectual property resulting from the collaboration. Regardless of such option, we may be unable to negotiate a license within the specified timeframe or under terms that are acceptable to us. If we are unable to do so, the institution may offer the intellectual property rights to other parties, potentially blocking our ability to pursue a program of interest to us.

If we are unable to successfully obtain and maintain rights to required third-party intellectual property, we may have to abandon development of that product candidate or pay additional amounts to the third-party, and our business and financial condition could suffer.

The patent protection and patent prosecution for some of our product candidates is dependent on third parties.

While we normally seek and gain the right to fully prosecute the patents relating to our product candidates, there may be times when patents relating to our product candidates are controlled by our licensors. For instance, this is the case with our agreement with RICC who is primarily responsible for the prosecution of patents and patent applications licensed to us under the applicable agreement. If they or any of our future licensors fail to appropriately and broadly prosecute and maintain patent protection for patents covering any of our product candidates, our ability to develop and commercialize those product candidates may be adversely affected and we may not be able to prevent competitors from making, using, importing, and selling competing products. In addition, even where we now have the right to control patent prosecution of patents and patent applications we have licensed from third parties, we may still be adversely affected or prejudiced by actions or inactions of our licensors in effect from actions prior to us assuming control over patent prosecution.

If we fail to comply with obligations in the agreements under which we license intellectual property and other rights from third parties or otherwise experience disruptions to our business relationships with our licensors, we could lose license rights that are important to our business.

We are a party to a number of intellectual property license and supply agreements that are important to our business and expects to enter into additional license agreements in the future. Our existing agreements impose, and we expect that future license agreements will impose, various diligence, milestone payment, royalty, purchasing, and other obligations on it. If we fail to comply with our obligations under these agreements, or we are subject to a bankruptcy, our agreements may be subject to termination by the licensor, in which event we would not be able to develop, manufacture, or market products covered by the license or subject to supply commitments.

We may be involved in lawsuits to protect or enforce our patents or the patents of our licensors, which could be expensive, time consuming, and unsuccessful.

Competitors may infringe our patents or the patents of our licensors. If we or one of our licensing partners were to initiate legal proceedings against a third party to enforce a patent covering one of our product candidates, the defendant could counterclaim that the patent covering our product candidate is invalid and/or unenforceable. In patent litigation in the United States, defendant counterclaims alleging invalidity and/or unenforceability are commonplace. Grounds for a validity challenge could be an alleged failure to meet any of several statutory requirements, including

lack of novelty, obviousness, written description, clarity 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 is unpredictable.

Interference proceedings provoked by third parties or brought by us or declared by the USPTO may be necessary to determine the priority of inventions with respect to our patents or patent applications or those of our licensors. An unfavorable outcome could require us to cease using the related technology or to attempt to license rights to us from the prevailing party. Our business could be harmed if the prevailing party does not offer us a license on commercially reasonable terms. Its defense of litigation or interference proceedings may fail and, even if successful, may result in substantial costs and distract our management and other employees. In addition, the uncertainties associated with litigation could have a material adverse effect on our ability to raise the funds necessary to continue our clinical trials, continue our research programs, license necessary technology from third parties, or enter into development partnerships that would help us bring our product candidates to market.

Furthermore, because of the substantial amount of discovery required in connection with intellectual property litigation, there is a risk that some of our confidential information could be compromised by disclosure during this type of litigation. There could also be public announcements of the results of hearings, motions, or other interim proceedings or developments. If securities analysts or investors perceive these results to be negative, it could have a material adverse effect on the price of our common stock.

We may be subject to claims that our employees, consultants, or independent contractors have wrongfully used or disclosed confidential information of third parties or that our employees have wrongfully used or disclosed alleged trade secrets of their former employers.

We employ individuals who were previously employed at universities or other biotechnology or pharmaceutical companies, including our competitors or potential competitors. Although we have written agreements and make every effort to ensure that our employees, consultants, and independent contractors do not use the proprietary information or intellectual property rights of others in their work for us, we may in the future be subject to any claims that our employees, consultants, or independent contractors have wrongfully used or disclosed confidential information of third parties. Litigation may be necessary to defend against these claims. If we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights or personnel, which could adversely impact our business. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management and other employees.

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

Filing, prosecuting, and defending patents on product candidates in all countries throughout the world would be prohibitively expensive, and our intellectual property rights in some countries outside the United States can be less extensive than those in the United States. In addition, the laws of some foreign countries do not protect intellectual property rights to the same extent as federal and state laws in the United States. Competitors may use our technologies in jurisdictions where we have not obtained patent protection to develop our own products and may also export infringing products to territories where we have patent protection, but enforcement is not as strong as that in the United States. These products may compete with our products and our patents or other intellectual property rights may not be effective or sufficient to prevent them from competing.

Many companies have encountered significant problems in protecting and defending intellectual property rights in foreign jurisdictions. The legal systems of some countries, particularly some developing countries, do not favor the enforcement of patents, trade secrets, and other intellectual property protection, particularly those relating to biotechnology products, which could make it difficult for us to stop the infringement of our patents or marketing of competing products in violation of our proprietary rights generally. Proceedings to enforce our patent rights in foreign jurisdictions, whether or not successful, could result in substantial costs and divert our efforts and attention from other aspects of our business, could put our patents at risk of being invalidated or interpreted narrowly and our patent applications at risk of not issuing and could provoke third parties to assert claims against us. We may not prevail in any lawsuits that we initiate and the damages or other remedies awarded, if any, may not be commercially meaningful. Accordingly, our efforts to enforce our intellectual property rights around the world may be inadequate to obtain a significant commercial advantage from the intellectual property that we develop or license.

Risks Related to Our Reliance on Third Parties

We rely on third parties to conduct our clinical trials, manufacture our product candidates and perform other services. If these third parties do not successfully perform and comply with regulatory requirements, we may not be able to successfully complete clinical development, obtain regulatory approval or commercialize our product candidates and our business could be substantially harmed.

We have relied upon and plan to continue to rely upon third-party CROs to conduct, monitor and manage our ongoing clinical programs. We rely on these parties for execution of clinical trials and manage and control only some aspects of their activities. We remain responsible for ensuring that each of our trials is conducted in accordance with the applicable protocol, legal, regulatory, and scientific standards and our reliance on the CROs does not relieve us of our regulatory responsibilities. We and our CROs and other vendors are required to comply with all applicable laws, regulations and guidelines, including those required by the FDA and comparable foreign regulatory authorities for all of our product candidates in clinical development. If we or any of our CROs or vendors fail to comply with applicable laws, regulations and guidelines, the results generated in our clinical trials may be deemed unreliable and the FDA or

comparable foreign regulatory authorities may require us to perform additional clinical trials before approving our marketing applications. We cannot be assured that our CROs and other vendors will meet these requirements, or that upon inspection by any regulatory authority, such regulatory authority will determine that efforts, including any of our clinical trials, comply with applicable requirements. Its failure to comply with these laws, regulations and guidelines may require us to repeat clinical trials, which would be costly and delay the regulatory approval process.

If any of our relationships with these third-party CROs terminate, we may not be able to enter into arrangements with alternative CROs in a timely manner or do so on commercially reasonable terms. In addition, our CROs may not prioritize our clinical trials relative to those of other customers and any turnover in personnel or delays in the allocation of CRO employees by the CRO may negatively affect our clinical trials. If CROs do not successfully carry out their contractual duties or obligations or meet expected deadlines, our clinical trials may be delayed or terminated and we may not be able to meet our current plans with respect to our product candidates. CROs may also involve higher costs than anticipated, which could negatively affect our financial condition and operations.

In addition, we do not currently have, nor do we currently plan to establish the capability to manufacture product candidates for use in the conduct of our clinical trials, and we lack the resources and the capability to manufacture any of our product candidates on a clinical or commercial scale without the use of third-party manufacturers. We plan to rely on third-party manufacturers and their responsibilities will include purchasing from third-party suppliers the materials necessary to produce our product candidates for our clinical trials and regulatory approval. There are expected to be a limited number of suppliers for the active ingredients and other materials that we expect to use to manufacture our product candidates, and we may not be able to identify alternative suppliers to prevent a possible disruption of the manufacture of our product candidates for our clinical trials, and, if approved, ultimately for commercial sale. Although we generally do not expect to begin a clinical trial unless we believe we have a sufficient supply of a product candidate to complete the trial, any significant delay or discontinuity in the supply of a product candidate, or the active ingredient or other material components in the manufacture of the product candidate could delay completion of our clinical trials and potential timing for regulatory approval of our product candidates, which would harm our business and results of operations.

We rely and expect to continue to rely on third parties to manufacture our clinical product supplies, and we intend to rely on third parties to produce and process our product candidates, if approved, and our commercialization of any of our product candidates could be stopped, delayed or made less profitable if those third parties fail to obtain approval of government regulators, fail to provide us with sufficient quantities of drug product, or fail to do so at acceptable quality levels or prices.

We do not currently have nor do we currently plan to develop the infrastructure or capability internally to manufacture our clinical supplies for use in the conduct of our clinical trials, and we lack the resources and the capability to manufacture any of our product candidates on a clinical or commercial scale. We currently rely on outside vendors to manufacture our clinical supplies of our product candidates and plans to continue relying on third parties to manufacture our product candidates on a commercial scale, if approved.

We do not yet have sufficient information to reliably estimate the cost of the commercial manufacturing of our product candidates and our current costs to manufacture our drug products is not commercially feasible, and the actual cost to manufacture our product candidates could materially and adversely affect the commercial viability of our product candidates. As a result, we may never be able to develop a commercially viable product.

In addition, our reliance on third-party manufacturers exposes us to the following additional risks:

- We may be unable to identify manufacturers on acceptable terms or at all.
- Our third-party manufacturers might be unable to timely formulate and manufacture our product or produce the quantity and quality required to meet our clinical and commercial needs, if any.
- Contract manufacturers may not be able to execute our manufacturing procedures appropriately.
- Our future third-party manufacturers may not perform as agreed or may not remain in the contract manufacturing business for the time required to supply our clinical trials or to successfully produce, store and distribute our products.
- Manufacturers are subject to ongoing periodic unannounced inspection by the FDA and corresponding state agencies to ensure strict compliance with cGMPs and other government regulations and corresponding foreign standards. We do not have control over third-party manufacturers' compliance with these regulations and standards.
- We may not own, or may have to share, the intellectual property rights to any improvements made by our third-party manufacturers in the manufacturing process for our product candidates.

- Our third-party manufacturers could breach or terminate their agreement with us.

Each of these risks could delay our clinical trials, the approval, if any of our product candidates by the FDA or the commercialization of our product candidates or result in higher costs or deprive us of potential product revenue. In addition, we rely on third parties to perform release testing on our product candidates prior to delivery to patients. If these tests are not appropriately conducted and test data are not reliable, patients could be put at risk of serious harm and could result in product liability suits.

The manufacture of medical products is complex and requires significant expertise and capital investment, including the development of advanced manufacturing techniques and process controls. Manufacturers of medical products often encounter difficulties in production, particularly in scaling up and validating initial production and absence of contamination. These problems include difficulties with production costs and yields, quality control, including stability of the product, quality assurance testing, operator error, shortages of qualified personnel, as well as compliance with strictly enforced federal, state and foreign regulations. Furthermore, if contaminants are discovered in our supply of our product candidates or in the manufacturing facilities, such manufacturing facilities may need to be closed for an extended period of time to investigate and remedy the contamination. We cannot be assured that any stability or other issues relating to the manufacture of our product candidates will not occur in the future. Additionally, our manufacturers may experience manufacturing difficulties due to resource constraints or as a result of labor disputes or unstable political environments. If our manufacturers were to encounter any of these difficulties, or otherwise fail to comply with their contractual obligations, our ability to provide our product candidates to patients in clinical trials would be jeopardized. Any delay or interruption in the supply of clinical trial supplies could delay the completion of clinical trials, increase the costs associated with maintaining clinical trial programs and, depending upon the period of delay, require us to commence new clinical trials at additional expense or terminate clinical trials completely.

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

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

- collaborators often have significant discretion in determining the efforts and resources that they will apply to the collaboration, and may not commit sufficient resources to the development, marketing or commercialization of the product or products that are subject to the collaboration;

- collaborators may not perform their obligations as expected;

- any such collaboration may significantly limit our share of potential future profits from the associated program, and may require us to relinquish potentially valuable rights to our current product candidates, potential products or proprietary technologies or grant licenses on terms that are not favorable to us;

- collaborators may cease to devote resources to the development or commercialization of our product candidates if the collaborators view our product candidates as competitive with their own products or product candidates;

- disagreements with collaborators, including disagreements over proprietary rights, contract interpretation or the course of development, might cause delays or termination of the development or commercialization of product candidates, and might result in legal proceedings, which would be time consuming, distracting and expensive;

- collaborators may be impacted by changes in their strategic focus or available funding, or business combinations involving them, which could cause them to divert resources away from the collaboration;

- collaborators may infringe the intellectual property rights of third parties, which may expose us to litigation and potential liability;

- the collaborations may not result in us achieving revenues to justify such transactions; and

- collaborations may be terminated and, if terminated, may result in a need for us to raise additional capital to pursue further development or commercialization of the applicable product candidate.

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

For instance, in October 2011, we entered into the Servier Collaboration Agreement with Servier for the research, development, and commercialization of RNA-targeting therapeutics in cardiovascular disease which was subsequently amended in May 2013, May 2014, May 2015 and September 2016. Under the Servier Collaboration Agreement, we granted Servier an exclusive license to research, develop, and commercialize RNA-targeting therapeutics for three targets in the cardiovascular field. Servier's rights to each of the targets are limited to therapeutics in the cardiovascular field in their territory, which is worldwide except for the United States and Japan. We retain all rights for each named target in the United States and Japan and for any products or product candidates outside of the cardiovascular field. We cannot guarantee that any product candidate will ever be successfully commercialized under the Servier Collaboration Agreement. If no product candidate subject to the Servier Collaboration Agreement is successfully commercialized, we may never receive additional milestone or any royalty payments under the Servier Collaboration Agreement. Also, due to restrictions contained in the Servier Collaboration Agreement, we may not be able to

effectively develop, market or commercialize any such product candidate in the United States and Japan.

We enter into various contracts in the normal course of our business in which we indemnify the other party to the contract. In the event we have to perform under these indemnification provisions, we could have a material adverse effect on our business, financial condition and results of operations.

In the normal course of business, we periodically enter into academic, commercial, service, collaboration, licensing, consulting and other agreements that contain indemnification provisions. With respect to our academic and other research agreements, we typically indemnify the institution and related parties from losses arising from claims relating to the products, processes or services made, used, sold or performed pursuant to the agreements for which we have secured licenses, and from claims arising from our or our sublicensees' exercise of rights under the agreement. With respect to our collaboration agreements, we indemnify our collaborators from any third-party product liability claims that could result from the production, use or consumption of the product, as well as for alleged infringements of any patent or other intellectual property right by a third party. With respect to consultants, we indemnify them from claims arising from the good faith performance of their services.

Should our obligation under an indemnification provision exceed applicable insurance coverage or if we were denied insurance coverage, our business, financial condition and results of operations could be adversely affected. Similarly, if we are relying on a collaborator to indemnify us and the collaborator is denied insurance coverage or the indemnification obligation exceeds the applicable insurance coverage, and if the collaborator does not have other assets available to indemnify us, our business, financial condition and results of operations could be adversely affected.

Risks Related to Commercialization of Our Product Candidates

We currently have limited marketing and sales experience. If we are unable to establish sales and marketing capabilities or enter into agreements with third parties to market and sell our product candidates, we may be unable to generate any revenue.

Although some of our employees may have marketed, launched, and sold other pharmaceutical products in the past while employed at other companies, we have no experience selling and marketing our product candidates and we currently have no marketing or sales organization. To successfully commercialize any products that may result from our development programs, we will need to find one or more collaborators to commercialize our products or invest in and develop these capabilities, either on our own or with others, which would be expensive, difficult and time consuming. Any failure or delay in the timely development of our internal commercialization capabilities could adversely impact the potential for success of our products.

If commercialization collaborators do not commit sufficient resources to commercialize our future products and we are unable to develop the necessary marketing and sales capabilities on our own, we will be unable to generate sufficient product revenue to sustain or grow our business. We may be competing with companies that currently have extensive and well-funded marketing and sales operations, particularly in the markets our product candidates are intended to address. Without appropriate capabilities, whether directly or through third-party collaborators, we may be unable to compete successfully against these more established companies.

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

We may attempt to form strategic collaborations, create joint ventures or enter into licensing arrangements with third parties with respect to our programs that we believe will complement or augment our existing business. We may face significant competition in seeking appropriate strategic collaborators, and the negotiation process to secure appropriate terms is time consuming and complex. We may not be successful in our efforts to establish such a strategic collaboration for any product candidates and programs on terms that are acceptable to it, or at all. This may be because our product candidates and programs may be deemed to be at too early of a stage of development for collaborative effort, our research and development pipeline may be viewed as insufficient, the competitive or intellectual property landscape may be viewed as too intense or risky, and/or third parties may not view our product candidates and programs as having sufficient potential for commercialization, including the likelihood of an adequate safety and efficacy profile.

Any delays in identifying suitable collaborators and entering into agreements to develop and/or commercialize our product candidates could delay the development or commercialization of our product candidates, which may reduce their competitiveness even if they reach the market. Absent a strategic collaborator, we would need to undertake development and/or commercialization activities at our own expense. If we elect to fund and undertake development and/or commercialization activities on our own, we may need to obtain additional expertise and additional capital, which may not be available to us on acceptable terms or at all. If we are unable to do so, we may not be able to develop our product candidates or bring them to market and our business may be materially and adversely affected.

If the market opportunities for our product candidates are smaller than we believe they are, we may not meet our revenue expectations and, assuming approval of a product candidate, our business may suffer. Because the patient populations in the market for our product candidates may be small, we must be able to successfully identify patients and acquire a significant market share to achieve profitability and growth.

Given the small number of patients who have the diseases that we are targeting, our eligible patient population and pricing estimates may differ significantly from the actual market addressable by our product candidates. For instance, our Phase 1 clinical trial in MRG-106 is focused on MF. The estimated prevalence of MF is 16,000 to 20,000 cases in the United States, only a subset of which may benefit from treatment with MRG-106. Our projections of both the number of people who have these diseases, as well as the subset of people with these diseases who have the potential to benefit from treatment with our product candidates, are based on our beliefs and estimates. These estimates have been derived from a variety of sources, including the scientific literature, patient foundations, or market research, and may prove to be incorrect. Further, new studies may change the estimated incidence or prevalence of these diseases. The number of patients may turn out to be lower than expected. Additionally, while we believe that the data in our Phase 1 clinical trials for MRG-106 and MRG-201 are supportive of application to other indications, there can be no assurance that our clinical trials will successfully address any additional indications. Likewise, the potentially addressable patient population for each of our product candidates may be limited or may not be amenable to treatment with our product candidates, and new patients may become increasingly difficult to identify or gain access to, which would adversely affect our business, financial condition, results of operations and prospects.

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

The development and commercialization of new drug products is highly competitive. We face competition from major pharmaceutical companies, specialty pharmaceutical companies, biotechnology companies, universities and other research institutions worldwide with respect to MRG-106, MRG-201 and the other product candidates that we may seek to develop or commercialize in the future. We are aware that the following companies have therapeutics marketed or in development for CTCL: Actelion Ltd, Bristol-Myers Squibb Company, Celgene Corporation, Merck & Co., Inc., Mylan Pharmaceuticals Inc., Novartis International AG, Spectrum Pharmaceuticals, Inc., Seattle Genetics, Inc., Takeda Pharmaceutical Company Ltd, and Valeant Pharmaceuticals International, Inc. We are also aware that the several companies have marketed therapeutics for pulmonary fibrosis, including Boehringer Ingelheim GmbH and F. Hoffmann-La Roche Ltd. Our competitors may succeed in developing, acquiring or licensing technologies and drug products that are more effective or less costly than MRG-106, MRG-201 or any other product candidates that we are currently developing or that we may develop, which could render our product candidates obsolete and noncompetitive.

48

In addition to the competition we face from alternative therapies for the diseases we intend to target with our product candidates, we are also aware of several companies that are also working specifically to develop microRNA therapeutics, including Mirna Therapeutics, Inc., Regulus Therapeutics, Inc., Microlin Bio, Inc. and InteRNA Technologies B.V. Further there are several companies working to develop other types of oligonucleotide therapeutic products, including Ionis Pharmaceuticals, Inc., Alnylam Pharmaceuticals, Inc., Dicerna Pharmaceuticals, Inc., RaNa Therapeutics, Inc., RXi Pharmaceuticals Corporation, and Silence Therapeutics AG. Many of our competitors have substantially greater financial, technical and other resources, such as larger research and development staff and experienced marketing and manufacturing organizations. Third-party payors, including governmental and private insurers, may also encourage the use of generic products. For example, if MRG-106 or MRG-201 is approved, it may be priced at a significant premium over other competitive products. This may make it difficult for MRG-106, MRG-201 or any other future products to compete with these products.

If our competitors obtain marketing approval from the FDA or comparable foreign regulatory authorities for their product candidates more rapidly than us, it could result in our competitors establishing a strong market position before we are able to enter the market.

Many of our competitors have materially greater name recognition and financial, manufacturing, marketing, research and drug development resources than we do. Additional mergers and acquisitions in the biotechnology and pharmaceutical industries may result in even more resources being concentrated in our competitors. Large pharmaceutical companies in particular have extensive expertise in pre-clinical and clinical testing and in obtaining regulatory approvals for drugs. In addition, academic institutions, government agencies, and other public and private organizations conducting research may seek patent protection with respect to potentially competitive products or technologies. These organizations may also establish exclusive collaborative or licensing relationships with our competitors. Failure of MRG-106, MRG-201 or other product candidates to effectively compete against established treatment options or in the future with new products currently in development would harm our business, financial condition, results of operations and prospects.

The commercial success of any of our current or future product candidates will depend upon the degree of market acceptance by physicians, patients, third-party payors, and others in the medical community.

Even with the approvals from the FDA and comparable foreign regulatory authorities, the commercial success of our products will depend in part on the health care providers, patients, and third-party payors accepting our product candidates as medically useful, cost-effective, and safe. Any product that we bring to the market may not gain market acceptance by physicians, patients and third-party payors. The degree of market acceptance of any of our products will depend on a number of factors, including but not limited to:

- the efficacy of the product as demonstrated in clinical trials and potential advantages over competing treatments;

- the prevalence and severity of the disease and any side effects;

- the clinical indications for which approval is granted, including any limitations or warnings contained in a product's approved labeling;

- the convenience and ease of administration;

- the cost of treatment;

- the willingness of the patients and physicians to accept these therapies;

- the perceived ratio of risk and benefit of these therapies by physicians and the willingness of physicians to recommend these therapies to patients based on such risks and benefits;

- the marketing, sales and distribution support for the product;

- the publicity concerning our products or competing products and treatments; and

- the pricing and availability of third-party insurance coverage and reimbursement.

