DICERNA PHARMACEUTICALS INC

FORM 10-K
(Annual Report)

Filed 03/12/15 for the Period Ending 12/31/14

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Table of Contents

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, DC 20549

Form 10-K

☒ **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934.**
For the fiscal year ended December 31, 2014
or

☐ **TRANSITION REPORTS PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934.**

For the transition period from to
Commission File Number: 001-36281

DICERNA PHARMACEUTICALS, INC.
(Exact name of registrant as specified in its charter)

Delaware	**20-5993609**
(State or other jurisdiction of incorporation or organization)	**(IRS Employer Identification No.)**

87 Cambridgepark Drive Cambridge, MA 02140
(Address of principal executive offices and zip code)
(617) 621-8097
(Registrant's telephone number, including area code)

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

Title of Each Class	**Name of Each Exchange on Which Registered**
Common Stock, $0.0001 par value	**The NASDAQ Global Select 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 (§ 229.405) is not contained herein, and will not be contained, to the best of registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. ☐

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, or a smaller reporting company. See the definitions of "large accelerated filer," "accelerated filer" and "smaller reporting company" in Rule 12b-2 of the Exchange Act. (Check one):

Large accelerated filer ☐ Accelerated filer ☐

Non-accelerated filer ☒ (Do not check if a smaller reporting company) Smaller reporting company ☐

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

Based on the closing price of the registrant's Common Stock on the last business day of the registrant's most recently completed second fiscal quarter, which was June 30, 2014, the aggregate market value of its shares (based on a closing price of $22.57 per share) held by non-affiliates was approximately $118.8 million. Shares of the registrant's Common Stock held by each executive officer and director and by each entity or person that owned five percent or more of the registrant's outstanding Common Stock were 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 11, 2015, there were 17,820,985 shares of common stock outstanding.

Table of Contents

DICERNA PHARMACEUTICALS, INC.

2014 ANNUAL REPORT ON FORM 10-K

TABLE OF CONTENTS

Forward-Looking Statements

This Annual Report on Form 10-K includes "forward-looking statements" within the meaning of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended. All statements other than statements of historical fact are "forward-looking statements" for purposes of this Annual Report on Form 10-K. In some cases, you can identify forward-looking statements by terminology such as "may," "could," "will," "would," "should," "expect," "plan," "anticipate," "believe," "estimate," "intend," "predict," "seek," "contemplate," "project," "continue," "potential," "ongoing" or the negative of these terms or other comparable terminology. These forward-looking statements include, but are not limited to, statements about:

- the initiation, timing, progress and results of our research and development programs, preclinical studies, any clinical trials and Investigational New Drug (IND) application, New Drug Application (NDA) and other regulatory submissions;
- our ability to identify and develop product candidates for treatment of additional disease indications;
- our or a collaborator's ability to obtain and maintain regulatory approval of any of our product candidates;
- the rate and degree of market acceptance of any approved products candidates;
- the commercialization of any approved product candidates;
- our ability to establish and maintain additional collaborations and retain commercial rights for our product candidates in the collaborations;
- the implementation of our business model and strategic plans for our business, technologies and product candidates;
- our estimates of our expenses, ongoing losses, future revenue and capital requirements;
- our ability to obtain additional funds for our operations;
- our ability to obtain and maintain intellectual property protection for our technologies and product candidates and our ability to operate our business without infringing the intellectual property rights of others;
- our reliance on third parties to conduct our preclinical studies or any future clinical trials;
- our reliance on third party supply and manufacturing partners to supply the materials and components for, and manufacture, our research and development, preclinical and clinical trial drug supplies;
- our ability to attract and retain qualified key management and technical personnel;
- our dependence on our existing collaborator, Kyowa Hakko Kirin Co., Ltd. (KHK), for developing, obtaining regulatory approval for and commercializing product candidates in the collaboration;
- our receipt and timing of any milestone payments or royalties under our research collaboration and license agreement with KHK or arrangement with any future collaborator;
- our expectations regarding the time during which we will be an emerging growth company under the Jumpstart Our Business Startups Act;
- our financial performance; and
- developments relating to our competitors or our industry.

These statements relate to future events or to our future financial performance and involve known and unknown risks, uncertainties and other factors that may cause our actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by these

forward-looking statements. Factors that may cause actual results to differ materially from current expectations include, among other things, those set forth in Part I, Item 1A “Risk Factors” below and for the reasons described elsewhere in this Annual Report on Form 10-K. Any forward-looking statement in this Annual Report on Form 10-K reflects our current view with respect to future events and is subject to these and other risks, uncertainties and assumptions relating to our operations, results of operations, industry and future growth. Given these uncertainties, you should not place undue reliance on these forward-looking statements. Except as required by law, we assume no obligation to update or revise these forward-looking statements for any reason, even if new information becomes available in the future.

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

Except where the context otherwise requires, in this Annual Report on Form 10-K, “we,” “us,” “our” and the “Company” refer to Dicerna Pharmaceuticals, Inc. and, where appropriate, its consolidated subsidiary.

Trademarks

This Annual Report on Form 10-K includes trademarks, service marks and trade names owned by us or other companies. All trademarks, service marks and trade names included in this Annual Report on Form 10-K are the property of their respective owners.

PART I

Item 1. *Business*

We are an RNA interference-based biopharmaceutical company focused on the discovery and development of innovative treatments for rare inherited diseases involving the liver and for cancers that are genetically defined. We are using our RNA interference (RNAi) technology platform to build a broad pipeline in these therapeutic areas. In both rare diseases and oncology, we are pursuing targets that have historically been difficult to inhibit using conventional approaches, but where we believe connections between targets and diseases are well understood and documented. We aim to discover, develop and commercialize these novel therapeutics either on our own or in collaboration with pharmaceutical partners. In indications such as rare diseases in which a small sales force will suffice, we seek to retain substantially all commercial rights in key markets. In oncology and other more prevalent disease areas, we may partner our products while seeking to retain significant portions of the commercial rights. We have partnered two of our oncology development programs with the global pharmaceutical company Kyowa Hakko Kirin Co., Ltd. (KHK). We are eligible to receive royalties on worldwide net sales for these product candidates. In addition, we have an option to co-promote, in the U.S., a therapeutic targeting the KRAS gene for an equal share of the profits from U.S. net sales.

In choosing which development programs to advance, we apply scientific, clinical, and commercial criteria that we believe allow us to best leverage our RNAi platform and maximize value for our company. Our current development programs are as follows.

- **DCR-PH1 for Primary Hyperoxaluria Type 1 (PH1).** We are developing DCR-PH1 for the treatment of PH1 by targeting the gene encoding the liver enzyme glycolate oxidase. PH1 is known to afflict an estimated one to three people per million of population, and may afflict as many as six to eight people per million of population, and causes severe renal disease and early mortality. In pre-clinical studies, we have shown that, by using our RNAi technology to inactivate the gene encoding glycolate oxidase, we can significantly reduce oxalate levels, the key pathology of PH1. We intend to begin clinical trials for DCR-PH1 in mid to late 2015. We expect to announce initial proof-of-concept clinical data in late 2015.
- **Other rare inherited diseases involving the liver.** We are investigating a number of other rare diseases involving genes expressed in the liver. We have selected these diseases and disease target genes based on criteria that include having a strong therapeutic hypothesis, a readily-identified patient population, the availability of predictive biomarkers, high unmet medical need, favorable competitive positioning, and a rapid projected path to approval.
- **DCR-MYC for MYC-related cancers.** We are developing DCR-MYC for the treatment of various cancers by targeting the MYC gene. Multiple lines of genetic evidence implicate MYC in the initiation and progression of tumors, including natural variations in the MYC gene that predispose to certain types of cancer, and frequent genetic amplification and overexpression of MYC within tumors. In preclinical studies, inhibition of the MYC gene with DCR-MYC has shown strong anti-tumor effects in animal models of human cancers. In the second quarter of 2014, we initiated a multi-center, dose-escalating Phase 1 clinical study of DCR-MYC to assess the safety and tolerability of DCR-MYC in patients with solid tumors, multiple myeloma, or lymphoma who are refractory or unresponsive to standard therapies. In fourth quarter of 2014, we initiated a global Phase 1b/2 clinical trial of DCR-MYC in patients with advanced hepatocellular carcinoma (HCC). We expect to announce initial proof-of-concept data from the first Phase 1 study in mid to late 2015.
- **Two product candidates in collaboration with KHK, including one for KRAS-related cancers.** We are developing, in collaboration with KHK, a therapeutic targeting the KRAS oncogene, a gene that is frequently mutated in numerous cancers, including non-small cell lung cancer, colorectal cancer and pancreatic cancer. Such mutations are associated with aggressive disease and resistance to current

therapies. We are also developing, with KHK, a therapeutic targeting a second cancer-related gene, which we are not identifying at this time. KHK is responsible for all preclinical and clinical development activities, including the selection of patient population and disease indications for clinical trials.

Our drug discovery and development efforts are based on the therapeutic modality of RNAi, a highly potent and specific mechanism for silencing the activity of a targeted gene. In this naturally occurring biological process, double-stranded RNA molecules induce the enzymatic destruction of the messenger RNA (mRNA) of a target gene that contains sequences that are complementary to one strand of the therapeutic double-stranded RNA molecule. Our approach is to design proprietary double-stranded RNA molecules that engage the enzyme Dicer and initiate an RNAi process to silence a specific target gene. We refer to these proprietary molecules generally as Dicer substrate short interfering RNAs (DsiRNAs), or as DsiRNA or DsiRNA-EX molecules, depending on the specific structure.