Even if a product displays a favorable efficacy and safety profile upon approval, market acceptance of the product remains uncertain. Efforts to educate the medical community and third-party payors on the benefits of the products may require significant investment and resources and may never be successful. If our products fail to achieve an adequate level of acceptance by physicians, patients, third-party payors, and other health care providers, we will not be able to generate sufficient revenue to become or remain profitable.

We may not be successful in any efforts to identify, license, discover, develop, or commercialize additional product candidates.

Although a substantial amount of our effort will focus on the continued clinical testing, potential approval, and commercialization of our existing product candidates, the success of our business is also expected to depend in part upon our ability to identify, license, discover, develop, or commercialize additional product candidates. Research programs to identify new product candidates require substantial technical, financial, and human resources. We may focus our efforts and resources on potential programs or product candidates that ultimately prove to be unsuccessful. Our research programs or licensing efforts may fail to yield additional product candidates for clinical development and commercialization for a number of reasons, including but not limited to the following:

- our research or business development methodology or search criteria and process may be unsuccessful in identifying potential product candidates;
- we may not be able or willing to assemble sufficient resources to acquire or discover additional product candidates;
- our product candidates may not succeed in pre-clinical or clinical testing;
- our potential product candidates may be shown to have harmful side effects or may have other characteristics that may make the products unmarketable or unlikely to receive marketing approval;
- competitors may develop alternatives that render our product candidates obsolete or less attractive;
- product candidates we develop may be covered by third parties' patents or other exclusive rights;
- the market for a product candidate may change during our program so that such a product may become unreasonable to continue to develop;
- a product candidate may not be capable of being produced in commercial quantities at an acceptable cost, or at all; and
- a product candidate may not be accepted as safe and effective by patients, the medical community, or third-party payors.

If any of these events occur, we may be forced to abandon our development efforts for a program or programs, or we may not be able to identify, license, discover, develop, or commercialize additional product candidates, which would have a material adverse effect on our business, financial condition or results of operations and could potentially cause us to cease operations.

Failure to obtain or maintain adequate reimbursement or insurance coverage for products, if any, could limit our ability to market those products and decrease our ability to generate revenue.

The pricing, coverage, and reimbursement of our approved products, if any, must be sufficient to support our commercial efforts and other development programs and the availability and adequacy of coverage and reimbursement by third-party payors, including governmental and private insurers, are essential for most patients to be able to afford expensive treatments. Sales of our approved products, if any, will depend substantially, both domestically and abroad, on the extent to which the costs of our approved products, if any, will be paid for or reimbursed by health maintenance, managed care, pharmacy benefit and similar healthcare management organizations, or government payors and private payors. If coverage and reimbursement are not available, or are available only in limited amounts, we may have to subsidize or provide products for free or we may not be able to successfully commercialize our products.

In addition, there is significant uncertainty related to the insurance coverage and reimbursement for newly approved products. In the United States, the principal decisions about coverage and reimbursement for new drugs are typically made by CMS, an agency within the U.S. Department of Health and Human Services, as CMS decides whether and to what extent a new drug will be covered and reimbursed under Medicare. Private payors tend to follow the coverage reimbursement policies established by CMS to a substantial degree. It is difficult to predict what CMS will decide with respect to reimbursement for novel product candidates such as our and what reimbursement codes our product candidates may receive if approved.

Outside the United States, international operations are generally subject to extensive governmental price controls and other price-restrictive regulations, and we believe the increasing emphasis on cost-containment initiatives in Europe, Canada, and other countries has and will continue to put pressure on the pricing and usage of products. In many countries, the prices of products are subject to varying price control mechanisms as part of national health systems. Price controls or other changes in pricing regulation could restrict the amount that we are able to charge for our products, if any. Accordingly, in markets outside the United States, the potential revenue may be insufficient to generate commercially reasonable revenue and profits.

Moreover, increasing efforts by governmental and private payors in the United States and abroad to limit or reduce healthcare costs may result in restrictions on coverage and the level of reimbursement for new products and, as a result, they may not cover or provide adequate payment for our products. Further, there has been increasing legislative and enforcement interest in the United States with respect to specialty drug pricing practices. Specifically, there have been several recent U.S. Congressional inquiries and proposed bills designed to, among other things, bring more transparency to drug pricing, review the relationship between pricing and manufacturer patient programs, reduce the cost of drugs under Medicare, and reform government program reimbursement methodologies for drugs. We expect to

experience pricing pressures in connection with products due to the increasing trend toward managed healthcare, including the increasing influence of health maintenance organizations and additional legislative changes. The downward pressure on healthcare costs in general, particularly prescription drugs has and is expected to continue to increase in the future. As a result, profitability of our products, if any, may be more difficult to achieve even if they receive regulatory approval.

Risks Related to Our Business Operations

Our future success depends in part on our ability to retain our president and chief executive officer and to attract, retain, and motivate other qualified personnel.

We are highly dependent on William S. Marshall, Ph.D., our president and chief executive officer, the loss of whose services may adversely impact the achievement of our objectives. Dr. Marshall could leave our employment at any time, as he is an “at will” employee. Recruiting and retaining other qualified employees, consultants, and advisors for our business, including scientific and technical personnel, will also be critical to our success. There is currently a shortage of highly qualified personnel in our industry, which is likely to continue. Additionally, this shortage of highly qualified personnel is particularly acute in the area where we are located. As a result, competition for personnel is intense and the turnover rate can be high. We may not be able to attract and retain personnel on acceptable terms given the competition among numerous pharmaceutical and biotechnology companies for individuals with similar skill sets. In addition, failure to succeed in development and commercialization of our product candidates may make it more challenging to recruit and retain qualified personnel. The inability to recruit and retain qualified personnel, or the loss of the services of Dr. Marshall may impede the progress of our research, development, and commercialization objectives and would negatively impact our ability to succeed in our product development strategy.

We will need to expand our organization and we may experience difficulties in managing this growth, which could disrupt our operations.

As of December 31, 2016, we had 44 full-time employees. As our development and commercialization plans and strategies develop, we expect to need additional managerial, operational, sales, marketing, financial, legal, and other resources. Our management may need to divert a disproportionate amount of our attention away from our day-to-day activities and devote a substantial amount of time to managing these growth activities. We may not be able to effectively manage the expansion of our operations, which may result in weaknesses in our infrastructure, operational mistakes, loss of business opportunities, loss of employees, and reduced productivity among remaining employees. Our expected growth could require significant capital expenditures and may divert financial resources from other projects, such as the development of additional product candidates. If our management is unable to effectively manage our growth, our expenses may increase more than expected, our ability to generate and/or grow revenue could be reduced and we may not be able to implement our business strategy. Our future financial performance and our ability to commercialize product candidates and compete effectively will depend, in part, on our ability to effectively manage any future growth.

Failure in our information technology and storage systems could significantly disrupt the operation of our business.

Our ability to execute our business plan and maintain operations depends on the continued and uninterrupted performance of our information technology, or IT, systems. IT systems are vulnerable to risks and damages from a variety of sources, including telecommunications or network failures, malicious human acts and natural disasters. Moreover, despite network security and back-up measures, some of our and our vendors' servers are potentially vulnerable to physical or electronic break-ins, including cyber-attacks, computer viruses and similar disruptive problems. These events could lead to the unauthorized access, disclosure and use of non-public information. The techniques used by criminal elements to attack computer systems are sophisticated, change frequently and may originate from less regulated and remote areas of the world. As a result, we may not be able to address these techniques proactively or implement adequate preventative measures. If our computer systems are compromised, we could be subject to fines, damages, litigation and enforcement actions, and we could lose trade secrets, the occurrence of which could harm our business. Despite precautionary measures to prevent unanticipated problems that could affect our IT systems, sustained or repeated system failures that interrupt our ability to generate and maintain data could adversely affect our ability to operate our business.

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

Our directors, officers, 5% stockholders and their affiliates currently beneficially own in excess of 76.0% of our outstanding voting stock. Therefore, these stockholders have the ability and may continue to have the ability to influence us through this ownership position. These stockholders may be able to determine some or all matters requiring stockholder approval. For example, these stockholders, acting together, may be able to control elections of directors, amendments of organizational documents, or approval of any merger, sale of assets, or other major corporate transaction. This may prevent or discourage unsolicited acquisition proposals or offers for our common stock that you may believe are in your best interest as one of our stockholders.

Risks Related to Ownership of our Common Stock

The market price of our common stock is expected to be volatile, and the market price of our common stock may drop in the future.

The market price of our common stock following the Merger could be subject to significant fluctuations. Market prices for securities of early-stage pharmaceutical, biotechnology and other life sciences companies have historically been particularly volatile. Some of the factors that may cause the market price of our common stock to fluctuate include:

- our ability to obtain regulatory approvals for MRG-106, MRG-201 or other product candidates, and delays or failures to obtain such approvals;
- failure of any of our product candidates, if approved, to achieve commercial success;
- failure to maintain our existing third-party license and supply agreements;
- changes in laws or regulations applicable to our product candidates;
- any inability to obtain adequate supply of our product candidates or the inability to do so at acceptable prices;
- adverse regulatory authority decisions;
- introduction of new products, services, or technologies by our competitors;
- failure to meet or exceed financial and development projections we may provide to the public;
- failure to meet or exceed the financial and development projections of the investment community;
- the perception of the pharmaceutical industry by the public, legislatures, regulators, and the investment community;
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announcements of significant acquisitions, strategic collaborations, joint ventures, or capital commitments by us or our competitors;

- disputes or other developments relating to proprietary rights, including patents, litigation matters, and our ability to obtain patent protection for our technologies;
- additions or departures of key personnel;
- significant lawsuits, including patent or stockholder litigation;
- if securities or industry analysts do not publish research or reports about our business, or if they issue an adverse or misleading opinions regarding our business and stock;
- changes in the market valuations of similar companies;
- general market or macroeconomic conditions;
- sales of our common stock by us our stockholders in the future;
- trading volume of our common stock;
- announcements by commercial partners or competitors of new commercial products, clinical progress or the lack thereof, significant contracts, commercial relationships or capital commitments;
- adverse publicity relating to microRNA therapeutics generally, including with respect to other products and potential products in such markets;
- the introduction of technological innovations or new therapies that compete with our potential products;
- changes in the structure of health care payment systems; and
- period-to-period fluctuations in our financial results.

Moreover, the stock markets in general have experienced substantial volatility that has often been unrelated to the operating performance of individual companies. These broad market fluctuations may also adversely affect the trading price of our common stock.

In the past, following periods of volatility in the market price of a company's securities, stockholders have often instituted class action securities litigation against those companies. Such litigation, if instituted, could result in substantial costs and diversion of management attention and resources, which could significantly harm our profitability and reputation.

Additionally, a decrease in our stock price may cause our common stock to no longer satisfy the continued listing standards of The NASDAQ Capital Market. If we are not able to maintain the requirements for listing on The NASDAQ Capital Market, we could be delisted, which could have a materially adverse effect on our ability to raise additional funds as well as the price and liquidity of our common stock.

We incur costs and demands upon management as a result of complying with the laws and regulations affecting public companies.

As a result of the Merger, we will incur significant legal, accounting and other expenses that Private Miragen did not incur as a private company, including costs associated with public company reporting requirements. We will also incur costs associated with corporate governance requirements, including requirements under the Sarbanes-Oxley Act, as well as new rules implemented by the SEC and The NASDAQ Stock Market LLC. These rules and regulations are expected to increase our legal and financial compliance costs and to make some activities more time-consuming and costly. For example, our management team consists of the executive officers of Private Miragen prior to the Merger, some of whom have not previously managed and operated a public company. These executive officers and other personnel will need to devote substantial time to gaining expertise regarding operations as a public company and compliance with applicable laws and regulations. These rules and regulations may also make it difficult and expensive for us to obtain directors' and officers' liability insurance. As a result, it may be more difficult for us to attract and retain qualified individuals to serve on our board of directors or as our executive officers, which may adversely affect investor confidence and could cause our business or stock price to suffer.

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

Provisions in our certificate of incorporation and bylaws may delay or prevent an acquisition or a change in management. These provisions include a prohibition on actions by written consent of our stockholders and the ability of our 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 Corporate Law, which prohibits stockholders owning in excess of 15% of our outstanding voting stock from merging or combining with us. 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.

Our bylaws provide that the Court of Chancery of the State of Delaware is the exclusive forum for substantially all disputes between us and our stockholders, which could limit our stockholders' ability to obtain a favorable judicial forum for disputes with us or our directors, officers or other employees.

Our bylaws provide that the Court of Chancery of the State of Delaware is the sole and exclusive forum for any derivative action or proceeding brought on our behalf, any action asserting a breach of fiduciary duty owed by any of our directors, officers or other employees to us or our stockholders, any action asserting a claim against us arising pursuant to any provisions of the Delaware General Corporation Law, our certificate of incorporation or our bylaws, or any action asserting a claim against us that is governed by the internal affairs doctrine. The choice of forum provision may limit a stockholder's ability to bring a claim in a judicial forum that it finds favorable for disputes with us or our directors, officers or other employees, which may discourage such lawsuits against our and our directors, officers and other employees. If a court were to find the choice of forum provision contained in the bylaws to be inapplicable or unenforceable in an action, we may incur additional costs associated with resolving such action in other jurisdictions.

We do not anticipate that we will pay any cash dividends in the foreseeable future.

The current expectation is that we will retain our future earnings, if any, to fund the development and growth of our business. As a result, capital appreciation, if any, of our common stock will be your sole source of gain, if any, for the foreseeable future.

An active trading market for our common stock may not develop and its stockholders may not be able to resell their shares of common stock for a profit, if at all.

Prior to the Merger, there had been no public market for Private Miragen's common stock. An active trading market for our shares of common stock may never develop or be sustained. If an active market for our common stock does not develop or is not sustained, it may be difficult for our stockholders to sell their shares at an attractive price or at all.

Future sales of shares by existing stockholders could cause our stock price to decline.

If our stockholders sell, or indicate an intention to sell, substantial amounts of our common stock in the public market after legal restrictions on resale lapse, the trading price of our common stock could decline. Approximately 13.6 million shares of our common stock will be available for sale in the public market beginning 180 days after the closing of the Merger as a result of the expiration of lock-up or similar agreements between certain stockholders and us. In addition, shares of common stock that are subject to our outstanding options will become eligible for sale in the public market to the extent permitted by the provisions of various vesting agreements and Rules 144 and 701 under the Securities Act. If these shares are sold, the trading price of our common stock could decline.

53

If equity research analysts do not publish research or reports, or publish unfavorable research or reports, about us, our business or our market, our stock price and trading volume could decline.

The trading market for our common stock will be influenced by the research and reports that equity research analysts publish about us and our business. Equity research analysts may elect not to provide research coverage of our common stock and such lack of research coverage may adversely affect the market price of our common stock. In the event we do have equity research analyst coverage, we will not have any control over the analysts or the content and opinions included in their reports. The price of our common stock could decline if one or more equity research analysts downgrade our stock or issue other unfavorable commentary or research. If one or more equity research analysts ceases coverage of us or fails to publish reports on us regularly, demand for our common stock could decrease, which in turn could cause our stock price or trading volume to decline.

Because the Merger resulted in an ownership change under Section 382 of the Code, our pre-Merger net operating loss carryforwards and certain other tax attributes are subject to limitation or elimination. The net operating loss carryforwards and certain other tax attributes of Private Miragen may also be subject to limitations as a result of ownership changes.

If a corporation undergoes an "ownership change" within the meaning of Section 382 of the Code, or Section 382, the corporation's net operating loss carryforwards and certain other tax attributes arising from before the ownership change are subject to limitations on use after the ownership change. In general, an ownership change occurs if there is a cumulative change in the corporation's equity ownership by certain stockholders that exceeds fifty percentage points by value over a rolling three-year period. Similar rules may apply under state tax laws. The Merger resulted in an ownership change for us and, accordingly, our net operating loss carryforwards and certain other tax attributes will be subject to limitation and possibly elimination after the Merger. Private Miragen previously performed an analysis of possible ownership changes for certain tax period ending on or prior to December 31, 2011. That analysis indicated such an ownership change occurred on May 14, 2008 and therefore Private Miragen's net operating loss carryforwards and certain other tax attributes created prior to that ownership change are subject to limitation. Private Miragen has not performed an analysis on whether it has experienced any ownership changes for tax periods since the year ended December 31, 2011. However, it is possible that Private Miragen's net operating loss carryforwards and certain other tax attributes since December 31, 2011 may also be subject to limitation as a result of prior shifts in equity ownership and/or the Merger. Additional ownership changes in the future could result in additional limitations on our net operating loss carryforwards and certain other tax attributes. Consequently, even if we achieve profitability, we may not be able to utilize a material portion of our net operating loss carryforwards and certain other tax attributes, which could have a material adverse effect on cash flow and results of operations.

If we fail to maintain proper and effective internal controls, our ability to produce accurate financial statements on a timely basis could be impaired.

We are subject to the reporting requirements of the Exchange Act, the Sarbanes-Oxley Act and the rules and regulations of The NASDAQ Stock Market LLC. The Sarbanes-Oxley Act requires, among other things, that we maintain effective disclosure controls and procedures and internal control over financial reporting. We must perform system and process evaluation and testing of our internal control over financial reporting to allow management to report on the effectiveness of our internal controls over financial reporting in our Annual Report filing for that year, as required by Section 404 of the Sarbanes-Oxley Act. As a private company, Private Miragen, has never been required to test its internal controls within a specified period. This will require that we incur substantial professional fees and internal costs to expand our accounting and finance functions and that we expend significant management efforts. We may experience difficulty in meeting these reporting requirements in a timely manner for each period.

We may discover weaknesses in our system of internal financial and accounting controls and procedures that could result in a material misstatement of our financial statements. Our internal control over financial reporting will not prevent or detect all errors and all fraud. A control system, no matter how well designed and operated, can provide only reasonable, not absolute, assurance that the control system’s objectives will be met. Because of the inherent limitations in all control systems, no evaluation of controls can provide absolute assurance that misstatements due to error or fraud will not occur or that all control issues and instances of fraud will be detected.

If we are not able to comply with the requirements of Section 404 of the Sarbanes-Oxley Act, or if we are unable to maintain proper and effective internal controls, we may not be able to produce timely and accurate financial statements. If that were to happen, the market price of our common stock could decline and it could be subject to sanctions or investigations by The Nasdaq Stock Market LLC, the SEC or other regulatory authorities.

Item 1B. Unresolved Staff Comments

None.

Item 2. Properties

Facilities

We lease 27,128 square feet of office and laboratory space in Boulder, Colorado under a lease that expires in August 2020, subject to two three-year renewal options prior to the expiration, and that includes rent escalation clauses through the lease term. We believe that this space is suitable for our current needs.

Item 3. Legal Proceedings

From time to time, we may be involved in legal proceedings in the ordinary course of business. We are currently not a party to any legal proceedings that we believe would have a material adverse effect on our business, financial condition or results of operations.

Item 4. Mine Safety Disclosures

Not applicable.

55

PART II

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

Market Information

On February 13, 2017, Signal and Private Miragen completed the Merger. Following the Merger, Private Miragen merged with and into Signal, with Signal as the surviving corporation. In connection with these mergers, we changed the name of the combined company to Miragen Therapeutics, Inc. and changed the trading symbol for our common stock to "MGEN." Our common stock originally began trading on The NASDAQ Capital Market on June 17, 2014 under the trading symbol "SGNL." Prior to June 17, 2014, there was no public market for our common stock. The following table sets forth, for the periods indicated, our high and low sales prices on The NASDAQ Capital Market (as adjusted for the 1-for-15 reverse stock split of our common stock effected in November 2016).

The stock price information included in this Item 5 is that of Signal prior to the Merger because the Merger was consummated after the period covered by the financial statements included in this Annual Report. Accordingly, the historical information included in this Annual Report, unless otherwise indicated or as the context otherwise requires, is that of Signal and its subsidiaries prior to the Merger.

	High	Low
Year Ended December 31, 2016:		
Fourth Quarter	$15.11	$1.80
Third Quarter	9.45	6.00
Second Quarter	11.10	6.00
First Quarter	12.45	6.15
Year Ended December 31, 2015:		
Fourth Quarter	$18.60	$9.94
Third Quarter	40.95	13.20
Second Quarter	44.10	21.30
First Quarter	59.55	26.40

Holders

As of March 17, 2017, we had 57 registered holders of record of our common stock. A substantially greater number of holders of our common stock are “street name” or beneficial holders, whose shares of record are held by banks, brokers, other financial institutions, and registered clearing agencies.

Dividend Policy

We historically have not, and do not anticipate in the future, paying dividends on our common stock. We currently intend to retain all of our future earnings, as applicable, to finance the growth and development of our business. We are not subject to any legal restrictions respecting the payment of dividends, except that we may not pay dividends if the payment would render us insolvent. Any future determination as to the payment of cash dividends on our common stock will be at our board of directors’ discretion and will depend on our financial condition, operating results, capital requirements and other factors that our board of directors considers to be relevant.

Item 6. Selected Financial Data

The following selected consolidated financial data is derived from our audited consolidated financial statements and should be read in conjunction with the consolidated financial statements, the notes to such statements and "Management's Discussion and Analysis of Financial Condition and Results of Operations" included elsewhere in this Annual Report. Historical results are not necessarily indicative of the results to be expected in the future.

The financial information included in this Selected Financial Data is that of Signal and its subsidiary prior to the Merger because the Merger was consummated after the period covered by the financial statements included in this Annual Report. Accordingly, the historical financial information included in this Annual Report, unless otherwise indicated or as the context otherwise requires, is that of Signal and its subsidiary prior to the Merger.

	Years Ended December 31,	
(in thousands, except share and per share data)	2016	2015
Consolidated statements of operations data[1]		
Net revenue[2]	$ 3,337	$ 2,538
Operating expenses:		
Cost of revenue	2,548	2,472
Research and development	888	1,002
Selling and marketing	1,669	2,559
General and administrative	7,906	7,692
Exit costs[3]	2,037	—
Asset impairment charges[3]	797	—
Total operating expenses	15,845	13,725
Loss from operations	(12,508)	(11,187)
Other expense:		
Interest expense	(95)	(141)
Loss on extinguishment of debt	(71)	—
Total other expense	(166)	(141)
Net loss	$ (12,674)	$ (11,328)
Net loss per common share, basic and diluted[4]	$ (17.58)	$ (21.02)
Weighted-average number of shares outstanding, basic and diluted[4]	721,415	539,460

	As of December 31,	
	2016	2015
Consolidated balance sheet data[1]		
Cash and cash equivalents	$ 3,341	$ 10,832
Total assets	4,259	12,902
Note payable – related party	1,045	1,105
Total liabilities	4,585	2,492
Total stockholders' equity (deficit)	(326)	10,410

(1) The table above does not give effect to the Merger and reflects solely the consolidated statements of operations data and consolidated balance sheet of Signal as of the fiscal years ended December 31, 2016 and 2015.

(2) During the year ended December 31, 2016, net favorable changes in estimates were recorded to revenue related to non-contracted revenues recorded in the prior year of $239,000. During the year ended December 31, 2015, net unfavorable changes in estimates were recorded to revenue related to non-contracted revenues recorded in the prior year of $193,000.

(3) Costs to exit Signal's lab and corporate operations of $2.0 million, which include employee-related costs for severance and retention bonuses, and costs to terminate contracts prior to the end of their term, and impairment losses on assets held for sale of $0.8 million were recognized during the year ended December 31, 2016.

(4) Effective November 4, 2016, Signal completed a one-for-15 reverse stock split of shares of its common stock. Share and per share amounts in the table above reflect this one-for-15 reverse stock split.

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

Introduction

The following discussion and analysis should be read together with our financial statements and the related notes appearing elsewhere in this Annual Report. This discussion contains forward-looking statements reflecting our current expectations that involve risks and uncertainties. See "*Forward-Looking Statements*" for a discussion of the uncertainties, risks and assumptions associated with these statements. Actual results and the timing of events could differ materially from those discussed in our forward-looking statements as a result of many factors, including those set forth under "*Risk Factors*" and elsewhere in this Annual Report.

As a result of the Asset Sale and Merger, our historic business operations ceased and our going forward operations will be those of Private Miragen. Accordingly, revenue and cost of revenue reported for the years ended December 31, 2016 and 2015, in this Management's Discussion and Analysis are not indicative of revenues or cost of revenue expected in 2017 or future years due to the termination of our historic business operations.

All references to 2016 and 2015 and 2014 refer to calendar years ended December 31, 2016 and 2015 and 2014, respectively.

Recent Developments

On February 13, 2017, Signal and Private Miragen completed the Merger in accordance with the terms of the Merger Agreement, whereby Signal merged with and into Private Miragen, with Private Miragen surviving as a wholly owned subsidiary of Signal. Immediately following the Merger, Signal changed its name to "Miragen Therapeutics, Inc." In connection with the closing of the Merger, our common stock began trading on The NASDAQ Capital Market under the ticker symbol "MGEN" on February 14, 2017. Additionally, on February 13, 2017, in connection with the Merger, we completed the sale of all of our intellectual property assets relating to our MyPRS Assets pursuant to the IP Purchase Agreement with Quest dated November 29, 2016. As consideration for the sale of the MyPRS Assets, Quest paid us $0.8 million, plus an additional $0.1 million, as consideration for exercising its right to require us to operate our lab beyond December 31, 2016 and an additional $21,000 for reimbursement of certain amounts paid by us to the University of Texas M.D. Anderson Cancer Center.

Effective November 4, 2016, Signal completed a one-for-15 reverse stock split, which we refer to as the Reverse Split, of shares of its common stock. Share and per share amounts this Management's Discussion and Analysis of Financial

Condition and Results of Operations reflect the Reverse Split.

The financial information included in this Management's Discussion and Analysis of Financial Condition and Results of Operations is that of Signal and its subsidiary prior to the Merger because the Merger was consummated after the period covered by the financial statements included in this Annual Report. Accordingly, the historical financial information included in this Annual Report, unless otherwise indicated or as the context otherwise requires, is that of Signal and its subsidiary prior to the Merger.

Signal Overview

Prior to the Merger, we were a commercial stage, molecular genetic diagnostic company historically focused on providing innovative diagnostic services that helped physicians make better-informed decisions concerning the care of their patients suffering from cancer.

We operated in only one segment and had no operations outside of the United States.

Sources of Revenues and Expenses

Revenues

Prior to the Merger and Asset Sale, we generated revenues primarily from the completion of tests processed through our College of American Pathologists, or CAP,-accredited and Clinical Laboratory Improvement Amendments of 1988, or CLIA,- certified laboratory when test results are delivered to ordering physicians. During 2016, we had three major customers, including the University of Arkansas for Medical Sciences, or UAMS. Revenue sourced either from or through UAMS as a percentage of net revenue during 2016 and 2015 were 22% and 54%, respectively. Revenue sourced either from or through Mount Sinai Hospital as a percentage of net revenue during the years ended December 31, 2016 and 2015 accounted for 24% and 5%, respectively. Revenue sourced either from or through Moffitt Cancer Center as a percentage of net revenue during the years ended December 31, 2016 and 2015 accounted for 11% and 9%, respectively.

A significant portion of our revenues consisted of payments or reimbursements received from various payors, including Medicare, contracted insurance companies, directly billed customers (UAMS, pharmaceutical companies, reference laboratories and hospitals) and non-contracted insurance companies. Signal reported revenues from contracted payors and directly billed customers based on the contractual rate. Medicare reimburses MyPRS based on the local coverage determination at approximately $1,900 per test and Blue Cross Blue Shield of Arkansas reimburses

MyPRS based on the contractual rate of approximately $2,000 per test. Revenues from non-contracted payors were reported based on the amount expected to be collected, which is based on the historical collection experience of each payor or payor group, as appropriate. The estimates of net revenue are subject to change based on the contractual status and payment policies of third-party payors with whom we deal as well as anticipated changes in the healthcare industry and related legislation. We regularly refine our estimates in order to make estimated revenue as accurate as possible based on our most recent collection experience with each third-party payor.

Cost of Revenue

Prior to the Merger and Asset Sale, our cost of revenue consisted primarily of the cost of materials and supplies, labor, and other costs associated with processing specimens including pathological review, quality control analyses, delivery charges necessary to render an individualized test result, depreciation, amortization and royalty expense. Costs associated with performing tests are recorded as the tests are processed.

Research and Development Expenses

Prior to the Merger and Asset Sale, our research and development expenses primarily included personnel costs, laboratory supplies, reagents, consulting costs associated with developing and validating new testing services and sponsored research agreements with leading academic institutions for clinical trials and other studies to further validate the use of MyPRS for multiple myeloma, or MM, and asymptomatic monoclonal gammopathy, or AMG.

Selling and Marketing Expenses

Prior to the Merger and Asset Sale, our selling and marketing expenses consisted primarily of sales commissions and support costs, salaries and related employee benefits, travel, and marketing costs for commercial, business development, medical affairs and managed care functions.

General and Administrative Expenses

Prior to the Merger and Asset Sale, our general and administrative expenses consisted primarily of personnel costs, professional service fees and other costs related to being a publicly-traded company.

Interest Expense

Prior to the Merger and Asset Sale, our interest expense primarily reflects interest on our promissory note previously issued to Mr. LeBow, or the Note.

Exit Costs and Asset Impairment Charges

Exit costs and asset impairment charges for our lab and corporate operations include employee-related costs for severance and retention bonuses for employees terminated in 2016 and during the first quarter of 2017, costs to terminate contracts prior to the end of their term and impairment losses on fixed assets held for sale. We determined the fair value of fixed assets held for sale of $0.2 million at December 31, 2016 based on contracted sales prices.

Critical Accounting Policies and Estimates

The preparation of financial statements in conformity with U.S. generally accepted accounting policies, or U.S. GAAP, requires the use of estimates and assumptions that affect the reported amounts of assets and liabilities, revenues and expenses, and related disclosures in the financial statements. Critical accounting policies are those accounting policies that may be material due to the levels of subjectivity and judgment necessary to account for highly uncertain matters or the susceptibility of such matters to change, and that have a material impact on financial condition or operating performance. While we base our estimates and judgments on our experience and on various other factors that we believe to be reasonable under the circumstances, actual results may differ from these estimates under different assumptions or conditions.

We believe the following critical accounting policies used in the preparation of our financial statements require significant judgments and estimates:

- Revenue Recognition
- Accounts Receivable, Contractual Allowance and Allowance for Doubtful Accounts
- Stock-Based Compensation
- Accounting for Income Taxes

During 2016, other than as discussed below, there were no significant changes in our critical accounting policies and estimates.

Revenue Recognition

We recognize revenue from testing services in accordance with the Financial Accounting Standards Board, or FASB, Accounting Standards Codification, or ASC, 605, Revenue Recognition, which requires that four basic criteria be met before revenue can be recognized: (1) persuasive evidence that an arrangement exists; (2) delivery has occurred and title and the risks and rewards of ownership have been transferred to the client or services have been rendered; (3) the price is fixed or determinable; and (4) collectability is reasonably assured.

Revenues are recorded on an accrual basis when the contractual obligations are completed as tests are processed through our laboratory and test results are delivered to ordering physicians. Revenues are billed to various payors, including Medicare, contracted insurance companies, directly billed customers (UAMS, pharmaceutical companies, reference laboratories and hospitals) and non-contracted insurance companies. Revenues from Medicare, contracted insurance companies and directly billed customers are reported based on the contractual rate. The difference between the amounts billed and the contractual rates from Medicare and contracted insurance companies are recorded as contractual allowances at the same time the revenue is recognized, to arrive at reported net revenue. The contractual rate is based on established agreed upon rates between us and the respective payor. Directly billed customers are invoiced at the contractual rate. Revenues from non-contracted insurance companies are reported based on the amount expected to be collected, which is based on the historical collection experience of each payor or payor group, as appropriate, and anticipated effects of changes in the healthcare industry, if any. The difference between the amount billed and the amount estimated to be collected from non-contracted insurance companies is recorded as a contractual allowance at the same time the revenue is recognized, to arrive at reported net revenue. We do not record revenue from individuals for billings until cash is collected; as collectability is not assured at the time services are provided, therefore there are no accounts receivable from self-payors. Gross revenues from individuals have been immaterial to date.

Our estimates of net revenue for non-contracted insurance companies are subject to change based on the contractual status and payment policies of the third-party payors with whom we deal. We regularly refine our estimates in order to make estimated revenue as accurate as possible based on our most recent collection experience with each third-party payor. We regularly review our historical collection experience for non-contracted payors and anticipated changes in the healthcare industry and adjust expected revenues for current and subsequent periods accordingly, including previously recorded revenues related to outstanding accounts receivable for such non-contracted payors.

Accounts Receivable, Contractual Allowances and Allowance for Doubtful Accounts

Prior to the Merger and Asset Sale, we recorded accounts receivable net of contractual allowances and an allowance for doubtful accounts. At December 31, 2016 and 2015, contractual allowances were $3.2 million and $2.1 million, respectively. An allowance for doubtful accounts was estimated based on the aging of the accounts receivable and the historical collection experience for each contracted payor. When the amounts are determined to be uncollectible, they are expensed as bad debt and subsequently charged-off against the allowance. During 2016 and 2015, $74,000 and $33,000, respectively, was recognized as bad debt expense. At December 31, 2016 and 2015, allowances for doubtful accounts were $54,000 and $0, respectively. Uncollectability of accounts receivable for a non-contracted payor is typically a reflection of an estimate in excess of actual collections and is adjusted in the period of collection as a change in estimate resulting in an increase in contractual allowances and, therefore, a reduction in current period net revenue.

The following tables present gross accounts receivable from customers outstanding by aging category reduced by total contractual and doubtful account allowances to arrive at the net accounts receivable balances at December 31, 2016 and 2015. Other than the direct bill customers, all receivables were pending approval by third-party payors as of the

date that the receivables were recorded:

	December 31, 2016				
(in thousands)	0 - 30 Days	31 - 60 Days	61 - 90 Days	Over 90 Days	Total
Medicare	$217	$ 53	$ 9	$4	$283
Contracted insurance companies	31	49	33	48	161
Direct bill	224	38	15	—	277
Non-contracted insurance companies	371	252	257	2,158	3,038
Accounts receivable, gross	843	392	314	2,210	3,759
Less: contractual and doubtful account allowances	(486)	(297)	(242)	(2,210)	(3,235)
Accounts receivable, net	$357	$ 95	$ 72	$—	$524

	December 31, 2015				
(in thousands)	0 - 30 Days	31 - 60 Days	61 - 90 Days	Over 90 Days	Total
Medicare	$116	$ 55	$ 32	$16	$219
Contracted insurance companies	13	—	9	16	38
Direct bill	101	12	24	14	151
Non-contracted insurance companies	336	256	215	1,244	2,051
Accounts receivable, gross	566	323	280	1,290	2,459
Less: contractual allowances	(347)	(245)	(230)	(1,243)	(2,065)
Accounts receivable, net	$219	$ 78	$ 50	$47	$394

The day sales outstanding, or DSO, at December 31, 2016 has increased to 57 days, compared to 53 days at December 31, 2015, which was attributable to the growth in net accounts receivable and was influenced by the increase in both test volume and average selling price for billings to non-contracted insurance payors.

Stock-Based Compensation

Prior to the Merger and Asset Sale, we recognized compensation expense in an amount equal to the estimated fair value of each stock award over the estimated period of service and vesting. The estimation of the fair value of each stock-based grant or issuance involves numerous assumptions by management. The use of different values by management in connection with these assumptions could produce substantially different results.

Accounting for Income Taxes

Prior to the Merger and Asset Sale, deferred income taxes resulted primarily from temporary differences between financial and tax reporting. Deferred tax assets and liabilities are determined based on the difference between the financial statement basis and tax basis of assets and liabilities using enacted tax rates. Future tax benefits are subject to a valuation allowance when management is unable to conclude that our deferred tax assets will more-likely-than-not be realized from the results of operations. The estimate for the valuation allowance for deferred tax assets requires management to make significant estimates and judgments about projected future operating results. If actual results differ from these projections or if management’s expectations of future results change, it may be necessary to adjust the valuation allowance.

Recently Adopted Accounting Pronouncements

In August 2014, the FASB issued ASU No. 2014-15, Presentation of Financial Statements—Going Concern, which provides guidance on management's responsibility in evaluating whether there is substantial doubt about a company's ability to continue as a going concern and the related footnote disclosure. For each reporting period, management will be required to evaluate whether there are conditions or events that raise substantial doubt about a company's ability to continue as a going concern within one year from the date the financials are issued. When management identifies conditions or events that raise substantial doubt about the entity's ability to continue as a going concern, this standard also outlines disclosures that are required in the company's footnotes based on whether or not there are any plans intended to mitigate the relevant conditions or events to alleviate the substantial doubt. This standard becomes effective for our annual reporting period ending December 31, 2016. Adoption of this guidance did not have an impact on our financial position or results of operations.

In March 2016, the FASB issued ASU No. 2016-09, which simplifies several aspects of the accounting for stock-based payment transactions, including the income tax consequences, classification of awards as either equity or liabilities, and classification on the statement of cash flows. The update is effective for fiscal years and the interim periods within those fiscal years beginning after December 15, 2016, with early adoption permitted. Amendments related to the timing of when excess tax benefits are recognized, minimum statutory withholding requirements and forfeitures are applied using a modified retrospective transition method by means of a cumulative-effect adjustment to equity as of the beginning of the period in which the guidance is adopted. Amendments related to the presentation of employee taxes paid on the statement of cash flows when an employer withholds shares to meet the minimum statutory withholding requirement is applied retrospectively. Amendments requiring recognition of excess tax benefits and tax deficiencies in the income statement are applied prospectively. We elected to early adopt this guidance effective January 1, 2016. Adoption of this guidance did not have an impact on our financial position, statements of operations or statements of cash flows.

In May 2015, the FASB issued ASU No. 2015-07 that eliminates the requirement to categorize investments within the fair value hierarchy if their fair value is measured using the net asset value per share practical expedient in the FASB's fair value measurement guidance. The amendments also limit certain disclosures to investments for which the entity has elected to measure at fair value using the net asset value per share practical expedient. The amendments were applied retrospectively by removing from the fair value hierarchy any investments for which fair value is measured using the net asset value per share practical expedient. Adoption of this guidance did not have an impact on our financial position or results of operations.

In January 2017, the FASB issued ASU No. 2017-01, which narrows the FASB's definition of a business and provides a framework that gives entities a basis for making reasonable judgments about whether a transaction involves an asset or a business. ASU 2017-01 states that when substantially all of the fair value of the gross assets acquired (or disposed of) is concentrated in a single identifiable asset or group of similar identifiable assets, the set is not a business. If this initial test is not met, a set cannot be considered a business unless it includes an input and a substantive process that together significantly contribute to the ability to create output. We elected to early adopt this guidance. We applied the guidance in our analysis of the sale of MyPRS Assets and determined that it did not meet the definition of a business.

Recent Accounting Pronouncements

We have reviewed all recently issued standards and have determined that other than as disclosed above and in Note 2 to the financial statements included herein, such standards will not have a material impact on its financial statements or do not otherwise apply to our operations.

Future Accounting Pronouncements

Section 107 of the JOBS Act provides that an emerging growth company, such as us, can take advantage of an 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. Although to date, we have not yet taken advantage of this delay, we have elected to avail ourselves of this extended transition period for adopting new or revised accounting standards in the future. Therefore, we will not be subject to the same new or revised accounting standards as other public companies that are not emerging growth companies. As a result of this election, the financial statements may not be comparable to companies that comply with public company effective dates. In the future, we may elect to opt out of the extended period for adopting new or revised accounting standards. If we do so, we will be required to disclose such decision, which will be irrevocable.

Results of Operations

Year Ended December 31, 2016 Compared to the Year Ended December 31, 2015

Net Revenue

Net revenue was $3.3 million during 2016, an increase of $0.8 million, or 31%, when compared to $2.5 million during 2015. Net revenue and tests billed during 2016 and 2015 were as follows:

	Net Revenue				Tests Billed			
			Increase (Decrease)				Increase (Decrease)	
(dollars in thousands)	2016	2015	$	%	2016	2015	#	%
Clinical patients at U.S. hospitals and direct billed customers	$2,880	$1,464	$1,416	97 %	1,982	1,267	715	56 %
Research testing services	184	954	(770)	(81)%	190	1,170	(980)	(84)%
Pharmaceutical services	273	120	153	128 %	65	59	6	10 %
Total	$3,337	$2,538	$799	31 %	2,237	2,496	(259)	(10)%

The number of tests billed for clinical patients at U.S. hospitals and direct billed customers increased 56% during 2016 compared to 2015 due to an increase in new hospital customers and an increase in tests sourced from existing customers. Net revenue recognized for such tests billed increased 97% during 2016 when compared to 2015. The increase in net revenue was driven primarily by the increased test volume and an increase in test average selling price estimates used to calculate revenue for billings to non-contracted insurance payors based on positive collections experience with such payors. Additionally, net favorable changes in estimates of $0.2 million were recorded in 2016, related to revenues recorded in prior years. Net revenue of $1.5 million in 2015 was reduced by $0.2 million of net unfavorable changes in estimates related to revenue recorded in 2014.

Both the net revenue recognized and number of tests reported and billed for research testing services, primarily UAMS, decreased 81% and 84%, respectively, during 2016 compared to 2015 primarily due to the decrease in funds available at UAMS for such services.

In the pharmaceutical services business, MyPRS is being run across multiple clinical trials in connection with the development of novel treatments for patients with multiple myeloma. Net revenue of $0.3 million was recognized for services rendered during 2016, an increase of $0.2 million, or 128%, when compared to $0.1 million during 2015 primarily due to an increase in test average selling price for clinical trials started in 2016.

Cost of Revenue

Cost of revenue was $2.5 million, or 76% of net revenues, during 2016, an increase of $76,000, or 3%, when compared to $2.5 million, or 97% of net revenues, during 2015. The increase in cost of revenue is primarily attributable to a $56,000 increase in royalty expense related to an increase in clinical patient-related revenues.

Research and Development Expenses

Research and development expenses were $0.9 million during 2016, a decrease of $0.1 million, or 11%, when compared to $1.0 million during 2015. The decrease is primarily attributable to a $0.5 million decrease in the usage of labor, materials and supplies for internal research projects compared to 2015, offset by a $0.3 million increase in sponsored research programs related to research to further validate the use of MyPRS in MM and AMG.

Selling and Marketing Expenses

Selling and marketing expenses were $1.7 million during 2016, a decrease of $0.9 million, or 35% when compared to $2.6 million during 2015. The decrease is primarily attributed to $0.1 million in recruiting and hiring costs incurred during 2015 related to establishing our medical affairs function, a $0.4 million decrease in marketing projects due to one-time projects incurred in 2015, and a $0.4 million decrease in personnel costs due to a reduction in staff during 2016.

General and Administrative Expenses

General and administrative expenses were $7.9 million during 2016, an increase of $0.2 million, or 3%, when compared to $7.7 million during 2015. The increase was primarily attributable to $1.0 million in transaction costs related to the Merger and $0.3 million in increased personnel costs related to the hiring of accounting, internal billing and information technology staff during the second half of 2016; offset by decreases of $0.9 million in stock-based compensation expense and $0.3 million in professional services.

Exit Costs

Exit costs of $2.0 million recognized during 2016 represent $1.8 million in exit costs related to severance benefits and retention bonuses for employees terminated in 2016 and the first quarter of 2017 and $0.2 million in exit costs incurred to terminate contracts prior to the end of their term in connection with the Merger.

Asset Impairment Charges

Asset impairment charges relate to losses on assets held for sale of $0.8 million related to certain lab and corporate fixed assets.

Interest Expense

Interest expense was $95,000 during 2016, a decrease of $46,000, or 33%, when compared to 2015, and primarily represents interest on the Note. The decrease was primarily attributable to higher amortization of deferred costs to interest expense during 2015.

Loss on Extinguishment of Debt

In October 2016, we amended the Note, or the Amended Note, to increase the interest per annum accruing on the note and to provide for the conversion of the unpaid principal and interest plus a premium immediately prior to the effective time of the Merger Agreement, into shares of common stock. The amendment is considered to be an extinguishment of existing debt, whereby the Note was derecognized, the Amended Note recorded at fair value and a loss on extinguishment for the difference of $0.1 million was recognized during 2016.

Liquidity and Capital Resources

We had cash and cash equivalents of $3.3 million at December 31, 2016 compared to $10.8 million at December 31, 2015. At December 31, 2016, we had working capital deficit of $0.3 million.

Due to market conditions, our liquidity position and its depressed stock price in the fourth quarter of 2016, we entered into the Merger Agreement with Private Miragen and the IP Purchase Agreement with Quest. Effective February 13, 2017, the Merger and Asset Sale were completed and the business of Signal became the business of Miragen.

Subsequent to December 31, 2016, on February 13, 2017, we completed the Asset Sale to Quest for cash consideration of $0.8 million plus an additional $0.1 million as consideration for Quest exercising its right to require us to operate our lab beyond December 31, 2016 and an additional $21,000 for reimbursement of certain amounts paid by us to the University of Texas M.D. Anderson Cancer Center.

During the first quarter of 2017, we anticipate using $1.8 million from our existing cash and cash equivalents to pay remaining severance, retention bonuses and contract termination costs in connection with the Merger.

As described above, we entered into the Merger Agreement with Private Miragen on October 31, 2016. On February 13, 2017, pursuant to the terms of the Merger Agreement, Signal Merger Sub, Inc., our wholly-owned subsidiary, merged with and into Private Miragen, with Private Miragen surviving as our wholly-owned subsidiary. Immediately following the Merger, Private Miragen merged with and into us, with us as the surviving corporation, which we refer to as the Short-Form Merger. In connection with the Short-Form Merger, we changed our corporate name to “Miragen Therapeutics, Inc.” Contingent on and concurrent with the Merger, Private Miragen issued and sold an aggregate of

approximately $40.7 million of shares of Private Miragen's common stock to certain stockholders of Private Miragen and certain new investors at a per share price of $4.50 (not adjusted to reflect the exchange ratio of Private Miragen's capital stock effective as of the Merger), or the Concurrent Financing.