RNAi therapeutics represent a novel advance in drug development. Historically, the pharmaceutical industry has developed small molecules or antibodies to inhibit the activity of disease-causing proteins. This approach is effective for many diseases; nevertheless, many proteins cannot be inhibited by either small molecules or antibodies. Some proteins lack the binding pockets small molecules require for interaction. Other proteins are solely intracellular and therefore inaccessible to antibody-based therapeutics which are limited to cell surface and extracellular proteins.

The novel advantage of RNAi is that instead of targeting proteins, RNAi goes upstream to silence the genes themselves. In 2006, the Nobel Prize was awarded for the discovery of RNAi. That same year we incorporated with the goal of developing RNAi-based therapeutics for previously “undruggable” disease target genes. Rather than seeking to inhibit a protein directly, the better approach may be to prevent its creation in the first place.

We believe our approach to RNAi drug development provides the following qualities and advantages compared to other methods of inducing RNAi.

- **We initiate RNAi through the Dicer enzyme.** DsiRNA and DsiRNA-EX molecules are structured to be processed by the enzyme Dicer, the initiation point for RNAi in the human cell cytoplasm. Unlike earlier generation RNAi molecules, which mimic the output product of Dicer processing, DsiRNA and DsiRNA-EX molecules enter the RNAi pathway prior to Dicer processing. This can result in preferential use of the correct strand of a double-stranded RNA molecule, and therefore increase the efficacy of the RNAi mechanism. We believe this benefit increases the potency of our DsiRNA and DsiRNA-EX molecules compared to other RNAi-inducing molecules. In addition, due to processing by the Dicer enzyme, our DsiRNA and DsiRNA-EX molecules have multiple sites for chemical modification and conjugation compared to earlier RNAi technologies. At these sites we can use modifications that enhance the drug-like properties on our molecules. Specifically, we can employ modifications that enhance the pharmacokinetic profile and/or suppress immunostimulatory activity.
- **Our DsiRNA-EX Conjugates enable subcutaneous delivery to the liver.** We have developed a proprietary subcutaneous conjugate-based delivery technology for our DsiRNA-EX molecules that enables delivery to hepatocytes in the liver. This technology involves conjugation of a hepatocyte-targeting ligand to the extended portion of our DsiRNA-EX molecules, and we term the entire construct a DsiRNA-EX Conjugate. This technology is well-suited to our focus on rare inherited diseases involving the liver and can generally be applied to disease target genes and viral pathogens in the liver. We intend to use DsiRNA-EX Conjugates in all future programs involving targets in the liver.
- **Our EnCore lipid nanoparticle technology enables delivery to solid tumors.** We have developed our proprietary EnCore lipid nanoparticle (LNP) technology for delivery of DsiRNA and DsiRNA-EX molecules to tumors. The EnCore system is engineered to accumulate in tumors and mediate delivery of DsiRNA and DsiRNA-EX molecules into tumor cells. We have extensive pre-clinical data, in multiple animal models of human tumors, of effective RNAi delivery mediated by the EnCore system.

We utilize this delivery system in our DCR-MYC program and intend to utilize it for future programs in oncology.

We believe we have a robust patent portfolio covering our proprietary RNAi platform. As of February 1, 2015, our patent estate included over 20 issued patents and over 70 pending patent applications covering our DsiRNA and DsiRNA-EX payload technologies and our lipid nanoparticle and conjugate delivery technologies.

Our executive management team has extensive experience in the biopharmaceutical industry. In addition, various members of our management team and our board of directors have contributed to the progress of the RNAi field through their substantial involvement in companies such as Alnylam Pharmaceuticals Inc. (Alnylam), Genta Inc., Genzyme Inc., GlaxoSmithKline plc, Pfizer Inc., Sirna Therapeutics Inc. and other companies. Our co-founder and chief executive officer, Douglas M. Fambrough III, Ph.D., was a lead venture capital investor and board member of Sirna Therapeutics, an early RNAi company acquired by Merck & Co., Inc. in 2006 for $1.1 billion. He played a pivotal role in the restructuring of Ribozyme Pharmaceuticals into Sirna Therapeutics, the management of the company as a member of its Board of Directors, and the execution of its 2006 acquisition by Merck & Co., Inc.

Strategy

We are committed to delivering transformative RNAi-based therapies to patients with rare inherited diseases involving the liver and for cancers that are genetically defined. The key elements of our strategy are as follows.