In April 2015, Private Miragen entered into a loan and security agreement with Silicon Valley Bank to borrow up to $10 million in two separate tranches. In December 2016, this agreement was amended to, among other items, extend the draw period from December 31, 2016 to July 31, 2017. On February 13, 2017, we became party to the loan and security agreement as a result of the closing of the Short-Form Merger. The first tranche of $5.0 million was funded in May 2015 and is scheduled to be repaid over a 48-month period with interest only payments during the first 18 months. The second tranche of up to $5.0 million is available under the amended agreement at any time during the draw period following the completion of the Concurrent Financing, which closed in February 2017.

In addition to utilizing our remaining cash balance to fund future operations, Private Miragen's cash and cash equivalents at December 31, 2016, together with the Concurrent Financing and additional flexibility provided by the amended loan and security agreement with Silicon Valley Bank, will be sufficient to fund operations in the normal course of business and allow us to meet our liquidity needs through at least March 31, 2018.

Operating activities

Cash used by operations during 2016 was $7.2 million, compared to $6.9 million during 2015.

During 2016, the provision of cash from changes in operating assets and liabilities of $2.2 million includes an increase in accounts payable and accrued liabilities of $2.0 million, a decrease in prepaid expenses and other current assets of $0.2 million, a decrease in inventory of $0.1 million, partially offset by a $0.1 million increase in accounts receivable, which primarily reflects an increase in net revenue during 2016 when compared to 2015.

During 2015, the provision of cash from changes in operating assets and liabilities of $1.1 million includes a $0.7 million decrease in accounts receivable, which reflects a reduction in DSO from 84 days at December 31, 2014 to 53 days at December 31, 2015, a $0.6 million increase in accounts payable and accrued liabilities, primarily due to higher accrued compensation and related expenses, partially offset by a $0.2 million reduction in the lease termination/abandonment payable, due to payments made on the terminated lease.

Investing activities

Net cash used by investing activities during 2016 and 2015 included $3,000 and $0.1 million, respectively, for the purchase of property and equipment. The net cash used during 2015 was partially offset by cash proceeds of $28,000 from a reduction in a security deposit on a lease.

Financing activities

Net cash used by financing activities during 2016 of $0.3 million consisted of $0.2 million used to repurchase shares from employees to satisfy tax withholding obligations for restricted stock awards and $0.1 million for repayment of a capital lease obligation.

Net cash provided by financing activities during 2015 of $12.7 million consisted primarily of the net proceeds from public offerings of common stock in February and September 2015 of $13.1 million, partially offset by $0.4 million used to repurchase shares from employees to satisfy tax withholding obligations for restricted stock awards and $0.1 million for repayment of a capital lease obligation.

Commitments and Contingencies

At December 31, 2016, we had no material commitments other than the liabilities reflected in our financial statements.

The JOBS Act

In April 2012, the JOBS Act was enacted. Section 107 of the JOBS Act provides that an emerging growth company can take advantage of an 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 elected to avail ourselves of the extended transition period for adopting new or revised accounting standards. As a result of this election, our financial statements may not be comparable to companies that comply with public company effective dates.

Item 7A. Quantitative and Qualitative Disclosures About Market Risk

As a “smaller reporting company,” we are not required to provide the information required by this Item.

Item 8. Financial Statements and Supplementary Data

The financial statements and supplemental data required by this item are set forth at the pages indicated in Part IV, Item 15(a)(1) of this Annual Report.

Item 9. Changes in and Disagreements with Accountants on Accounting and Financial Disclosure

Not applicable.

Item 9A. Controls and Procedures

Disclosure Controls and Procedures

In evaluating the disclosure controls and procedures, management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving the desired control objectives, and management is required to apply its judgment in evaluating the cost-benefit relationship of possible controls and procedures. Our management, with the participation of our Chief Executive Officer and our Chief Financial Officer, evaluated the effectiveness of our disclosure controls and procedures as of the end of the period covered by this Annual Report. Based on that evaluation, our Chief Executive Officer and our Chief Financial Officer concluded that our disclosure controls and procedures were effective, at the reasonable assurance level, as of the end of the period covered by this Annual Report to ensure that information we are required to disclose in reports that we file or submit under the Exchange Act, (1) is recorded, processed, summarized and reported within the time periods specified in SEC rules and forms, and (2) is accumulated and communicated to management, including our Chief Executive Officer and our Chief Financial Officer as appropriate to allow timely decisions regarding required disclosure.

Management’s Report on Internal Control Over Financial Reporting

Internal control over financial reporting refers to the process designed by, or under the supervision of, our Chief Executive Officer and Chief Financial Officer, and effected by our board of directors, management and other personnel, 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, and includes those policies and procedures that: (1) pertain to the maintenance of records that in reasonable detail accurately and fairly reflect the transactions and dispositions of our assets, (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that our receipts and expenditures are being made only in accordance with authorizations of our management and directors, and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of the company’s assets that could have a material effect on the financial statements.

Internal control over financial reporting cannot provide absolute assurance of achieving financial reporting objectives because of its inherent limitations. Internal control over financial reporting is a process that involves human diligence and compliance and is subject to lapses in judgment and breakdowns resulting from human failures. Internal control over financial reporting also can be circumvented by collusion or improper management override. Because of such limitations, there is a risk that material misstatements may not be prevented or detected on a timely basis by internal control over financial reporting. However, these inherent limitations are known features of the financial reporting process. Therefore, it is possible to design into the process safeguards to reduce, though not eliminate, this risk.

Management is responsible for establishing and maintaining adequate internal control over our financial reporting, as such term is defined in Rule 13a-15(f) under the Exchange Act. Under the supervision and with the participation of our management, including our Chief Executive Officer and Chief Financial Officer, we conducted an evaluation of the effectiveness of our internal control over financial reporting. Management has used the framework set forth in the report entitled “Internal Control — Integrated Framework (2013 Framework)” published by the Committee of Sponsoring Organizations of the Treadway Commission to evaluate the effectiveness of our internal control over financial reporting. Based on its evaluation, management has concluded that our internal control over financial reporting was effective as of December 31, 2016, the end of our most recent fiscal year.

Changes in Internal Control Over Financial Reporting

There were no changes in our internal control over financial reporting that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting during the fourth fiscal quarter of 2016.

Item 9B. Other Information

None.

PART III

Item 10. Directors, Executive Officers and Corporate Governance

The following table lists the names and ages as of March 24, 2017 and positions of the individuals who are currently serving as our executive officers and directors:

Name	Age	Position(s)
Executive Officers		
William S. Marshall, Ph.D.	53	President, Chief Executive Officer and Director
Jason A. Leverone	43	Chief Financial Officer, Secretary and Treasurer
Adam S. Levy	39	Chief Business Officer
Paul D. Rubin, M.D.	63	Executive Vice President, Research and Development
Non-Employee Directors		
Bruce L. Booth, Ph.D.	42	Director
John W. Creecy	63	Director
Thomas E. Hughes, Ph.D.	57	Director
Kevin Koch, Ph.D.	56	Director
Kyle A. Lefkoff	57	Director
Joseph L. Turner	65	Director

Executive Officers

William S. Marshall, Ph.D. Dr. Marshall has served as our president and chief executive officer and as a director since February 2017. Prior to joining us, Dr. Marshall was the president, chief executive and a director of Private Miragen since the company was founded in September 2007. Prior to founding Private Miragen, Dr. Marshall was vice president of technology and business development for bioscience at Thermo Fisher Scientific Inc., a serving science company, from April 2005 to July 2007. Dr. Marshall was one of the scientific founders of Dharmacon, Inc., a biotechnology company, which was acquired by Fisher Scientific International Inc. in April 2004, and he served as the executive vice president for research and operations and general manager of Dharmacon from August 2002 to April 2005. Prior to joining Dharmacon, Dr. Marshall served in multiple positions at Amgen, Inc., a biotechnology company, most recently as associate director of research, site head for research and head of the nucleic acid and peptide technology department. Dr. Marshall earned a B.S. in Biochemistry from the University of Wisconsin-Madison and his Ph.D. in Chemistry at the University of Colorado at Boulder.

We believe that Dr. Marshall's role as our chief executive, prior board service, and extensive experience and innovations in the field of biotechnology enable him to bring a unique perspective to our board of directors. In addition, Dr. Marshall's academic expertise and accomplishments provide the board of directors with in-depth product and field knowledge.

Jason A. Leverone. Mr. Leverone has served as our chief financial officer, secretary and treasurer since February 2017. Prior to joining us, Mr. Leverone joined Private Miragen in November 2008 as its senior director of finance and operations and was appointed vice president, finance in March 2010. Mr. Leverone was appointed as Private Miragen's chief financial officer in February 2012. Prior to joining Private Miragen, Mr. Leverone was senior director of finance and controller for Replidyne, Inc., a publicly-traded biotechnology company, from November 2005 to November 2008. Prior to joining Replidyne, Mr. Leverone was the corporate controller for CreekPath System, Inc., an international software development company, from September 2002 to October 2005. He commenced his professional career with the accounting firm of Ernst and Young LLP, where he last served a senior accountant, and then Arthur Andersen LLP, where he last served as an audit manager. Mr. Leverone is a Certified Public Accountant and earned a B.S. in Business Administration from Bryant University.

Adam S. Levy. Mr. Levy has served as our chief business officer since February 2017. Prior to joining us, Mr. Levy served as Private Miragen's chief business officer since May 2016. Prior to joining Private Miragen, Mr. Levy served as a senior vice president of healthcare investment banking at Wedbush Securities Inc. from September 2013 to May 2016. From May 2011 to August 2012, Mr. Levy was employed by Merrill Lynch, Pierce, Fenner & Smith, Incorporated as vice president of healthcare investment banking. Prior to joining Merrill Lynch, Mr. Levy served as vice president of healthcare investment banking at Wedbush from October 2009 through April 2011. Mr. Levy earned a B.S. in Applied Economics from Cornell University.

Paul D. Rubin, M.D. Dr. Rubin has served as our executive vice president, research and development since February 2017. Prior to joining us, Dr. Rubin served as Private Miragen's executive vice president, research and development since November 2016. Prior to joining Private Miragen, Dr. Rubin served as senior vice president, research and development and chief medical officer of Xoma Corporation, a publicly-traded biotechnology company, from November 2011 to November 2016, having joined Xoma in June 2011 as its vice president, clinical development and chief medical officer. Prior to joining XOMA, Dr. Rubin was the chief medical officer at Funxional Therapeutics Ltd., a pharmaceutical company from February 2011 to June 2011. He served as chief executive officer of Resolvyx Pharmaceuticals, Inc. from 2007 to 2009 and president and chief executive officer of Critical Therapeutics, Inc. from 2002 to 2007. From 1996 to 2002, Dr. Rubin served as senior vice president, development, and later as executive vice president, research and development at Sepracor Inc. From 1993 to 1996, Dr. Rubin held senior level positions at Glaxo-Wellcome Pharmaceuticals, most recently as vice president of worldwide clinical pharmacology and early clinical development. During his tenure with Abbott Laboratories from 1987 to 1993, Dr. Rubin served as vice president, immunology and endocrinology. Dr. Rubin received a B.A. from Occidental College and his M.D. from Rush Medical College. He completed his training in internal medicine at the University of Wisconsin.

Non-Employee Directors

Bruce L. Booth, Ph.D. Dr. Booth has served as a member of our board of directors since February 2017 and, prior to joining our board of directors, he served as a member of Private Miragen's board of directors since September 2007. Dr. Booth joined Atlas Venture Associates in 2005, and currently serves as partner in its life sciences group. Prior to joining Atlas Venture, from 2004 to 2005, Dr. Booth was a principal at Caxton Health Holdings L.L.C., a healthcare-focused investment firm. Prior to joining Caxton, from 1999 to 2004, Dr. Booth was an associate principal at McKinsey & Company, a global strategic management consulting firm. Dr. Booth serves on the board of Zafgen, Inc., a publicly-traded biopharmaceutical company, and several privately-held companies. Dr. Booth earned a Ph.D. in molecular immunology from Oxford University's Nuffield Department of Medicine and a B.S. in biochemistry from Pennsylvania State University.

We believe Dr. Booth is qualified to serve on our board of directors due to his years of investment in the healthcare industry and his continued service leading the boards of directors of both private and public companies, which will enable him to contribute important strategic insight to our board of directors.

John W. Creecy. Mr. Creecy has served as a member of our board of directors since February 2017 and, prior to joining our board of directors, he served as a member of Private Miragen's board of directors since April 2012. Mr. Creecy has served as the chief executive officer and a director of Remeditex Ventures, LLC, a biomedical investment company, since June 2011. Prior to joining Remeditex, Mr. Creecy served as president and chief executive officer of Hunt Petroleum Corporation from February 2001 to September 2008. Prior to Hunt, Mr. Creecy served as the chief operating officer of the Hodges Companies, Inc. from 1988 to 2000. In addition to Miragen, Mr. Creecy sits on the boards of a number of private companies. Mr. Creecy earned a B.S. in Accounting from Texas Tech University and an M.S. in Accounting from the University of North Texas.

We believe Mr. Creecy is qualified to serve on our board of directors due to his years of investment in the biomedical industry and his experience as an executive officer, which will enable him to contribute important strategic insight to our board of directors.

Thomas E. Hughes, Ph.D. Dr. Hughes has served as a member of our board of directors since February 2017 and, prior to joining our board of directors, he served as a member of Private Miragen's board of directors since September 2009. Dr. Hughes joined Zafgen, Inc., a publicly-traded biopharmaceutical company, as the chief executive officer and as a director in October 2008 and also served as its president from October 2008 until June 2014. From 1987 to 2008, Dr. Hughes held several positions at Novartis AG (formerly Sandoz Pharmaceuticals), including vice president and global head of the cardiovascular and metabolic diseases therapeutic area at the Novartis Institutes for BioMedical Research in Cambridge, MA. Dr. Hughes also serves as a member of the scientific advisory board for Navitor Therapeutics, a discovery-stage biopharmaceutical company, and as a member of the strategic advisory board for Broadview Ventures, an early-stage investment company. Dr. Hughes earned a Ph.D. in nutritional biochemistry from

Tufts University, an M.S. in Zoology from Virginia Polytechnic Institute & State University and a B.A. in biology from Franklin and Marshall College.

We believe Dr. Hughes is qualified to serve on our board of directors due to his years of experience in the biotechnology industry and service on both public and private boards of directors of biopharmaceutical companies, which will enable him to contribute important strategic insight to our board of directors.

Kevin Koch, Ph.D. Dr. Koch has served as a member of our board of directors since February 2017 and, prior to joining our board of directors, he served as a member of Private Miragen's board of directors since July 2016. Dr. Koch has served as a venture partner at OrbiMed Advisors, LLC since May 2016. Prior to joining OrbiMed, Dr. Koch acted as a consultant in the biotech industry from September 2015 to May 2016. Prior to acting as a consultant, Dr. Koch served as the senior vice president, drug discovery, chemical and molecular therapeutics, at Biogen, Inc. from December 2013 to September 2015. Prior to joining Dr. Koch, founded Array BioPharma Inc., a publicly-traded biopharmaceutical company, and served as its president, chief scientific officer and a member of its board of directors from May 1998 to November 2013. Prior to forming Array, Dr. Koch was an associate director of medicinal chemistry and project leader for the protease inhibitor and new technologies group for Amgen Inc. from 1995 to 1998. From 1988 until 1995, Dr. Koch held various research positions within the Central Research Division of Pfizer, Inc., including senior research investigator and senior research scientist. Dr. Koch earned a B.S. in chemistry and in biochemistry from the State University of New York at Stony Brook and a Ph.D. in synthetic organic chemistry from the University of Rochester.

We believe Dr. Koch is qualified to serve on our board of directors due to his years of experience in the biotechnology industry and service on both public and private boards of biopharmaceutical companies, which will enable him to contribute important strategic insight to our board of directors.

Kyle A. Lefkoff. Mr. Lefkoff has served as a member of our board of directors since February 2017 and, prior to joining our board of directors, he served as a member of Private Miragen's board of directors since September 2007. Mr. Lefkoff has served as a General Partner of Boulder Ventures, Ltd, a venture capital firm, since its founding in 1995. From 1986 until 1995, Mr. Lefkoff was employed by Colorado Venture Management, a venture capital firm, as a General Partner. Mr. Lefkoff serves as chairman of the board of directors of Array BioPharma Inc., a publicly-traded biopharmaceutical company, and is a director of number of private companies. Mr. Lefkoff earned a B.A. in Economics from Vassar College, completed a fellowship in Economic History at the London School of Economics and has an M.B.A. in Finance at the University of Chicago.

We believe Mr. Lefkoff is qualified to serve on our board of directors due to his years of venture capital experience and his continued service leading the boards of directors of both private and public biopharmaceutical companies, which will enable him to contribute important strategic insight to our board of directors.

Joseph L. Turner. Mr. Turner has served as a member of our board of directors since February 2017. Prior to joining our board of directors, Mr. Turner served on the boards of directors and was the chair of the audit committees of Corcept Therapeutics, Inc., a publicly-traded pharmaceutical company, from 2012 to May 2016, Kythera Biopharmaceuticals, Inc., a publicly-traded pharmaceutical company, from 2008 until Kythera's acquisition by Allergan Inc. October 2015, and Sophiris Bio, a publicly-traded pharmaceutical company from 2013 to May 2016. From July 2010 until its acquisition by Grupo Ferrer Internacional, S.A. in June 2016, Mr. Turner served on the board of directors and as a chair of the audit committee of Alexza Pharmaceuticals, Inc., a publicly-traded pharmaceutical company. In 2012, Mr. Turner served on the board of directors and as chair of the audit committee of Allos Therapeutics, Inc., a publicly-traded pharmaceutical company, until its acquisition by Spectrum Pharmaceuticals Inc. in September 2012. From 2010 through 2012, he served on the board of directors and as a member of the audit committee of QLT Inc., a publicly-traded biotechnology company. In 2008, Mr. Turner served as a director and member of the audit committee of SGX Pharmaceuticals Inc., a publicly-traded pharmaceutical company. Mr. Turner served as chief financial officer at Myogen, Inc., a publicly-traded biopharmaceutical company, from 1999 until it was acquired by Gilead Sciences in 2006. Previously, Mr. Turner was the chief financial officer at Centaur Pharmaceuticals, Inc. and served as chief financial officer and vice president, finance and administration at Cortech, Inc. Since 2009, Mr. Turner has also served on the board of managers of Swarthmore College where at various times he has served on its executive committee, finance committee, audit committee, academic affairs committee (which he currently chairs) and student affairs committee and property committee. In 2013 until 2015, Mr. Turner served on the board of directors of the Linda Crnic Institute for Down Syndrome at the University of Colorado Medical School. Mr. Turner has an M.B.A. from the University of North Carolina at Chapel Hill, an M.A. in molecular biology from the University of Colorado and a B.A. in chemistry from Swarthmore College.

We believe Mr. Turner is qualified to serve on our board of directors due to his years of service on both public and private boards of directors of pharmaceutical companies, including service on audit committees and extensive finance experience, which will enable him to contribute important strategic insight to our board of directors.

Audit Committee and Financial Expert

The audit committee of our board of directors was established by our board of directors in accordance with Section 3(a)(58)(A) of the Exchange Act to oversee our corporate accounting and financial reporting processes and audits of our financial statements. Our audit committee is currently composed of Mr. Turner, who serves as chairman, and Messrs. Lefkoff and Creecy, each of whom our board of directors has determined satisfies the NASDAQ Stock Market and SEC independence requirements. Our board of directors has also determined that Mr. Turner qualifies as an "audit committee financial expert," as defined in applicable SEC rules.

Section 16(a) Beneficial Ownership Reporting Compliance

Section 16(a) of the Exchange Act requires our directors and executive officers, and persons who own more than ten percent of a registered class of our equity securities, to file with the SEC initial reports of ownership within 10 days after he or she becomes a beneficial owner, director or officer and reports of changes in ownership of our common stock and other equity securities within two business days after the transaction is executed. Our officers, directors and greater than ten percent stockholders are required by SEC regulations to furnish us with copies of all Section 16(a) forms they file. To our knowledge, based solely on a review of the copies of such reports furnished to us and written representations that no other reports were required, during the fiscal year ended December 31, 2016, all Section 16(a) filing requirements applicable to our officers, directors and greater than ten percent beneficial owners were complied with; except that one report, reporting the grant of a stock option or restricted stock unit, as applicable, was filed late by each of Bennet. S. Lebow, Samuel D. Riccitelli, David A. Gonyer, Douglas A. Schuling, Tamara A. Seymour and Robin L. Smith.

Code of Ethics

We have adopted a written code of business conduct and ethics that applies to our directors, officers and employees, including our principal executive officer, principal financial officer, principal accounting officer or controller, or persons performing similar functions. A current copy of the code is posted on our website, which is located at *www.miragentherapeutics.com*. If we make any substantive amendments to, or grant any waivers from, the code of business conduct and ethics for any officer or director, we will disclose the nature of such amendment or waiver on our website or in a current report on Form 8-K.

Item 11. Executive Compensation

Our named executive officers for the year ended December 31, 2016, which consist of our principal executive officer for the year ended December 31, 2016 and our other most highly compensated executive officer for the year ended December 31, 2016, include:

- Samuel D. Riccitelli, our chief executive officer and president, as of December 31, 2016; and
- Tamara A. Seymour, our chief financial officer, as of December 31, 2016.

This discussion does not include Drs. Marshall or Rubin or Messrs. Leverone and Levy, because none of these individuals served as our executive officers in the year ended December 31, 2016.

Summary Compensation Table

The following table sets forth the information as to compensation paid to or earned by our president and chief executive officer and our only other executive officer during the fiscal years noted below whose total compensation exceeded $100,000. The persons listed in the following table are referred to herein as the "named executive officers."

Name and Principal Position	Fiscal Year	Salary	Bonus	**Stock Award(s) [1]**	**Option Award(s)[1]**	All Other Compensation	Total
Samuel D. Riccitelli	2016	$450,000	$135,000(2)	$ 102,000	$ —	$ —	$687,000
Chief Executive Officer and President	2015	$450,000	$135,000(3)	$ —	$ —	$ —	$585,000
Tamara A. Seymour	2016	$350,000	$105,000(2)	$ 51,000	$ —	$ —	$506,000
Chief Financial Officer	2015	$350,000	$105,000(4)	$ —	$ 53,070	$ —	$508,070

(1) Represents the aggregate grant date fair value of stock awards or options for common stock computed in accordance with FASB ASC Topic 718.

(2) Represents discretionary bonus for services rendered in our fiscal year ending December 31, 2016 granted in January 2017 not made pursuant to any contractual arrangement.

(3) Represents discretionary bonuses of $33,750 and $101,250 for services rendered in our fiscal year ending December 31, 2015 granted in March 2016 and January 2017, respectively, not made pursuant to any contractual arrangement.

(4)

Represents discretionary bonuses of $26,250 and $78,750 for services rendered in our fiscal year ending December 31, 2015 granted in March 2016 and January 2017, respectively, not made pursuant to any contractual arrangement.

Riccitelli Employment Agreement

We entered into an amended and restated employment agreement, or the CEO Agreement, with Samuel D. Riccitelli, on June 17, 2014 (the effective date of the CEO Agreement) in connection with our initial public offering. The CEO Agreement was subsequently amended on July 23, 2014, to bring the agreement into compliance with Section 409A of the Code, the Treasury Regulations and interpretive guidance issued thereunder. The CEO Agreement prohibits Mr. Riccitelli from engaging in any competitive activity, as described in the CEO Agreement, during his employment with us and for a period of one year following termination of his employment for any reason.

The CEO Agreement's first term ended on October 31, 2015, and automatically renews for additional one-year terms on each anniversary of the effective date of the CEO Agreement after such date. The CEO Agreement provides for, among other things, an annual base salary of $450,000, payable on a semi-monthly basis. It also provides that Mr. Riccitelli will be reimbursed for all reasonable business expenses, including travel and entertainment expenses incurred in the performance of his duties. During the term of his employment, Mr. Riccitelli is entitled to participate in any annual performance-based incentive compensation programs and any long-term incentive compensation programs that are established by the Company, on the terms established from time to time our compensation committee or our board of directors. Mr. Riccitelli is also entitled to four weeks of paid vacation time and is eligible to receive the same employee benefits as are provided by us to other executive employees.

The CEO Agreement also provides for certain post-termination benefits. See "*Payments Due Upon Termination of Employment or a Change in Control*" below for more information.

Mr. Riccitelli's employment with us terminated in February 2017 upon closing of the Merger.

Seymour Employment Agreement

We entered into an employment agreement, or the CFO Agreement, with Tamara A. Seymour, on August 4, 2014 (the effective date of the CFO Agreement). The CFO Agreement prohibits Ms. Seymour from engaging in any competitive activity, as described in the CFO Agreement, during her employment with us.

The CFO Agreement's first term ended on the one year anniversary of the effective date of the CFO Agreement, and automatically renews for additional one-year terms on each anniversary of such date. The CFO Agreement provides for, among other things, an annual base salary of $350,000, payable on a semi-monthly basis. It also provides that Ms. Seymour will be reimbursed for all reasonable business expenses, including travel and entertainment expenses incurred in the performance of her duties. The CFO Agreement also provides that at the end of each fiscal year of the Company, in addition to Ms. Seymour's base salary then in effect, she will be eligible to receive a bonus payment of up to 30% of her base salary then in effect, which bonus payment will be awarded in the sole discretion of our compensation committee based upon performance goals established by our compensation committee during the first ninety days of each fiscal year, which goals shall be set after consultation with our chief executive officer. Pursuant to the terms of the CFO Agreement, Ms. Seymour received an initial restricted stock unit award for 92,000 shares as of the effective date. Ms. Seymour is also entitled to four weeks of paid vacation time and is eligible to receive the same employee benefits as are provided by us to other executive employees.

The CFO Agreement also provides for certain post-termination benefits. See "*Payments Due Upon Termination of Employment or a Change in Control*" below for more information.

Ms. Seymour's employment with us terminated in February 2017 upon closing of the Merger.

Outstanding Equity Awards at Fiscal Year-End 2016

The following table provides information about the number of outstanding equity awards held by our named executive officers at December 31, 2016.

	Option Awards				Stock Awards			
	Number of securities underlying unexercised	Number of securities underlying unexercised	Equity incentive plan awards: number of	Option exercise price	Equity Incentive Plan Awards:	Market Value of Shares	Equity Incentive Plan Awards:	Equity Incentive Plan Awards:

Name	unexercised options exercisable (#)	unexercised options unexercisable (#)	securities underlying unexercised unearned options (#)	Option exercise price ($)	Option expiration date ($)	Market or Payout Value of Unearned Shares, Units Or Other Rights That Have Not Vested ($)	Number of Unearned Shares, Units Or Other Rights That Have Not Vested (#)	Market or Payout Value of Unearned Shares, Units Or Other Rights That Have Not Vested ($)
Samuel D. Riccitelli	—	—	—	$ —	$ —	$ —	—	$ —
Tamara A Seymour	4,000	—	—	$ 23.55	$ —	$ —	—	$ —

Payments Due Upon Termination of Employment or a Change in Control

Employment Agreements

Mr. Riccitelli's CEO Agreement and Ms. Seymour's CFO Agreement entitle each of them, each individual referred to herein as the Executive, to receive certain payments upon the termination of such person's employment under certain circumstance as described below.

- *Termination for Cause* - In the event Executive's employment is terminated for "Cause," Executive's sole remedy will be to collect all unpaid base salary, all accrued personal time off and all unreimbursed expenses payable for all periods through the effective date of termination, as well as any amount arising from his participation in, or benefits under, any employee benefit plan, program or arrangement, payable in accordance with the terms of such plan, program or arrangement.

- *Termination Without Cause* - In the event the Executive's employment is terminated without "Cause," he will be entitled to receive all unpaid base salary, accrued annual bonus or incentive compensation (including any unpaid, accrued annual bonus or incentive compensation from the immediately preceding year), accrued personal time off, and all unreimbursed expenses payable for all periods through the effective date of termination (with such amounts to be paid on the date of termination).

For the purposes above, “Cause” means (1) expiration of the term of the CEO Agreement or CFO Agreement (as applicable), (2) a material breach by Executive of his or her fiduciary duty to the Company that results in material harm to the Company; (3) a material breach by Executive of the terms of the CEO Agreement or CFO Agreement (as applicable) or any other agreement between Executive and the Company, which remains uncured for a period of 30 days following the receipt of written notice specifying the nature of the breach; (4) the willful commission by Executive of any act of embezzlement, fraud, larceny or theft on or from the Company; (5) substantial and continuing willful neglect or inattention by Executive of the duties of such person’s employment, refusal to perform the lawful and reasonable directions of the board of directors or the willful misconduct or gross negligence of Executive in connection with the performance of such duties which remain uncured for a period of 30 days following the receipt of written notice specifying the nature of the breach; (6) the willful commission by Executive of any crime involving moral turpitude or a felony; and (7) Executive’s performance or omission of any act which, in the judgment of our board of directors, if known to the customers, clients, stockholders or any regulators of the Company, would have a material adverse impact on the business of the Company.

In addition, should Mr. Riccitelli’s termination occur after June 23, 2015, he will be entitled to receive a severance payment, equal to his then-current base salary for a period of twelve months.

In the event Ms. Seymour’s employment is terminated without Cause, Ms. Seymour will be entitled to continue to receive her then-current base salary for twelve months and accelerated vesting of all time-based equity compensation awards then held by Executive to the extent that such awards would have vested during the twelve months following the Executive’s termination.

Neither Executive will be required to mitigate the amount of any severance payments received by seeking other employment during the term of the severance period. However, should the Executive obtain other employment during the term of the severance period, we will pay such person, for the remaining length of the severance period, only the difference between such person’s new salary and base salary (as in effect at the time of termination), if the new salary is less than such person’s base salary (i.e., we will not be obligated to make any severance payments to Executive if such person’s new salary is greater than such person’s applicable base salary). The severance payment (less all applicable withholdings) will be paid in equal monthly installments over the applicable period immediately following the termination of Executive’s employment. We will also reimburse Executive for premiums for COBRA coverage for Executive (and to the extent he or she has family coverage, his family), provided that Executive elects such coverage, during the applicable period when such person is receiving severance payments, until such time as Executive obtains other employment and is entitled to comparable health coverage from such employer.

In connection with the Merger, the compensation committee of our board of directors deemed it advisable and in the best interests of our stockholders to permit lump sum payment of the severance arrangements of Mr. Riccitelli and Ms. Seymour upon his or her termination to the extent permitted under Section 409A of the Code, as opposed to the monthly payments originally contemplated therein to avoid a potential acquirer from having to make continued payments following the closing of a merger. Therefore, on October 11, 2016, the compensation committee of our board of directors approved modifications to the severance arrangements of Mr. Riccitelli and Ms. Seymour to allow

for the payment of severance in a lump sum to the extent such payments can be made in compliance with Section 409A of the Code.

Termination After Disability or Death - In the event that Executive's employment is terminated due to disability (as described in the CEO Agreement or CFO Agreement (as applicable)) or on account of such person's death, then Executive (or such person's estate or personal representative, as applicable) will be entitled to receive all unpaid base salary, accrued annual bonus or incentive compensation (including any unpaid, accrued annual bonus or incentive compensation from the immediately preceding year), accrued personal time off, and all unreimbursed expenses payable for all periods through the effective date of termination. In the case of disability only, Executive will be entitled to receive, in addition to the amounts specified above, for a period of six months, a series of monthly payments equal to such person's then-current monthly base salary payments such person received during his or her employment if and only if Executive does not receive any payments as a result of the short-term and long-term disability insurance benefits that we obtain on such person's behalf pursuant to the CEO Agreement or CFO Agreement (as applicable), which payments will be paid in equal installments over the applicable period. If Executive is provided with such insurance payments, then such person will only be entitled to receive the difference between the insurance payments and such person's base salary, if the payments are less than such person's base salary.

Termination by Executive for Good Reason - In the event that Executive's employment is terminated by such person for "Good Reason," then Executive will be entitled to receive all unpaid base salary, accrued annual bonus or incentive compensation (including any such unpaid, accrued compensation from the immediately preceding year), accrued personal time off and all unreimbursed expenses payable for all periods through the effective date of such person's termination. In addition, Executive will be entitled to receive the same severance payment such person would be entitled to receive if his or her employment were terminated by us without Cause

"Good Reason" means (1) we have materially breached the CEO Agreement or CFO Agreement (as applicable) and we have failed to cure or remedy such breach after 30-days written notice from Executive (provided that Executive must resign within 30 days after expiration of the 30-day period following written notice without cure or remedy by us), (2) there has occurred any material and substantial diminution or reduction in duties, base salary, title, health care coverage (but only if such diminution is disproportionate to a diminution in health care coverage applicable to other of our employees), authority or responsibilities of Executive, whether is scope or nature, and we have failed to cure or remedy such breach after 30-days written notice from Executive; or (3) we have required that Executive perform any act or refrain from performing any act that would be in violation of applicable law.

Termination by Executive without Good Reason - In the event Executive terminates his or her employment without Good Reason, such person will only be entitled to receive all unpaid base salary, all accrued personal time off and all unreimbursed expenses payable for all periods through the effective date of termination and Executive will not be entitled to any compensation or other amounts from us following the effective date of termination.

Employee Benefit Plans

2016 Equity Incentive Plan

Purpose

Our 2016 Equity Incentive Plan, or the 2016 Plan, was adopted by us, and approved by our stockholders in connection with the Merger. The 2016 Plan is designed to secure and retain the services of our employees, directors and consultants, provide incentives for such, directors and consultants to exert maximum efforts for our success and to provide a means by our employees, directors and consultants may be given an opportunity to benefit from increases in the value of its common stock. The 2016 Plan was adopted to replace and supersede our 2014 Stock Incentive Plan, or the 2014 Plan.

As of December 31, 2016, there were no outstanding equity awards under the 2016 Plan.

Types of Awards

The terms of the 2016 Plan provide for the grant of incentive stock options, nonstatutory stock options, stock appreciation rights, restricted stock awards, restricted stock unit awards, other stock awards, and performance awards that may be settled in cash, stock, or other property.

Shares Available for Awards

The aggregate number of shares of our common stock that may be issued under the 2016 Plan, or the Share Reserve, will not exceed 4,182,404 shares, which number is the sum of (i) 1,681,294 shares, plus (ii) the number of shares

subject to outstanding stock awards that were granted under the Private Miragen 2008 Equity Incentive Plan, or the Miragen 2008 Plan, that, from and after the closing date of the Merger, expire or terminate for any reason prior to exercise or settlement, are forfeited because of the failure to meet a contingency or condition required to vest such shares, or are reacquired, withheld or not issued to satisfy a tax withholding obligation in connection with an award or to satisfy the purchase price or exercise price of a stock award, if any, as such shares become available from time to time. In addition, the share reserve will automatically increase on January 1st of each year, for a period of not more than ten years, commencing on January 1st of the year following the year in which the effective date of the 2016 Plan occurs, and ending on (and including) January 1, 2026, in an amount equal to 4% of the shares of common stock outstanding on December 31st of the preceding calendar year; however the board of directors or compensation committee may act prior to January 1st of a given year to provide that there will be no January 1st increase in the share reserve for such year or that the increase in the share reserve for such year will be a lesser number of shares of common stock than would otherwise occur pursuant to the automatic increase.

The following shares of common stock will become available again for issuance under the 2016 Plan: (i) any shares subject to a stock award that are not issued because such stock award expires or otherwise terminates without all of the shares covered by such stock award having been issued; (ii) any shares subject to a stock award that are not issued because such stock award is settled in cash; (iii) any shares issued pursuant to a stock award that are forfeited back to or repurchased by us because of the failure to meet a contingency or condition required for the vesting of such shares; and (iv) any shares reacquired by us in satisfaction of tax withholding obligations on a stock award or as consideration for the exercise or purchase price of a stock award.

Eligibility

All of our employees and non-employee directors are eligible to participate in the 2016 Plan and may receive all types of awards other than incentive stock options. Incentive stock options may be granted under the 2016 Plan only to our employees (including officers) and employees of our affiliates.

Section 162(m) Limits

Under the 2016 Plan, subject to adjustment for specified changes in our capitalization, no participant will be eligible to be granted performance-based compensation during any calendar year more than: (i) a maximum of 1,500,000 shares of common stock subject to stock options and stock appreciation rights whose value is determined by reference to an increase over an exercise or strike price of at least 100% of the fair market value of a share of common stock on the date of grant; (ii) a maximum of 1,500,000 shares of common stock subject to performance stock awards; and (iii) a maximum of $3,000,000 subject to performance cash awards. These limits are designed to allow us to grant awards that are intended to be exempt from the $1.0 million limitation on the income tax deductibility of compensation paid per covered employee imposed by Section 162(m) of the Code, and will not apply to awards that our board of directors determines will not be treated as performance-based compensation.

73

Non-Employee Director Compensation Limit

Under the 2016 Plan, the maximum number of shares of common stock subject to stock awards granted under the 2016 Plan or otherwise during any one calendar year to any non-employee director, taken together with any cash fees paid us to such non-employee director during such calendar year for services on its board of directors, will not exceed $500,000 in total value (calculating the value of any such stock awards based on the grant date fair value of such stock awards for financial reporting purposes), or, with respect to the calendar year in which a non-employee director is first appointed or elected to our board of directors, $1,000,000.

Administration

The 2016 Plan is administered by our board of directors, which may in turn delegate authority to administer the 2016 Plan to a committee. Our board of directors has delegated concurrent authority to administer the 2016 Plan to its compensation committee, but may, at any time, revest in itself some or all of the power delegated to its compensation committee. Our board of directors and its compensation committee are each considered to be a Plan Administrator for purposes of the 2016 Plan. Subject to the terms of the 2016 Plan, the Plan Administrator may determine the recipients, the types of awards to be granted, the number of shares of common stock subject to or the cash value of awards, and the terms and conditions of awards granted under the 2016 Plan, including the period of their exercisability and vesting. The Plan Administrator also has the authority to provide for accelerated exercisability and vesting of awards. Subject to the limitations set forth below, the Plan Administrator also determines the fair market value applicable to a stock award and the exercise or strike price of stock options and stock appreciation rights granted under the 2016 Plan.

The Plan Administrator may also delegate to one or more officers the authority to designate employees who are not officers to be recipients of certain stock awards and the number of shares of common stock subject to such stock awards. Under any such delegation, the Plan Administrator will specify the total number of shares of common stock that may be subject to the stock awards granted by such officer. The officer may not grant a stock award to himself or herself.

Repricing; Cancellation and Re-Grant of Stock Awards

Under the 2016 Plan, the Plan Administrator does not have the authority to reprice any outstanding stock option or stock appreciation right by reducing the exercise or strike price of the stock option or stock appreciation right or to cancel any outstanding stock option or stock appreciation right that has an exercise or strike price greater than the then-current fair market value of a share of common stock in exchange for cash or other stock awards without obtaining the approval of our stockholders. Such approval must be obtained within 12 months prior to such an event.

Stock Options

Stock options may be granted under the 2016 Plan pursuant to stock option agreements. The 2016 Plan permits the grant of stock options that are intended to qualify as ISOs and NSOs.

The exercise price of a stock option granted under the 2016 Plan may not be less than 100% of the fair market value of the common stock subject to the stock option on the date of grant and, in some cases (see "*Limitations on Incentive Stock Options*" below), may not be less than 110% of such fair market value.

The term of stock options granted under the 2016 Plan may not exceed ten years and, in some cases (see "*Limitations on Incentive Stock Options*" below), may not exceed five years. Except as otherwise provided in a participant's stock option agreement or other written agreement with us or one of our affiliates, if a participant's service relationship with us or any of our affiliates, referred to herein as continuous service, terminates (other than for cause and other than upon the participant's death or disability), the participant may exercise any vested stock options for up to three months following the participant's termination of continuous service. Except as otherwise provided in a participant's stock option agreement or other written agreement with us or one of our affiliates, if a participant's continuous service terminates due to the participant's disability or death (or the participant dies within a specified period, if any, following termination of continuous service), the participant, or his or her beneficiary, as applicable, may exercise any vested stock options for up to 12 months following the participant's termination due to the participant's disability or for up to 18 months following the participant's death. Except as explicitly provided otherwise in a participant's stock option agreement or other written agreement with us or one of our affiliates, if a participant's continuous service is terminated for cause (as defined in the 2016 Plan), all stock options held by the participant will terminate upon the participant's termination of continuous service and the participant will be prohibited from exercising any stock option from and after such termination date. Except as otherwise provided in a participant's stock option agreement or other written agreement with us or one of its affiliates, the term of a stock option may be extended if the exercise of the stock option following the participant's termination of continuous service (other than for cause and other than upon the participant's death or disability) would be prohibited by applicable securities laws or if the sale of any common stock received upon exercise of the stock option following the participant's termination of continuous service (other than for cause) would violate our insider trading policy. In no event, however, may a stock option be exercised after its original expiration date.

Acceptable forms of consideration for the purchase of common stock pursuant to the exercise of a stock option under the 2016 Plan will be determined by the Plan Administrator and may include payment: (i) by cash, check, bank draft or money order payable to us; (ii) pursuant to a program developed under Regulation T as promulgated by the Federal Reserve Board; (iii) by delivery to us of shares of common stock (either by actual delivery or attestation); (iv) by a net exercise arrangement (for NSOs only); or (v) in other legal consideration approved by the Plan Administrator.

Stock options granted under the 2016 Plan may vest as determined by the Plan Administrator at the rate specified in the stock option agreement. Shares covered by different stock options granted under the 2016 Plan may be subject to different vesting schedules as the Plan Administrator may determine.

The Plan Administrator may impose limitations on the transferability of stock options granted under the 2016 Plan in its discretion. Generally, a participant may not transfer a stock option granted under the 2016 Plan other than by will or the laws of descent and distribution or, subject to approval by the Plan Administrator, pursuant to a domestic relations order or an official marital settlement agreement. However, the Plan Administrator may permit transfer of a stock option in a manner that is not prohibited by applicable tax and securities laws. In addition, subject to approval by the Plan Administrator, a participant may designate a beneficiary who may exercise the stock option following the participant's death.

Limitations on Incentive Stock Options

The aggregate fair market value, determined at the time of grant, of shares of common stock with respect to ISOs that are exercisable for the first time by a participant during any calendar year under all of our stock plans may not exceed $100,000. The stock options or portions of stock options that exceed this limit or otherwise fail to qualify as ISOs are treated as NSOs. No ISO may be granted to any person who, at the time of grant, owns or is deemed to own stock possessing more than 10% of our total combined voting power or that of any affiliate unless the following conditions are satisfied:

- the exercise price of the ISO must be at least 110% of the fair market value of the common stock subject to the ISO on the date of grant; and
- the term of the ISO must not exceed five years from the date of grant.

Subject to adjustment for specified changes in capitalization, the aggregate maximum number of shares of common stock that may be issued pursuant to the exercise of ISOs under the 2016 Plan is 20,912,020 shares.

Stock Appreciation Rights

Stock appreciation rights may be granted under the 2016 Plan pursuant to stock appreciation right agreements. Each stock appreciation right is denominated in common stock share equivalents. The strike price of each stock appreciation right will be determined by the Plan Administrator, but will in no event be less than 100% of the fair market value of the common stock subject to the stock appreciation right on the date of grant. The Plan Administrator may also impose restrictions or conditions upon the vesting of stock appreciation rights that it deems appropriate. The appreciation distribution payable upon exercise of a stock appreciation right may be paid in shares of our common stock, in cash, in a combination of cash and stock, or in any other form of consideration determined by the Plan Administrator and set forth in the stock appreciation right agreement. Stock appreciation rights will be subject to the same conditions upon termination of continuous service and restrictions on transfer as stock options under the 2016 Plan.

Restricted Stock Awards

Restricted stock awards may be granted under the 2016 Plan pursuant to restricted stock award agreements. A restricted stock award may be granted in consideration for cash, check, bank draft or money order payable to us, the participant's services performed for us or any of ours affiliates, or any other form of legal consideration acceptable to the Plan Administrator. Shares of common stock acquired under a restricted stock award may be subject to forfeiture to or repurchase by us in accordance with a vesting schedule to be determined by the Plan Administrator. Rights to acquire shares of common stock under a restricted stock award may be transferred only upon such terms and conditions as are set forth in the restricted stock award agreement. A restricted stock award agreement may provide that any dividends paid on restricted stock will be subject to the same vesting conditions as apply to the shares subject to the restricted stock award. Upon a participant's termination of continuous service for any reason, any shares subject to restricted stock awards held by the participant that have not vested as of such termination date may be forfeited to or repurchased by us.

Restricted Stock Unit Awards

Restricted stock unit awards may be granted under the 2016 Plan pursuant to restricted stock unit award agreements. Payment of any purchase price may be made in any form of legal consideration acceptable to the Plan Administrator. A restricted stock unit award may be settled by the delivery of shares of Signal common stock, in cash, in a combination of cash and stock, or in any other form of consideration determined by the Plan Administrator and set forth in the restricted stock unit award agreement. Restricted stock unit awards may be subject to vesting in accordance with a vesting schedule to be determined by the Plan Administrator. Dividend equivalents may be credited in respect of shares of common stock covered by a restricted stock unit award, provided that any additional shares credited by reason of such dividend equivalents will be subject to all of the same terms and conditions of the underlying restricted stock unit award. Except as otherwise provided in a participant's restricted stock unit award agreement or other written agreement with us or one of our affiliates, restricted stock units that have not vested will be forfeited upon the participant's termination of continuous service for any reason.

75

Performance Awards

The 2016 Plan allows us to grant performance stock and cash awards, including such awards that may qualify as performance-based compensation that is not subject to the $1 million limitation on the income tax deductibility of compensation paid per covered employee imposed by Section 162(m) of the Code.

A performance stock award is a stock award that is payable (including that may be granted, may vest, or may be exercised) contingent upon the attainment of pre-determined performance goals during a performance period. A performance stock award may require the completion of a specified period of continuous service. The length of any performance period, the performance goals to be achieved during the performance period, and the measure of whether and to what degree such performance goals have been attained will be determined by the compensation committee of our board of directors, except that the Plan Administrator also may make any such determinations to the extent that the award is not intended to qualify as performance-based compensation under Section 162(m) of the Code. In addition, to the extent permitted by applicable law and the performance stock award agreement, the Plan Administrator may determine that cash may be used in payment of performance stock awards.

A performance cash award is a cash award that is payable contingent upon the attainment of pre-determined performance goals during a performance period. A performance cash award may require the completion of a specified period of continuous service. The length of any performance period, the performance goals to be achieved during the performance period, and the measure of whether and to what degree such performance goals have been attained will be determined by the compensation committee of our board of directors, except that the Plan Administrator also may make any such determinations to the extent that the award is not intended to qualify as performance-based compensation under Section 162(m) of the Code. The Plan Administrator may specify the form of payment of performance cash awards, which may be cash or other property, or may provide for a participant to have the option for his or her performance cash award to be paid in cash or other property.

In granting a performance stock or cash award intended to qualify as “performance-based compensation” under Section 162(m) of the Code, the compensation committee of our board of directors will set a period of time, or a performance period, over which the attainment of one or more goals, or performance goals, will be measured. Within the time period prescribed by Section 162(m) of the Code (no later than the earlier of the 90th day of a performance period and the date on which 25% of the performance period has elapsed, and in any event at a time when the achievement of the performance goals remains substantially uncertain), the compensation committee of our board of directors will establish the performance goals, based upon one or more criteria, or performance criteria, enumerated in the 2016 Plan and described below. As soon as administratively practicable following the end of the performance period, the compensation committee of our board of directors will certify in writing whether the performance goals have been satisfied.

Performance goals under the 2016 Plan will be based on any one or more of the following performance criteria: (i) earnings (including earnings per share and net earnings); (ii) earnings before interest, taxes and depreciation; (iii) earnings before interest, taxes, depreciation and amortization; (iv) earnings before interest, taxes, depreciation, amortization and legal settlements; (v) earnings before interest, taxes, depreciation, amortization, legal settlements and other income (expense); (vi) earnings before interest, taxes, depreciation, amortization, legal settlements, other income (expense) and stock-based compensation; (vii) earnings before interest, taxes, depreciation, amortization, legal settlements, other income (expense), stock-based compensation and changes in deferred revenue; (viii) earnings before interest, taxes, depreciation, amortization, legal settlements, other income (expense), stock-based compensation, other non-cash expenses and changes in deferred revenue; (ix) total stockholder return; (x) return on equity or average stockholder's equity; (xi) return on assets, investment, or capital employed; (xii) stock price; (xiii) margin (including gross margin); (xiv) income (before or after taxes); (xv) operating income; (xvi) operating income after taxes; (xvii) pre-tax profit; (xviii) operating cash flow; (xix) sales or revenue targets; (xx) increases in revenue or product revenue; (xxi) expenses and cost reduction goals; (xxii) improvement in or attainment of working capital levels; (xxiii) economic value added (or an equivalent metric); (xxiv) market share; (xxv) cash flow; (xxvi) cash flow per share; (xxvii) cash balance; (xxviii) cash burn; (xxix) cash collections; (xxx) share price performance; (xxxi) debt reduction; (xxxii) implementation or completion of projects or processes (including, without limitation, clinical trial initiation, clinical trial enrollment and dates, clinical trial results, regulatory filing submissions, regulatory filing acceptances, regulatory or advisory committee interactions, regulatory approvals, new and supplemental indications for existing products, and product supply); (xxxiii) stockholders' equity; (xxxiv) capital expenditures; (xxxv) debt levels; (xxxvi) operating profit or net operating profit; (xxxvii) workforce diversity; (xxxviii) growth of net income or operating income; (xxxix) billings; (xl) bookings; (xli) employee retention; (xlii) initiation of phases of clinical trials and/or studies by specific dates; (xliii) acquisition of new customers, including institutional accounts; (xliv) customer retention and/or repeat order rate; (xlv) number of institutional customer accounts (xlvi) budget management; (xlvii) improvements in sample and test processing times; (xlviii) regulatory milestones; (xlix) progress of internal research or clinical programs; (l) progress of partnered programs; (li) partner satisfaction; (lii) milestones related to samples received and/or tests run; (liii) expansion of sales in additional geographies or markets; (liv) research progress, including the development of programs; (lv) submission to, or approval by, a regulatory body (including, but not limited to the FDA) of an applicable filing or a product; (lvi) timely completion of clinical trials; (lvii) milestones related to samples received and/or tests or panels run; (lviii) expansion of sales in additional geographies or markets; (lix) research progress, including the development of programs; (lx) patient samples processed and billed; (lxi) sample processing operating metrics (including, without limitation, failure rate maximums and reduction of repeat rates); (lxii) strategic partnerships or transactions (including in-licensing and out-licensing of intellectual property); (lxiii) pre-clinical development related to compound goals; (lxiv) customer satisfaction; and (lxv) and to the extent that an award is not intended to comply with Section 162(m) of the Code, other measures of performance selected by our board of directors.

Performance goals may be based on a company-wide basis, with respect to one or more business units, divisions, affiliates or business segments, and in either absolute terms or relative to the performance of one or more comparable companies or the performance of one or more relevant indices. The compensation committee our board of directors (or, to the extent that an award is not intended to qualify as "performance-based compensation" under Section 162(m) of the Code, the Plan Administrator) is authorized to make appropriate adjustments in the method of calculating the attainment of performance goals for a performance period as follows; *provided, however*, that to the extent that an award is intended to qualify as "performance-based compensation" under Section 162(m) of the Code, any such adjustment may be made only if such adjustment is objectively determinable and specified in the award agreement at the time the award is granted or in such other document setting forth the performance goals for the award at the time the performance goals are established: (i) to exclude restructuring and/or other nonrecurring charges; (ii) to exclude exchange rate effects; (iii) to exclude the effects of changes to U.S. GAAP; (iv) to exclude the effects of any statutory adjustments to corporate tax rates; (v) to exclude the effects of items that are unusual in nature or occur infrequently as determined under U.S. GAAP; (vi) to exclude the dilutive effects of acquisitions or joint ventures; (vii) to assume that any business divested by us achieved performance objectives at targeted levels during the balance of a performance period following such divestiture; (viii) to exclude the effect of any change in the outstanding shares of our common stock by reason of any stock dividend or split, stock repurchase, reorganization, recapitalization, merger, consolidation, spin-off, combination or exchange of shares or other similar corporate change, or any distributions to common stockholders other than regular cash dividends; (ix) to exclude the effects of stock based compensation and the award of bonuses under our bonus plans; (x) to exclude costs incurred in connection with potential acquisitions or divestitures that are required to be expensed under U.S. GAAP; and (xi) to exclude the goodwill and intangible asset impairment charges that are required to be recorded under U.S. GAAP.

In addition, the compensation committee of our board of directors (or, to the extent that an award is not intended to qualify as "performance-based compensation" under Section 162(m) of the Code, the Plan Administrator) retains the discretion to reduce or eliminate the compensation or economic benefit due upon the attainment of any performance goals and to define the manner of calculating the performance criteria it selects to use for a performance period.

Other Stock Awards

Other forms of stock awards valued in whole or in part by reference to, or otherwise based on, common stock may be granted either alone or in addition to other stock awards under the 2016 Plan. The Plan Administrator will have sole and complete authority to determine the persons to whom and the time or times at which such other stock awards will be granted, the number of shares of common stock to be granted and all other terms and conditions of such other stock awards.

Clawback Policy

Awards granted under the 2016 Plan will be subject to recoupment in accordance with any clawback policy that the we are required to adopt pursuant to the listing standards of any national securities exchange or association on which our securities are listed or as is otherwise required by the Dodd-Frank Wall Street Reform and Consumer Protection Act or other applicable law. In addition, the Plan Administrator may impose other clawback, recovery or recoupment provisions in an award agreement as the Plan Administrator determines necessary or appropriate, including a reacquisition right in respect of previously acquired shares of common stock or other cash or property upon the occurrence of cause.

Changes to Capital Structure

In the event of certain capitalization adjustments, the Plan Administrator will appropriately adjust: (i) the class(es) and maximum number of securities subject to the 2016 Plan and by which the share reserve may increase automatically each year; (ii) the class(es) and maximum number of securities that may be issued pursuant to the exercise of ISOs; (iii) the class(es) and maximum number of securities that may be awarded to any participant pursuant to Section 162(m) limits; (iv) the class and maximum number of shares that may be awarded to any non-employee director; and (v) the class(es) and number of securities and price per share of stock subject to outstanding stock awards.

Corporate Transaction

In the event of a corporate transaction (as defined in the 2016 Plan and described below), the Plan Administrator may take one or more of the following actions with respect to stock awards, contingent upon the closing or consummation of the corporate transaction, unless otherwise provided in the instrument evidencing the stock award, in any other written agreement between us or one of our affiliates and the participant or in our director compensation policy, or unless otherwise provided by the Plan Administrator at the time of grant of the stock award:

- arrange for the surviving or acquiring corporation (or its parent company) to assume or continue the stock award or to substitute a similar stock award for the stock award (including an award to acquire the same consideration paid to our stockholders pursuant to the corporate transaction);

- arrange for the assignment of any reacquisition or repurchase rights held by us in respect of common stock issued pursuant to the stock award to the surviving or acquiring corporation (or its parent company);

- accelerate the vesting (and, if applicable, the exercisability) of the stock award to a date prior to the effective time of the corporate transaction as determined by the Plan Administrator (or, if the Plan Administrator does not determine such a date, to the date that is five days prior to the effective date of the corporate transaction), with the stock award terminating if not exercised (if applicable) at or prior to the effective time of the corporate transaction; provided, however, that the Plan Administrator may require participants to complete and deliver to us a notice of exercise before the effective date of a corporate transaction, which is contingent upon the effectiveness of the corporate transaction;

- arrange for the lapse of any reacquisition or repurchase rights held by us with respect to the stock award;

- cancel or arrange for the cancellation of the stock award, to the extent not vested or not exercised prior to the effective time of the corporate transaction, and pay such cash consideration (including no consideration) as the Plan Administrator may consider appropriate; and

- cancel or arrange for the cancellation of the stock award, to the extent not vested or not exercised prior to the effective time of the corporate transaction, in exchange for a payment, in such form as may be determined by our board of directors equal to the excess, if any, of (i) the per share amount payable to holders of common stock in connection with the corporate transaction, over (ii) the per share exercise price under the applicable award. For clarity, this payment may be zero if the value of the property is equal to or less than the exercise price. In addition, any escrow, holdback, earnout or similar provisions in the definitive agreement for the corporate transaction may apply to such payment to the same extent and in the same manner as such provisions apply to the holders of common stock.

The Plan Administrator is not required to take the same action with respect to all stock awards or portions of stock awards or with respect to all participants. The Plan Administrator may take different actions with respect to the vested and unvested portions of a stock award.

In the event of a corporate transaction, unless otherwise provided in the instrument evidencing a performance cash award or any other written agreement between us or one of our affiliates and the participant, or unless otherwise provided by the Plan Administrator, all performance cash awards will terminate prior to the effective time of the corporate transaction.

For purposes of the 2016 Plan, a corporate transaction generally will be deemed to occur in the event of the consummation of: (i) a sale or other disposition of all or substantially all of our consolidated assets; (ii) a sale or other disposition of more than 50% of our outstanding securities; (iii) a merger, consolidation or similar transaction following which we are not the surviving corporation; or (iv) a merger, consolidation or similar transaction following which we are the surviving corporation but the shares of common stock outstanding immediately prior to the transaction are converted or exchanged into other property by virtue of the transaction.

Change in Control

Under the 2016 Plan, a stock award may be subject to additional acceleration of vesting and exercisability upon or after a change in control (as defined in the 2016 Plan and described below) as may be provided in the participant's stock award agreement, in any other written agreement with us or one of our affiliates or in any director compensation policy, but in the absence of such provision, no such acceleration will occur.

2008 Equity Incentive Plan

The Miragen 2008 Plan was adopted by Private Miragen's board of directors and approved by its stockholders in May 2008, and was subsequently amended by its board of directors and stockholders, most recently in October 2015. Upon completion of the Merger, no further awards will be made under the Miragen 2008 Plan, but all awards outstanding under the 2008 Miragen Plan as of the effective time of the Merger remain subject to the terms and conditions of the 2008 Miragen Plan.

As of December 31, 2016, there were outstanding stock options to purchase 2,320,393 shares of our common stock under the Miragen 2008 Plan. These shares reflect the exchange ratio of Private Miragen's capital stock effective as of the Merger.

78

All awards granted under the Miragen 2008 Plan that, from and after the effective date of the Merger, expire or terminate for any reason prior to exercise or settlement, are forfeited because of the failure to meet a contingency or condition required to vest, or are reacquired, withheld or not issued to satisfy a tax withholding obligation in connection with an award or to satisfy the exercise price of a stock award, will become available for grant under the 2016 Plan in accordance with its terms.

Stock Awards

The Miragen 2008 Plan provides for the grant of ISO, NSOs, stock appreciation rights, restricted stock awards and restricted stock unit awards (collectively, stock awards), all of which may be granted to employees, including officers, non-employee directors and consultants of Private Miragen. ISOs may be granted only to employees. All other awards may be granted to employees, including officers, and to non-employee directors and consultants. Private Miragen only granted stock options under the Miragen 2008 Plan.

Administration

Our board of directors or the compensation committee of our board of directors may act as the administrator of the Miragen 2008 Plan. The administrator has the complete discretion to make all decisions relating to the plan and outstanding awards. The administrator has the authority to modify outstanding awards under the Miragen 2008 Plan. Subject to the terms of the Miragen 2008 Plan, the administrator has the authority to reduce the exercise or strike price of any outstanding stock award, cancel any outstanding stock award in exchange for new stock awards, cash or other consideration, or take any other action that is treated as a repricing under U.S. GAAP, with the consent of any adversely affected participant.

Terms of Awards

Subject to the terms of the Miragen 2008 Plan, the administrator determines the terms of all awards. The exercise price for stock options granted under the Miragen 2008 Plan may not be less than 100% of the fair market value of Miragen common stock on the grant date; however, the exercise price for an incentive stock option granted to a holder of more than 10% of Miragen’s stock may not be less than 110% of such fair market value on the grant date. Options are generally transferable only by will or the laws of descent and distribution, and may be exercised during the holder’s lifetime only by the holder.

The term of options granted under the Miragen 2008 Plan may not exceed ten years and will generally expire sooner if the optionee's service terminates. Options vest at the times determined by the administrator. Shares may be awarded under the terms of the Miragen 2008 Plan in consideration for services rendered to Private Miragen, or sold under the terms of the Miragen 2008 Plan. Shares awarded or sold under the Miragen 2008 Plan may be fully vested at grant or subject to special forfeiture conditions or rights of repurchase as determined by the administrator.

Changes in Capitalization

If any change is made in the shares of common stock by reason of any merger, consolidation, reorganization, recapitalization, stock dividend, split up, combination of shares, exchange of shares, change in corporate structure, or otherwise, appropriate adjustments will be made by the administrator to the class and maximum number of shares reserved for issuance under the Miragen 2008 Plan, the class and maximum number of shares that may be issued upon the exercise of ISOs and the class and number of shares and price per share of stock subject to each outstanding award under the Miragen 2008 Plan. Any increase in the shares, or the right to acquire shares, as the result of such an adjustment will be subject to the same terms and conditions that apply to the award for which such increase was received.

Corporate Transaction

In the event of certain specified significant corporate transactions, outstanding stock awards shall be assumed, continued or substituted for similar stock awards by the surviving or acquiring corporation. If any surviving or acquiring corporation fails to assume, continue or substitute such stock awards, stock awards held by participants whose continuous service has not terminated will accelerate vesting in full prior to the corporate transaction, and all stock awards will terminate at or prior to the corporate transaction. In addition, in the event a stock award will terminate if not exercised before a corporate transaction, our board of directors may, in its sole discretion, provide that the holder of the stock award may not exercise the stock award but will receive a payment equal to the excess, if any, of (i) the value of our common stock the holder would have received upon exercise of the stock awards, over (ii) any exercise price payable by the holder in connection with the exercise.

Under the Miragen 2008 Plan, a corporate transaction is generally the consummation of (i) a sale or other disposition of all or substantially all of our consolidated assets, (ii) a sale or other disposition of at least 90% of our outstanding securities, (iii) a merger, consolidation or similar transaction following which we are not the surviving corporation, or (iv) a merger, consolidation or similar transaction following which we are the surviving corporation but the shares of our common stock outstanding immediately prior to such transaction are converted or exchanged into other property by virtue of the transaction.

Change in Control

The Miragen 2008 Plan provides that if a change in control of us occurs and as of, or within thirteen (13) months after, the effective time of such change in control, the service of an award holder is terminated due to an involuntary termination without cause (not including death or disability), or due to a voluntary termination with good reason, then the vesting and exercisability of the holder's awards will be accelerated in full. In addition, the administrator may provide, in an individual award agreement or in any other written agreement between a participant and us, that the stock award will be subject to additional acceleration of vesting and exercisability in the event of a change in control.

Under the Miragen 2008 Plan, a change of control is generally (i) the acquisition by a person or entity of more than 50% of our combined voting power other than by merger, consolidation or similar transaction; (ii) a consummated merger, consolidation or similar transaction involving us immediately after which our stockholders cease to own more than 50% of the combined voting power of the surviving entity or of its parent entity; (iii) a consummated sale, lease or exclusive license or other disposition of all or substantially of our consolidated assets; or (v) when a majority of our board of directors becomes comprised of individuals who were not serving on the board on the date of adoption of the Miragen 2008 Plan, or whose nomination, appointment, or election was not approved by a majority of the incumbent board then still in office. The Merger did not constitute a change in control for purposes of the Miragen 2008 Plan, but the change in control provisions could be triggered by a subsequent transaction

Amendment and Termination

Our board of directors may at any time amend the Miragen 2008 Plan. However, our board of directors must obtain approval of our stockholders or any amendment requiring such approval under federal tax or federal securities laws. In addition, our board of directors may not alter or impair any award previously granted under the Miragen 2008 Plan without the consent of the holder of such award. The Miragen 2008 Plan will terminate on the earliest of ten years after the date the Miragen 2008 Plan was adopted by Private Miragen's board of directors, ten years after the date Private Miragen's stockholder approved the Miragen 2008 Plan or a date determined by our board of directors.

2014 Stock Incentive Plan

Prior to our initial public offering, we adopted the 2014 Plan. On March 25, 2015, our board of directors approved an amendment to the 2014 Plan, or the 2014 Plan Amendment, which was subsequently approved by our stockholders on June 18, 2015, which increased the number of shares of our common stock reserved for issuance by 854,601 shares to 2,100,000 shares. The 2014 Plan Amendment also provides for an annual increase to the total number of shares available for issuance under the 2014 Plan, as amended, on the first day of each calendar year, beginning with January 1, 2016 and ending with the last January 1 during the initial ten-year term of the plan, equal to the lesser of (A) four

percent (4%) of the shares of our common stock outstanding (on an as-converted basis) on the last day of the immediately preceding fiscal year, and (B) such smaller number of shares of common stock as determined by our board of directors. No other amendments were made to the 2014 Plan.

As of December 31, 2016, there were outstanding stock options to purchase 37,465 shares of our common stock under the 2014 Plan.

Our board of directors terminated the 2014 Plan in February 2017 in connection with the Merger. There are no awards outstanding under the terms of the 2014 Plan and no future awards will be issued under the 2014 Plan.

Eligibility. Selected employees, officers, directors, and other individuals providing bona fide services to us or any of our affiliates, were eligible for awards under the 2014 Plan. The plan administrator could also grant awards to individuals in connection with hiring, retention, or otherwise before the date the individual first performs services for the Company or an affiliate. However, those awards would not become vested or exercisable before the date the individual first performs those services for us.

Administration. The 2014 Plan was administered by our board of directors or by a committee or committees as the board may appoint from time to time. The plan administrator had the full authority and discretion to administer the 2014 Plan and to take any action that is necessary or advisable in connection with the administration of the plan, including without limitation the authority and discretion to interpret and administer the plan and any instrument or agreement relating to the plan or any award made thereunder. The plan administrator's determinations will be final and conclusive.

Types of awards. The 2014 Plan provided for grants of stock options (including incentive stock options qualifying under Code section 422 and nonstatutory stock options), stock appreciation rights, restricted or unrestricted stock awards, restricted stock units, performance awards, other stock-based awards, or any combination of the foregoing.

Stock options. The 2014 Plan allowed the plan administrator to grant incentive stock options, as that term is defined in section 422 of the Internal Revenue Code, or nonqualified stock options. Only our employees or employees of our subsidiaries or any parent corporation may receive incentive stock option awards. Options must have an exercise price at least equal to the fair market value of the underlying shares (110% of the fair market value for incentive stock options if the grantee is a 10% holder within the meaning of Code section 422) on the date of grant. The option holder may pay the exercise price in cash or by check, by tendering shares of common stock, by a combination of cash and shares, or by any other means that the plan administrator approves. Generally, options granted under the 2014 Plan will have a 10 year term (five year term in the case of incentive stock options granted to a 10% holder), however, the options will expire earlier if the option holder's service relationship with us terminates.

80

Stock appreciation rights. The 2014 Plan allowed the plan administrator to grant awards of stock appreciation rights, which entitle the holder to receive a payment in cash, in shares of common stock, or in a combination of both, having an aggregate value equal to the spread on the date of exercise between the fair market value of the underlying shares on that date and the base price of the shares specified in the grant agreement, multiplied by the number of shares specified in the award being exercised.

Stock awards. The 2014 Plan allowed the plan administrator to grant stock awards to eligible participants in such amounts, on such terms and conditions, and for such consideration, including no consideration or minimum consideration as may be required by law. A stock award may be denominated in common stock or other securities, stock-equivalent units or restricted stock units, securities or debentures convertible into common stock, or any combination of the foregoing and may be paid in common stock or other securities, in cash, or in a combination of common stock or other securities and cash, all as determined in the sole discretion of the plan administrator.

Performance awards. The 2014 Plan allowed the plan administrator to grant performance awards which become payable in common stock or other securities, in cash, or in a combination of common stock or other securities and cash, on account of attainment of one or more performance goals established by the plan administrator.

Change in control. In the event of any transaction resulting in a “change in control” of the Company (as defined in the 2014 Plan), outstanding stock options and other awards that are payable in or convertible into our common stock terminate upon the effective time of the change in control unless provision is made in connection with the transaction for the continuation, assumption, or substitution of the awards by the surviving or successor entity or its parent. In the event of such termination the holders of stock options and other awards under the 2014 Plan will be permitted immediately before the change in control to exercise or convert all portions of awards that are then exercisable or convertible or which become exercisable or convertible upon or prior to the effective time of the change in control. In the event that a change in control occurs after a performance-based stock award has been granted but before completion of the applicable performance period, a pro rata portion of such award will become payable (or a pro rata portion of the lapse restrictions will lapse, as applicable) as of the date of the change in control to the extent otherwise earned on the basis of achievement of the pro rata portion of the performance goals and performance targets relating to the portion of the performance period completed as of the date of the change in control. All outstanding awards under the 2014 Plan were terminated in connection with the Merger.

Amendment and termination. The 2014 Plan became effective on June 17, 2014. The 2014 Plan Amendment became effective on June 18, 2015. The 2014 Plan we terminated upon the effectiveness of the Merger.

Director Compensation

Prior to our Corporate Conversion and our initial public offering, we did not pay compensation to our managers for their service on our board of managers. In connection with our initial public offering, our board of directors adopted the following compensation arrangement for our non-employee independent directors, which was in effect until August 6, 2015.

Annual Compensation

- Board retainer/meeting fees - $25,000, plus $1,000 per meeting
- Audit Committee Member Meeting Fees - $500 per meeting
- Audit Committee Chairman Retainer - $10,000
- Compensation Committee Member Meetings Fees - $500 per meeting
- Compensation Committee Chairman Retainer - $5,000
- Nominating and Corporate Governance Committee Member Meeting Fees - $500 per meeting
- Nominating and Corporate Governance Committee Chairman Retainer - $5,000

Equity Awards granted upon appointment to the Board of Directors

- Restricted Stock Unit Award - 5,500 shares
- Stock Option Award - 6,000 shares

Our Compensation Committee established the following fees for payment to members of our Board of Directors or committees, as the case may be, effective as of August 6, 2015:

Annual Compensation

- Board Member Retainer - $40,000
- Board Chairman Retainer - $30,000

- Audit Committee Member Retainer - $10,000
- Audit Committee Chairman Retainer - $20,000
- Compensation Committee Member Retainer - $7,500
- Compensation Committee Chairman Retainer - $15,000
- Nominating and Corporate Governance Committee Member Retainer - $5,000
- Nominating and Corporate Governance Committee Chairman Retainer - $10,000

Equity Awards granted upon appointment to the Board of Directors

- Stock Option Award - 25,000 shares

Beginning in 2016, the chair person and each current non-employee director received, subject to approval by our board of directors, an annual option grant as of the date of the Company's annual meeting to purchase 18,000 shares of our common stock, which grant shall vest monthly over a one-year period beginning on the date of grant and shall have an exercise price equal to the fair market value of a share of our common stock as of the date of grant and shall be subject to such other terms and conditions as set forth in the Company's form of stock option grant agreement.

In connection with the Merger, we assumed a non-employee director cash and equity compensation policy effective upon the closing of the Merger. Under this policy, we will pay each of our non-employee directors a cash stipend for service our board of directors and, if applicable, on the audit committee, compensation committee and nominating and corporate governance committee. Each of our non-employee directors will receive an additional stipend if they serve as the chairperson of the compensation committee, nominating and corporate governance committee or audit committee or serve as the non-executive chairperson. The stipends payable to each non-employee directors for service on our board of directors are as follows:

	Member Annual Service Stipend[(1)]	Chairperson Annual Service Stipend[(1)(2)]
Board of directors	$ 35,000	$ —
Audit committee	7,500	15,000
Compensation committee	5,000	10,000
Nominating and corporate governance committee	3,750	7,500
Non-Executive Chairperson	30,000	N/A

(1) Each non-employee director has the right to elect to receive all or a portion of his or her annual cash compensation under the policy in the form of either cash, quarterly restricted common stock based on the closing price of our common stock on The NASDAQ Capital Market on the date of grant, or quarterly stock options to purchase common stock based on the Black-Scholes option-pricing model as of the date of grant. Any such election will be

made before the start of the fiscal year and with any such stock options or restricted common stock elected by the directors to be vested upon grant, with stock options to expire ten years from the date of grant;

(2) Chairpersons will not receive a stipend for being a member of the applicable committee.

In addition, the cash compensation described above each member of our board of directors will receive an automatic option grant to purchase 12,000 shares (subject to adjustment for stock splits and similar matters) of our common stock at each annual meeting when such director is re-elected with an exercise price equal to the fair market value of a share of our common stock on such date. Each option grant will vest in full on the earlier of the one year anniversary of the date of grant or our next annual meeting.

Each new director elected or appointed to our board of directors will receive an initial option grant to purchase 24,000 shares (subject to adjustment for stock splits and similar matters) of our common stock upon such director's appointment or election with an exercise price equal to the fair market value of a share of our common stock on such date. Each option grant will vest in 36 equal monthly installments.

2016 Director Compensation

The table below sets forth the compensation of our non-employee directors for fiscal year 2016.

Name[1]	Fees Earned or Paid in Cash ($)	Stock Awards ($)	Option Awards[2] ($)	Total ($)
David A. Gonyer, R. Ph.	$67,500	$ —	$ 2,713	$70,213
Bennett S. LeBow	$70,000	$ —	$ 2,713	$72,713
Douglas A. Schuling	$72,500	$ —	$ 2,713	$75,213
Robin L. Smith, M.D.	$70,000	$ —	$ 2,713	$72,713

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(1) Mr. Riccitelli, our president and chief executive officer, also served as a director on our board of directors for the fiscal year ended December 31, 2016. Mr. Riccitelli's compensation for serving as our president and chief executive officer is reported in the Summary Compensation Table and other compensation tables set forth under "*Executive Compensation*." Mr. Riccitelli did not receive any additional compensation for his service on our board of directors.

(2) Each of the non-employee directors was granted a stock option to purchase 1,200 shares of common stock on June 15, 2016. The stock options vest in twelve equal monthly installments beginning on June 30, 2016. The values set forth in this column are based on the aggregate grant date fair value of the awards computed in accordance with FASB ASC Topic 718.

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

Security Ownership of Certain Beneficial Owners and Management

The following table sets forth certain information with respect to the beneficial ownership of our capital stock as of March 17, 2017 (except where otherwise indicated) for:

- each person, or group of affiliated persons, who are known by us to beneficially own more than 5% of the outstanding shares of our capital stock;
- each of our directors as of March 17, 2017;
- each of our named executive officers as of March 17, 2017; and
- all of our current directors and executive officers of as a group.

Applicable percentages are based on 21,370,063 shares outstanding on March 17, 2017, adjusted as required by rules promulgated by the SEC. Beneficial ownership is determined under SEC rules and includes sole or shared power to vote or dispose of shares of our common stock. The number and percentage of shares beneficially owned by a person or entity also include shares of common stock subject to stock options that are currently exercisable or become exercisable within 60 days of March 17, 2017. However, these shares are not deemed to be outstanding for the purpose of computing the percentage of shares beneficially owned of any other person or entity. Except as indicated in footnotes to the table below or, where applicable, to the extent authority is shared by spouses under community property laws, the beneficial owners named in the table have, to our knowledge, sole voting and dispositive power with respect to all shares of common stock shown to be beneficially owned by them based on information provided to us by such stockholders. Unless otherwise indicated, the address for each stockholder listed is: c/o Miragen Therapeutics, Inc., 6200 Lookout Road Boulder, Colorado 80301.

Name	Number of Shares Beneficially Owned	Percentage Ownership
5% or Greater Stockholders		
Entities affiliated with Atlas Venture VII, L.P.	3,948,216 (1)	18.5 %
FMR, LLC	3,124,888 (2)	14.6
Remeditex Ventures LLC	2,706,563 (3)	12.7

Entities affiliated with Boulder Ventures	2,070,910 (4)	9.7
Entities affiliated with BraMira, LLC	1,574,788 (5)	7.4
MRL Ventures Fund, LLC	1,401,214 (6)	6.6
JAFCO SV4 Investment Limited Partnership	1,201,041 (7)	5.6
Directors and Named Executive Officers		
Samuel D. Riccitelli	38,089 (8)	*
Tamara A Seymour	7,096 (9)	*
William S. Marshall, Ph.D.	557,760 (10)	2.6
Bruce L. Booth, Ph.D.	3,948,216 (1)	18.5
John W. Creecy	2,706,563 (3)	12.7
Thomas E. Hughes, Ph.D.	29,881 (11)	*
Kevin Koch, Ph.D.	4,874 (12)	*
Kyle A. Lefkoff	2,070,910 (4)	9.7
Joseph L. Turner	2,000 (13)	*
All directors and officers as a group (10 persons)	9,482,567 (14)	44.4 %

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* Represents beneficial ownership of less than 1% of class.

(1) Includes 3,142,580 shares of common stock held directly by Atlas Venture VII, L.P., or Atlas Venture VII, and 805,636 shares of common stock held directly by Atlas Venture Fund X, L.P., or Atlas Venture X. Atlas Venture Associates VII, L.P., or AVA VII LP, is the general partner of Atlas Venture VII, and Atlas Venture Associates VII, Inc., or AVA VII Inc., is the general partner of AVA VII LP. Atlas Venture Associates X, L.P., or AVA X LP, is the general partner of Atlas Venture X, and Atlas Venture Associates X, LLC, or AVA X LLC, is the general partner of AVA X LP. Bruce L. Booth is a member of our board of directors and is a director AVA VII Inc. and a member of AVA X LLC. The principal business address of (i) Atlas Venture VII is 25 First Street, Suite 303, Cambridge, MA 02141 and (ii) Atlas Venture X is 400 Technology Sq., 10th Floor, Cambridge, MA 02139.

(2) Based solely upon a Schedule 13G filed with the SEC on March 10, 2017. The address for FMR, LLC is 245 Summer Street, Boston, MA 02110.

(3) All shares are held directly by Remeditex Ventures LLC, or Remeditex. John H. Creecy is the chief executive officer of Remeditex and may be deemed to be the indirect beneficial owner of the shares owned by Remeditex. The principal business address of Remeditex is 2727 N. Harwood Street, Suite 200, Dallas, TX 75201.

(4) Includes 1,607,437 shares held by Boulder Ventures V, L.P., or Boulder Ventures V, and 463,473 shares held by Boulder Ventures VI, L.P., or Boulder Ventures VI and, collectively with Boulder Ventures V, the Boulder Ventures Funds. BV Partners V, L.L.C., or BV V, is the general partner of Boulder Ventures V. BV Partners VI, L.L.C., or BV VI, is the general partner of Boulder Ventures VI. BV V may be deemed to indirectly beneficially own the shares owned by Boulder Ventures V and BV VI may be deemed to indirectly beneficially own the shares owned by Boulder Ventures VI. Kyle A. Lefkoff, Peter A. Roshko and Jonathan L. Perl are managing members of BV V and Mr. Lefkoff, Mr. Roshko and Mr. Perl are managing members of BV VI, and each share voting and dispositive power over the shares held by the applicable Boulder Venture Funds. The principal business address of Boulder Ventures Funds is 1941 Pearl Street, Suite 300, Boulder, CO 80302.

(5) Includes 793,566 shares of common stock held directly by BraMira, LLC and 781,22 shares of common stock held directly by Brace Pharmaceuticals LLC, or the BraMira Entities. The principal business address of BraMira Entities is 155 Gibbs Street, Suite 406, Rockville, MD 20850.

(6) All shares are held directly by MRL Ventures Fund, LLC, or MRL Ventures. The principal business address of MRL Ventures is 320 Bent Street, 4th Floor, Cambridge, MA 02141.

(7) All shares are held directly by JAFCO SV4 Investment Limited Partnership, or JAFCO LP. JAFCO Co., Ltd, or JAFCO Ltd, is the general partner of JAFCO LP. The principal business address of JAFCO LP is Otemachi First Square, West Tower 11F, 1-5-1 Otemachi, Chiyoda-ku, Tokyo 100-0004 Japan.

(8) Mr. Riccitelli's service to Miragen terminated in February 2017.

(9) Ms. Seymour's service to Miragen terminated in February 2017. Includes 7,096 shares of common stock owned directly by Ms. Seymour.

(10) Includes 148,578 shares of common stock and 409,182 shares of common stock issuable upon exercise of options to purchase our common stock within 60 days of March 17, 2017.

(11) Includes 14,062 shares of common stock and 15,819 shares of common stock issuable upon exercise of options to purchase our common stock within 60 days of March 17, 2017.

(12) Includes 4,874 shares of common stock issuable upon exercise of options to purchase our common stock within 60 days of March 17, 2017.

(13) Includes 2,000 shares of common stock issuable upon exercise of options to purchase our common stock within 60 days of March 17, 2017.

(14) Includes 8,888,329 shares of common stock and 594,238 shares of common stock issuable upon exercise of options to purchase our common stock within 60 days of March 17, 2017 held by our current directors and officers, including William S. Marshall, Ph.D., Jason A. Leverone, Adam S. Levy, Paul D. Rubin, M.D., Thomas E. Hughes, Ph.D., Kevin Koch, Ph.D., Bruce L. Booth, Ph.D., Kyle A. Lefkoff, John W. Creecy and Joseph L. Turner, and their affiliates. Samuel D. Riccitelli and Tamara A. Seymour are not included among our directors and officers, as neither is a director or officer of Miragen as of March 17, 2017.

Securities Authorized for Issuance Under Equity Compensation Plans

As of December 31, 2016, we had one equity compensation plan in place under which shares of our common stock were authorized for issuance:

Plan Category

	Number of securities to be issued upon exercise of outstanding options, warrants and rights	Weighted average exercise price of outstanding options, warrants and rights	Number of securities remaining available for future issuance under equity compensation plans (excluding securities reflected in first column)
Equity compensation plans approved by stockholders	37,465 (1)	$ 28.83	67,695
Equity compensation plans not approved by stockholders	—	$ —	—
Total	37,465	$ 28.83	67,695

(1) Represents outstanding options to purchase shares of common stock.

Item 13. Certain Relationships and Related Transactions and Director Independence

Related-Person Transaction Policy and Procedures

In February 2017, we adopted a related person transaction policy that sets forth our procedures for the identification, review, consideration and approval or ratification of related person transactions. For purposes of our policy only, a related person transaction is a transaction, arrangement or relationship, or any series of similar transactions, arrangements or relationships, in which we and any related person are, were or will be participants in which the amount involved exceeds the lesser of (x) $120,000 or (y) 1% of the average of our total assets at year end for the last two completed fiscal years. Transactions involving compensation for services provided to us as an employee or director are not covered by this policy. A related person is any executive officer, director or beneficial owner of more than 5% of any class of our voting securities, including any of their immediate family members and any entity owned or controlled by such persons.

Under the policy, if a transaction has been identified as a related person transaction, including any transaction that was not a related person transaction when originally consummated or any transaction that was not initially identified as a related person transaction prior to consummation, our management must present information regarding the related person transaction to our audit committee, or, if audit committee approval would be inappropriate, to another independent body of our board of directors, for review, consideration and approval or ratification. The presentation must include a description of, among other things, the material facts, the interests, direct and indirect, of the related persons, the benefits to us of the transaction and whether the transaction is on terms that are comparable to the terms available to or from, as the case may be, an unrelated third party or to or from employees generally. Under the policy, we will collect information that we deem reasonably necessary from each director, executive officer and, to the extent feasible, significant stockholder to enable us to identify any existing or potential related-person transactions and to effectuate the terms of the policy. In addition, under our code of business conduct and ethics, our employees and directors will have an affirmative responsibility to disclose any transaction or relationship that reasonably could be expected to give rise to a conflict of interest. In considering related person transactions, our audit committee, or other independent body of our board of directors, will take into account the relevant available facts and circumstances including, but not limited to:

- the risks, costs and benefits to us;
- the impact on a director's independence in the event that the related person is a director, immediate family member of a director or an entity with which a director is affiliated;
- the availability of other sources for comparable services or products; and
- the terms available to or from, as the case may be, unrelated third parties or to or from employees generally.

The policy requires that, in determining whether to approve, ratify or reject a related person transaction, our audit committee, or other independent body of our board of directors, must consider, in light of known circumstances, whether the transaction is in, or is not inconsistent with, our best interests and those of our stockholders, as our audit committee, or other independent body of our board of directors, determines in the good faith exercise of its discretion.

Certain Related-Person Transactions

Described below are the transactions and series of similar transactions since January 1, 2016 in which:

- the amounts involved exceeded or will exceed the lesser of (x) $120,000 or (y) 1% of the average of our total assets at year end for the last two completed fiscal years; and
- any of the directors, executive officers, holders of more than 5% of our capital stock (sometimes refer to as 5% stockholders below) or any member of their immediate family had or will have a direct or indirect material interest.

Amendment to the Bennet S. Lebow Promissory Note

In connection with our initial public offering in 2014, Bennett S. LeBow advanced $1,000,000 to us to pay for certain offering expenses. Following the offering, this amount, along with an additional $45,000, which was advanced to pay for certain additional offering expenses, was reclassified as amounts due to related party on our consolidated balance sheet. This aggregate amount was non-interest bearing and due on demand.

On March 6, 2015, we issued the Note to Mr. Lebow, who was then a member of our board of directors and our largest stockholder. When issued, the terms of the Note provided (i) for a principal amount of $1,105,009, which accrued interest computed on the basis of the actual number of days elapsed in a 360-day year, at a rate per annum of 8%, (ii) that at any time on or after June 30, 2015, Mr. LeBow may demand payment of the entire outstanding principal of the Note and all unpaid interest accrued thereon and (iii) that upon the occurrence and during the continuance of any event of default by Signal under the Note, the principal balance of the Note shall accrue interest at a rate of 11%.

On October 31, 2016, prior to the execution of the Merger Agreement, we entered into the Note Amendment with Mr. LeBow. The Note Amendment (i) made the outstanding principal balance and all accrued interest on the Note, plus a premium of 11% on the outstanding balance, automatically convertible into shares our common stock immediately prior to the effective time of the Merger at a conversion price of $5.39 per share, which was the closing price of our common stock on the effective date of the Note Amendment, and (ii) modified the principal amount of the Note to $1,045,000, the original amount advanced to us as of June 17, 2014, and the interest of the Note to a rate per annum of 11% commencing on June 17, 2014, with interest computed on the basis of the actual number of days in a 360-day year. The terms of the Note Amendment were approved by our stockholders on February 10, 2017. Upon the closing of the Merger, the Note converted into 279,067 shares of our common stock.

Private Placement of Common Stock

On October 31 2016, Private Miragen entered into the Subscription Agreement with certain stockholders of Private Miragen and certain new investors pursuant to which the purchasers agreed to purchase an aggregate of 9,045,126 shares of Private Miragen's common stock at a price per share of $4.50, or 6,359,617 shares of common stock at a price per share of $6.40 as adjusted for the subsequent conversion as of the Merger Date, for an aggregate consideration of approximately $40.7 million immediately prior to the consummation of the Merger, subject to specified conditions in the Subscription Agreements. The table below sets forth the number of shares of Private Miragen's common stock agreed to be purchased and the purchase price for the shares of common stock for each purchaser that is a director, executive officer or 5% stockholder, and their affiliates. As a result of the Merger, these stockholders received 0.7031 shares of our common stock in exchange for each share of Private Miragen's common stock held immediately prior to the Merger, which is reflected in the table below.

Name of Purchaser	Shares of Common Stock Pre-Merger (#)	Shares of Common Stock Post-Merger (#)	Purchase Price ($)
Fidelity Select Portfolios: Biotechnology Portfolio[1]	3,507,819	2,466,347	$15,785,186
Fidelity Advisor Series VII: Fidelity Advisor Biotechnology Fund[1]	936,625	658,541	$4,214,813
Atlas Venture Fund X, L.P.[2]	1,145,835	805,636	$5,156,258
Boulder Ventures VI, L.P.[3]	147,419	103,650	$663,386
MRL Ventures Fund, LLC[4]	412,774	290,221	$1,857,483
JAFCO SV4 Investment Limited Partnership[5]	353,806	248,760	$1,592,127
Remeditex Ventures LLC[6]	797,308	560,587	$3,587,886
BraMira LLC[7]	1,111,111	781,222	$5,000,000

(1) Fidelity Select Portfolios: Biotechnology Portfolio and Fidelity Advisor Series VII: Fidelity Advisor Biotechnology Fund, together, hold more than 5% of our outstanding capital stock.

(2) The Atlas Venture Funds, together, hold more than 5% of our outstanding capital stock. Dr. Booth is a member of our board of directors and a director of Atlas Venture Associates VII, Inc. and Atlas Venture Associates X, Inc., which are affiliated with the Atlas Venture Funds.

(3) Boulder Ventures holds more than 5% of our outstanding capital stock. Mr. Lefkoff is a member of our board of directors and a managing member of BV Partners V, L.L.C. and BV Partners VI, L.L.C., which are each affiliated with Boulder Ventures.

(4) MRL Ventures Fund, LLC holds more than 5% of our outstanding capital stock.

(5) JAFCO SV4 Investment Limited Partnership, or JAFCO, holds more than 5% of our outstanding capital stock.

(6) Remeditex Ventures LLC holds more than 5% of our outstanding capital stock. Mr. Creecy is a member of our board of directors and the chief executive officer of Remeditex Ventures LLC.

(7) BraMira LLC, together with its affiliates, holds more than 5% of our outstanding capital stock.

Issuance of Series C Convertible Preferred Stock

In October 2015 and September 2016, Private Miragen issued and sold in two closings an aggregate of 9,268,563 shares of Private Miragen's Series C convertible preferred stock at a price per share of $4.43 for an aggregate consideration of approximately $41.1 million, inclusive of the conversion, at a price per share equal to $4.43, of approximately $8.9 million of principal and accrued interest on then outstanding convertible promissory notes previously issued by Private Miragen. The table below sets forth the number of shares of Series C convertible preferred stock purchased and the purchase price for the shares of Series C convertible preferred stock for each purchaser that is a director, executive officer or 5% stockholder, and their affiliates. Immediately prior to the closing of the Merger each outstanding share of Private Miragen's Series C convertible preferred stock converted into one share of Private Miragen's common stock. As a result of the Merger, these stockholders received 0.7031 shares of our common stock in exchange for each share of Private Miragen's common stock held immediately prior to the Merger, as presented in the table below.

Name of Purchaser	Shares of Series C Convertible Preferred Stock Pre-Merger (#)	Shares of Common Stock Post-Merger (#)	Purchase Price ($)
Atlas Venture Fund VII, L.P.[1]	1,245,502	875,712	$5,517,574
Boulder Ventures V, L.P.[2]	233,089	163,884	$1,032,584
Boulder Ventures VI, L.P.[2]	564,334	396,783	$2,500,000
MRL Ventures Fund, LLC[3]	1,580,135	1,110,992	$6,999,998
JAFCO SV4 Investment Limited Partnership[4]	1,354,402	952,280	$6,000,001
Remeditex Ventures LLC[5]	1,968,830	1,384,284	$8,721,917
BraMira LLC[6]	1,128,668	793,566	$4,999,999
William S. Marshall, Ph.D[7]	17,263	12,137	$76,475

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(1) Atlas Venture Fund VII, L.P. holds more than 5% of our outstanding capital stock. Dr. Booth is a member of our board of directors and a director of Atlas Venture Associates VII, Inc., which is affiliated with the Atlas Venture Fund VII, L.P.

(2) Boulder Ventures holds more than 5% of our outstanding capital stock. Mr. Lefkoff is a member of our board of directors and a managing member of BV Partners V, L.L.C. and BV Partners VI, L.L.C., which are each affiliated with Boulder Ventures.

(3) MRL Ventures Fund, LLC holds more than 5% of our outstanding capital stock.

(4) JAFCO holds more than 5% of our outstanding capital stock.

(5) Remeditex Ventures LLC holds more than 5% of our outstanding capital stock. Mr. Creecy is a member of our board of directors and the chief executive officer of Remeditex Ventures LLC.

(6) BraMira LLC, together with its affiliates, holds more than 5% of our outstanding capital stock.

(7) Dr. Marshall is a member of our board of directors and serves as our president and chief executive officer.

Director and Officer Indemnification and Insurance

We have entered into indemnification agreements with each of our executive officers and directors and purchased directors' and officers' liability insurance. Our indemnification agreements and bylaws require us to indemnify our directors and officers to the fullest extent permitted under Delaware law.

Director Independence

NASDAQ's listing standards require that our board of directors consist of a majority of independent directors, as determined under the applicable rules and regulations of The NASDAQ Stock Market LLC. Based upon information requested from and provided by each director concerning his or her background, employment and affiliations, including family relationships, other than Dr. Marshall by virtue of his position as our chief executive officer, our board of directors believes that each of Drs. Booth, Hughes and Koch and Messrs. Creecy, Lefkoff and Turner qualify as an independent director.

Item 14. Principal Accounting Fees and Services

The following table represents aggregate fees billed to us for the fiscal years ended December 31, 2016 and December 31, 2015, by BDO USA, LLP, or BDO, our independent registered public accounting firm.

(in thousands)	Fiscal Year Ended December 31,	
	2016	2015
Audit Fees[1]	$ 172	$ 160
Audit-related Fees[2]	—	—
Tax Fees[3]	—	—
All Other Fees[4]	33	65
Total Fees	$ 205	$ 225

(1) Audit fees consist of fees billed for professional services by BDO for audit and quarterly review of our financial statements and review of our registration statement for the Merger, and related services that are normally provided in connection with statutory and regulatory filings or engagements.

(2) Audit-Related Fees include services relating to accounting consultations and reviews and due diligence services.

(3) Tax Fees include services relating to tax compliance, tax advice, and tax planning in the United States.

(4) Services associated with SEC registration statements, periodic reports, and other documents filed with the SEC, or other documents issued in connection with securities offerings.

88

All fees described above were pre-approved by our audit committee.

Pre-Approval Policies and Procedures

BDO serves as our independent registered public accounting firm for the year ended December 31, 2016 and has served in that capacity since July 15, 2013. The decision to engage BDO as our independent registered public accounting firm was approved by our audit committee.

Our audit committee considered the independence of BDO and whether the audit and non-audit services BDO provides to us are compatible with maintaining that independence. Our audit committee has adopted a set of policies governing the provision of non-audit services by BDO. Our audit committee has adopted procedures by which our audit committee must approve in advance all services provided by and fees paid to our independent registered public accounting firm. The advance approval requirement was not waived in any instance during the past fiscal year.

PART IV

Item 15. Exhibits and Financial Statement Schedules

(a)(1) Financial Statements

The financial statements required by this item are submitted in a separate section beginning on page F-1 of this annual report.

(a)(2) Financial Statement Schedules

Financial statement schedules have been omitted because they are either not required, not applicable, or the information is otherwise included.

(a)(3) Exhibits

The exhibits listed below are required by Item 601 of Regulation S-K. Each management contract or compensatory plan or arrangement required to be filed as an exhibit to this Annual Report has been identified.

Exhibit Number	Description of Exhibit
2.1^	Agreement and Plan of Merger, dated as of October 31, 2016, by and among Registrant, Signal Merger Sub, Inc. and Private Miragen (incorporated by reference to Exhibit 2.1 to the Registrant's Current Report on Form 8-K (File No. 001-36483), as filed with the SEC on November 1, 2016).
2.2^	Form of Support Agreement, by and between Registrant and certain directors, officers and stockholders of Private Miragen (incorporated by reference to Exhibit 2.2 to the Registrant's Current Report on Form 8-K (File No. 001-36483), as filed with the SEC on November 1, 2016).
2.3^	Form of Support Agreement, by and between Private Miragen and certain directors, officers and stockholders of Registrant (incorporated by reference to Exhibit 2.3 to the Registrant's Current Report on Form 8-K (File No. 001-36483), as filed with the SEC on November 1, 2016).
2.4^	

	Subscription Agreement, dated as of October 31, 2016, by and among Private Miragen and each purchaser listed on Annex A thereto (incorporated by reference to Exhibit 2.4 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
2.5^	Intellectual Property Purchase Agreement, dated as of November 29, 2016 by and between Registrant and Quest Diagnostics Investments LLC (incorporated by reference to Exhibit 2.5 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
3.1	Certificate of Incorporation of the Registrant (incorporated by reference to Exhibit 3.1 to the Registrant's Quarterly Report on Form 10-Q (No. 001-36483), as filed with the SEC on August 14, 2014).
3.2	Certificate of Amendment of Certificate of Incorporation of the Registrant (incorporated by reference to Exhibit 3.3 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
3.3	Certificate of Amendment of Certificate of Incorporation of the Registrant (incorporated by reference to Exhibit 3.1 to the Registrant's Current Report on Form 8-K (File No. 001-36483), as filed with the SEC on February 13, 2017).
3.4	Certificate of Amendment of Certificate of Incorporation of the Registrant (incorporated by reference to Exhibit 3.2 to the Registrant's Current Report on Form 8-K (File No. 001-36483), as filed with the SEC on February 13, 2017).
3.5	Amended and Restated Bylaws of the Registrant (incorporated by reference to Exhibit 3.1 to the Registrant's Quarterly Report on Form 10-Q (No. 001-36483), as filed with the SEC on August 15, 2016).
3.6	Amendment to the Amended and Restated Bylaws of the Registrant (incorporated by reference to Exhibit 3.3 to the Registrant's Current Report on Form 8-K (File No. 001-36483), as filed with the SEC on February 13, 2017).
3.7	Certificate of Ownership and Merger of the Registrant (incorporated by reference to Exhibit 3.4 to the Registrant's Current Report on Form 8-K (File No. 001-36483), as filed with the SEC on February 13, 2017).
4.1	Specimen Common Stock Certificate (incorporated by reference to Exhibit 4.1 to the Registration Statement on Form S-1 (No. 333-194668), as filed with the SEC on March 19, 2014).
10.1	Form of Indemnification Agreement between Registrant and each of its directors and executive officers (incorporated by reference to Exhibit 10.14 to the Registrant's Registration Statement on Form S-1 (No. 333-194668), as filed with the SEC on March 19, 2014).
10.2*	2014 Stock Incentive Plan (incorporated by reference to Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q (No. 001-36483), as filed with the SEC on August 14, 2014).
10.3*	First Amendment to the Registrant's 2014 Stock Incentive Plan (incorporated by reference to Exhibit 10.1 to the Registrant's Current Report on Form 8-K (No. 001-36483), as filed with the SEC on June 23, 2015).

Exhibit Number	Description of Exhibit
10.4*	Amended and Restated Employment Agreement, dated June 17, 2014, by and between Registrant and Samuel D. Riccitelli (incorporated by reference to Exhibit 10.4 to the Registrant's Quarterly Report on Form 10-Q (No. 001-36483), as filed with the SEC on August 14, 2014).
10.5*	Employment Agreement, dated August 4, 2014, by and between Registrant and Tamara A. Seymour (incorporated by reference to Exhibit 10.1 to the Registrant's Current Report on Form 8-K (No. 001-36483), as filed with the SEC on July 23, 2014).
10.6*	Amendment to Amended and Restated Employment Agreement, dated July 23, 2014, by and between Registrant and Samuel D. Riccitelli (incorporated by reference to Exhibit 10.2 to the Registrant's Current Report on Form 8-K (No. 001-36483), as filed with the SEC on July 23, 2014).
10.7	Unsecured Demand Promissory Note by and between Registrant and Bennett LeBow, dated March 6, 2015(incorporated by reference to Exhibit 10.29 to the Registrant's Annual Report on Form 10-K (No. 001-36483), as filed with the SEC on March 27, 2015).
10.8	Controlled Equity OfferingSM Sales Agreement, dated July 10, 2015, by and between Registrant and Cantor Fitzgerald & Co. (incorporated by reference to Exhibit 1.2 to the Registrant's Registration Statement on Form S-3 (No. 333-205620), as filed with the SEC on July 10, 2015).
10.9*	Second Amendment to the Registrant's 2014 Stock Incentive Plan (incorporated by reference to Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q (File No. 001-36483), as filed with the SEC on August 15, 2016).
10.10	Amendment to Unsecured Demand Promissory Note, dated as of October 31, 2016, by and between Registrant and Bennett LeBow (incorporated by reference to Exhibit 10.1 to the Registrant's Current Report on Form 8-K (File No. 001-36483), as filed with the SEC on November 1, 2016).
10.11*	Form of Indemnity Agreement between Registrant and each of its directors and executive officers (incorporated by reference to Exhibit 10.32 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.12*	Employment Agreement by and between Registrant and William S. Marshall, Ph.D., dated as of December 2, 2016 (incorporated by reference to Exhibit 10.33 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended)
10.13*	Employment Agreement by and between Registrant and Jason A. Leverone, dated as of December 2, 2016 (incorporated by reference to Exhibit 10.34 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended)
10.14*	Employment Agreement by and between Registrant and Adam S. Levy, dated as of December 2, 2016 (incorporated by reference to Exhibit 10.35 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended)
10.15*	Employment Agreement by and between Registrant and Paul D. Rubin, M.D., dated as of December 2, 2016 (incorporated by reference to Exhibit 10.36 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended)
10.16*	Form of 2016 Equity Incentive Plan (incorporated by reference to Exhibit 10.37 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.17*	Form of Stock Option Grant Notice and Stock Option Agreement under 2016 Equity Incentive Plan (incorporated by reference to Exhibit 10.38 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.18*	Form of 2016 Employee Stock Purchase Plan (incorporated by reference to Exhibit 10.39 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).

10.19	Lease by and between Registrant and Crestview, LLC, dated as of December 16, 2010 (incorporated by reference to Exhibit 10.40 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.19.1	First Addendum to Lease by and between Registrant and Crestview, LLC, dated as of February 18, 2015 (incorporated by reference to Exhibit 10.40.1 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.19.2	Second Addendum to Lease by and between Registrant and Crestview, LLC, dated as of October 23, 2015 (incorporated by reference to Exhibit 10.40.2 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.20†	Exclusive Patent License Agreement, dated as of April 16, 2008, by and between Registrant and Board of Regents of The University of Texas System (incorporated by reference to Exhibit 10.41 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).

Exhibit Number	Description of Exhibit
10.21†	Exclusive Patent License Agreement, dated as of April 16, 2008, by and between Registrant and Board of Regents of The University of Texas System (incorporated by reference to Exhibit 10.42 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.22†	License and Collaboration Agreement, dated as of October 20, 2010, by and between Registrant and T2Cure GmbH (incorporated by reference to Exhibit 10.43 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.22.1	Amendment No. 1 to License and Collaboration Agreement, dated as of July 8, 2014, by and between Registrant and T2cure GmbH (incorporated by reference to Exhibit 10.43.1 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.23†	Amended and Restated License Agreement, dated as of December 31, 2012, by and between Registrant and Santaris Pharma A/S (incorporated by reference to Exhibit 10.44 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.24†	License and Collaboration Agreement, dated as of October 12, 2011, by and between Registrant and Les Laboratoires Servier, on the first part, and Institut de Recherches Servier, on the second part (incorporated by reference to Exhibit 10.45 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.25.1†	First Amendment of the License and Collaboration Agreement, effective as of May 13, 2013, by and between Registrant and Les Laboratoires Servier, on the first part, and Institut de Recherches Servier, on the second part (incorporated by reference to Exhibit 10.45.1 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.25.2†	Second Amendment of the License and Collaboration Agreement, effective as of April 10, 2014, by and between Registrant and Les Laboratoires Servier, on the first part, and Institut de Recherches Servier, on the second part (incorporated by reference to Exhibit 10.45.2 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.25.3†	Third Amendment of the License and Collaboration Agreement, effective as of May 28, 2015, by and between Registrant and Les Laboratoires Servier, on the first part, and Institut de Recherches Servier, on the second part (incorporated by reference to Exhibit 10.45.3 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.25.4	Fourth Amendment of the License and Collaboration Agreement, effective as of September 22, 2016, by and between Registrant and Les Laboratoires Servier, on the first part, and Institut de Recherches Servier, on the second part (incorporated by reference to Exhibit 10.45.4 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.26†	Exclusive Patent License Agreement, dated as of May 10, 2016, by and between Registrant and The Brigham and Women's Hospital, Inc. (incorporated by reference to Exhibit 10.46 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.27	Loan and Security Agreement, dated as of April 30, 2015, by and between Registrant and Silicon Valley Bank (incorporated by reference to Exhibit 10.47 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.27.1	First Loan Modification Agreement, dated as of December 22, 2016, by and between Registrant and Silicon Valley Bank (incorporated by reference to Exhibit 10.47.1 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.28	Registrant 2008 Equity Incentive Plan (incorporated by reference to Exhibit 10.8 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as

	amended).
10.29*	Form of Stock Option Grant Notice and Stock Option Agreement under the Registrant 2008 Equity Incentive Plan (incorporated by reference to Exhibit 10.49 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.30*	Non-Employee Director Compensation Policy (incorporated by reference to Exhibit 10.50 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
10.31†	Research Subaward Agreement, dated as of October 1, 2016, by and between Registrant and Yale University, as amended (incorporated by reference to Exhibit 10.51 to the Registrant's Registration Statement on Form S-4 (File No. 333-214893), as filed with the SEC on December 2, 2016, as amended).
21.1	Subsidiaries of the Registrant.
23.1	Consent of BDO USA, LLP.

Exhibit Number	Description of Exhibit
24.1	Power of Attorney (included on signature page hereto).
31.1	Certification of Principal Executive Officer pursuant to Rule13a-14(a) and Rule 15d-14(a) of the Securities and Exchange Act, as amended.
31.2	Certification of Principal Financial Officer pursuant to Rule13a-14(a) and Rule 15d-14(a) of the Securities and Exchange Act, as amended.
32.1**	Certification of Principal Executive Officer and Principal Financial Officer pursuant to 18 U.S.C. 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
101.INS***	XBRL Instance Document
101.SCH***	XBRL Taxonomy Extension Schema Document
101.CAL***	XBRL Taxonomy Extension Calculation Linkbase Document
101.DEF***	XBRL Taxonomy Extension Definition Linkbase Document
101.LAB***	XBRL Taxonomy Extension Label Linkbase Document
101.PRE***	XBRL Taxonomy Extension Presentation Linkbase Document

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^ The schedules and exhibits to this exhibit have been omitted pursuant to Item 601(b)(2) of Regulation S-K. A copy of any omitted schedule and/or exhibit will be furnished to the SEC upon request.

† Confidential treatment granted as to portions of the exhibit. Confidential materials omitted and filed separately with the SEC.

* Management contract or compensatory plans or arrangements.

** This certification is being furnished pursuant to 18 U.S.C. Section 1350, and is not being filed for purposes of Section 18 of the Securities Exchange Act of 1934, as amended, and is not to be incorporated by reference into any filing of the Registrant, whether made before or after the date hereof.

*** In accordance with Rule 406T of Regulation S-T, the Interactive Data Files in Exhibit 101 are deemed not filed or part of a registration statement or prospectus for purposes of Sections 11 or 12 of the Securities Act of 1933, as amended, are deemed not filed for purposes of Section 18 of the Exchange Act of 1934, as amended, and otherwise are not subject to liability under these sections.

Item 16. Form 10-K Summary

None.

93

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this Annual Report to be signed on its behalf by the undersigned, thereunto duly authorized.

Date: March 24, 2017 MIRAGEN THERAPEUTICS, INC.

By: /s/ William S. Marshall, Ph.D.
William S Marshall, Ph.D., Chief Executive Officer

KNOW ALL PERSONS BY THESE PRESENTS, that each person whose signature appears below constitutes and appoints William S. Marshall and Jason A. Leverone, and each of them, as his attorneys-in-fact, with the power of substitution, for him in any and all capacities, to sign any amendments to this Annual Report, and to file the same, with exhibits thereto and other documents in connection therewith with the Securities and Exchange Commission, hereby ratifying and confirming all that said attorneys-in-fact, and each of them, or his substitute or substitutes may do or cause to be done by virtue hereof.

Pursuant to the requirements of the Securities Exchange Act of l934, this Annual Report has been signed below by the following persons on behalf of the Registrant and in the capacities and on the dates indicated.

Signature	**Title**	**Date**
/s/ William S. Marshall, Ph.D. **William S Marshall, Ph.D.**	Chief Executive Officer and Director (Principal Executive Officer)	March 24, 2017
/s/ Jason A. Leverone **Jason A. Leverone**	Chief Financial Officer, Treasurer and Secretary (Principal Financial Officer; Principal Accounting Officer)	March 24, 2017
/s/ Bruce L. Booth, Ph.D. **Bruce L. Booth, Ph.D.**	Chairman of the Board	March 24, 2017

/s/ John W. Creecy **John W. Creecy**	Director	March 24, 2017
/s/ Thomas E. Hughes, Ph.D. **Thomas E. Hughes, Ph.D.**	Director	March 24, 2017
/s/ Kevin Koch, Ph.D. **Kevin Koch, Ph.D.**	Director	March 24, 2017
/s/ Joseph L. Turner **Joseph L. Turner**	Director	March 24, 2017
/s/ Kyle A. Lefkoff **Kyle A. Lefkoff**	Director	March 24, 2017

SIGNAL GENETICS, INC.

CONSOLIDATED FINANCIAL STATEMENTS

INDEX

Report of Independent Registered Public Accounting Firm

Board of Directors and Stockholders

Miragen Therapeutics, Inc. (Formerly known as Signal Genetics, Inc.)

Boulder, Colorado

We have audited the accompanying consolidated balance sheets of Miragen Therapeutics, Inc. (formerly known as Signal Genetics, Inc.) and Subsidiary (the "Company") as of December 31, 2016 and 2015 and the related consolidated statements of operations, changes in stockholders' equity (deficit), and cash flows for each of the two years in the period ended December 31, 2016. These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on these financial statements based on our audits.

We conducted our audits in accordance with the standards of the Public Company Accounting Oversight Board (United States). Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. The Company is not required to have, nor were we engaged to perform, an audit of its internal control over financial reporting. Our audits included consideration of internal control over financial reporting as a basis for designing audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control over financial reporting. Accordingly, we express no such opinion. An audit also includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements, assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of Miragen Therapeutics, Inc. (formerly known as Signal Genetics, Inc.) and Subsidiary at December 31, 2016 and 2015, and the results of their operations and their cash flows for each of two years in the period ended December 31, 2016, in conformity with accounting principles generally accepted in the United States of America.

On February 13, 2017, the Stockholders of the Company voted to approve a sale of principally all the assets of the Company and merge the remaining assets with Miragen Therapeutics, Inc. See Note 1 for discussion.

/s/ BDO USA, LLP

San Diego, CA

March 24, 2017

SIGNAL GENETICS, INC.

CONSOLIDATED BALANCE SHEETS

(in thousands, except share and par value data)

	December 31, 2016	December 31, 2015
ASSETS		
Current assets:		
Cash and cash equivalents	$3,341	$10,832
Accounts receivable, net	524	394
Inventory	64	187
Fixed assets held for sale	170	—
Prepaid expenses and other current assets	160	321
Total current assets	4,259	11,734
Property and equipment, net	—	1,153
Security deposits	—	15
Total assets	$4,259	$12,902
LIABILITIES AND STOCKHOLDERS' EQUITY (DEFICIT)		
Current liabilities:		
Accounts payable	$159	$242
Accrued liabilities	3,377	1,018
Note payable – related party	1,045	1,105
Other current liabilities	4	103
Total current liabilities	4,585	2,468
Other noncurrent liabilities	—	24
Commitments and contingencies		
Stockholders' equity (deficit):		
Preferred stock, $0.01 par value, 5,000,000 shares authorized, no shares issued or outstanding at December 31, 2016 or 2015	—	—
Common stock, $0.01 par value, 50,000,000 shares authorized, 742,293 and 709,024 shares issued and outstanding at December 31, 2016 and 2015, respectively	7	7
Additional paid in capital	30,309	28,371
Accumulated deficit	(30,642)	(17,968)
Total stockholders' equity (deficit)	(326)	10,410
Total liabilities and stockholders' equity (deficit)	$4,259	$12,902

See accompanying notes to consolidated financial statements.

F-3

SIGNAL GENETICS, INC.

CONSOLIDATED STATEMENTS OF OPERATIONS

(in thousands, except share and per share data)

	Years Ended December 31,	
	2016	2015
Net revenue	$ 3,337	$ 2,538
Operating expenses:		
Cost of revenue	2,548	2,472
Research and development	888	1,002
Selling and marketing	1,669	2,559
General and administrative	7,906	7,692
Exit costs	2,037	—
Asset impairment charges	797	—
Total operating expenses	15,845	13,725
Loss from operations	(12,508)	(11,187)
Other expense:		
Interest expense	(95)	(141)
Loss on extinguishment of debt	(71)	—
Total other expense	(166)	(141)
Net loss	$ (12,674)	$ (11,328)
Net loss per common share, basic and diluted	$ (17.58)	$ (21.02)
Weighted-average number of shares outstanding, basic and diluted	721,415	539,460

See accompanying notes to consolidated financial statements.

SIGNAL GENETICS, INC.

CONSOLIDATED STATEMENTS OF CHANGES IN STOCKHOLDERS' EQUITY (DEFICIT)

(in thousands, except share data)

	Common Stock		Additional Paid-in	Accumulated	Total Stockholders'
	Shares	Amount	Capital	Deficit	Equity (Deficit)
Balance, December 31, 2014	252,174	$ 3	$ 12,628	$ (6,640)	$ 5,991
Public offerings of common stock, net of costs to issue	428,762	4	12,761	—	12,765
Fair value of warrants and option for overallotment shares to underwriters issued in connection with public stock offering	—	—	330	—	330
Stock-based compensation	—	—	3,015	—	3,015
Shares issued under employee stock incentive plan, net of shares repurchased to satisfy tax withholding obligations	28,088	—	(363)	—	(363)
Net loss	—	—	—	(11,328)	(11,328)
Balance, December 31, 2015	709,024	7	28,371	(17,968)	10,410
Stock-based compensation	—				