- **Validate our product candidates and our platform in clinical proof-of-concept studies.** In 2014, we initiated a Phase 1 study of DCR-MYC in patients with solid tumors, multiple myeloma, or lymphoma. In the fourth quarter of 2014, we initiated a Phase 1b/2 study of DCR-MYC in patients with advanced HCC. In the second half of 2015, we plan to initiate a Phase 1 study of DCR-PH1 in patients with Primary Hyperoxaluria Type 1 (PH1). We expect to announce initial proof-of-concept clinical data for DCR-MYC in mid to late 2015 and DCR-PH1 in late 2015. Based on precedents in the RNAi field, we are optimistic that our preclinical data showing the significant knockdown of target mRNA activity may translate into clinical results.
- **Create new programs in indication areas with high unmet medical need.** We intend to continue to use our proprietary RNAi technology platform to create new, high value pharmaceutical programs. Our primary focus will remain: (1) rare inherited diseases involving the liver; and (2) genetically-defined oncogene targets in oncology.
- **Continue to develop product candidates for rare diseases and oncology while retaining meaningful commercial rights.** We seek to maintain significant commercial rights to our key development programs. In rare disease areas, such as PH1, we seek to retain full commercial rights in key markets. In oncology, we seek to partner our product candidates while retaining meaningful commercial rights. For example, in our collaboration with KHK, we have an option to co-promote the product candidate targeting KRAS in the U.S. if it is approved for an equal share of profits from U.S. net sales.
- **Enter into additional partnerships with pharmaceutical companies either on our RNAi technology platform or specific indications or therapeutic areas.** We may choose to establish partnerships with pharmaceutical companies across multiple programs or indication areas depending on the attractiveness of the opportunities. These partnerships may provide us with further validation of our technology platform, funding to advance our proprietary product candidates, and/or access to development, manufacturing and commercial capabilities.
- **Continue to invest in our RNAi technology platform.** We will continue to invest in expanding and improving our DsiRNA and DsiRNA-EX RNAi payload technologies and our conjugate and LNP delivery technologies. Building on what we believe are significant advantages in potency and delivery, we seek to develop product candidates that will have a profound impact on the lives of patients.

Our RNAi Technology Platform

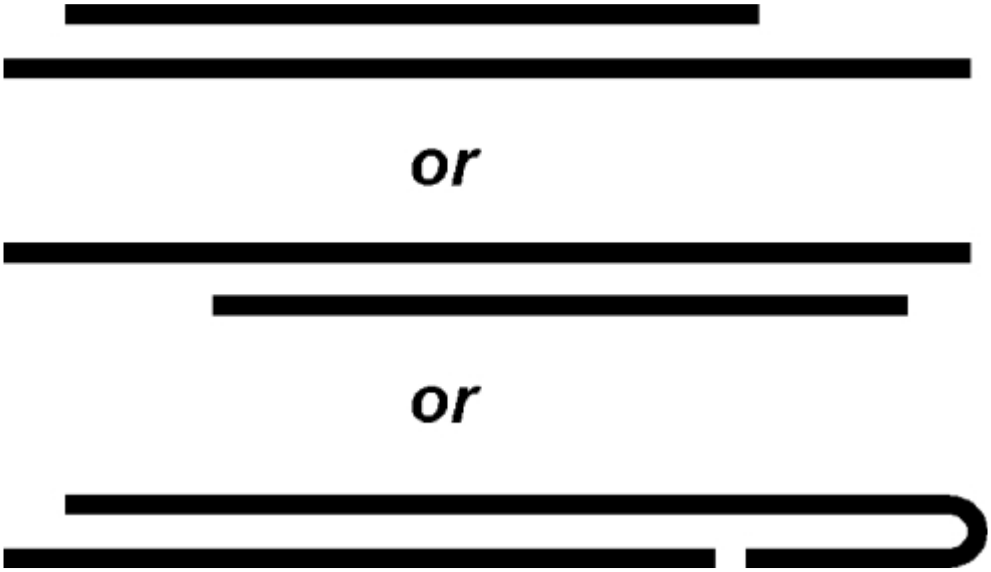
All of our drug discovery and development efforts are based on the therapeutic modality of RNAi, a highly potent and specific mechanism for silencing the activity of a targeted gene. The RNAi process is triggered by double-stranded RNA molecules containing sequences that are complementary to the sequence of the targeted gene. Our novel and highly potent approach is based on double-stranded RNAs that are aimed to serve as optimal substrates for the RNAi initiating enzyme Dicer, and thus our proprietary RNAi molecules are known as Dicer substrates, which we refer to as DsiRNAs generally or as DsiRNA or DsiRNA-EX molecules, depending on the specific structure. The RNAi machinery, guided by a DsiRNA or DsiRNA-EX molecule (or other double-stranded RNAi-inducing molecules) causes the targeted destruction of specific mRNAs of the complementary target gene. Destroying these mRNAs immediately decreases the biological activity from the target gene. A single DsiRNA or DsiRNA-EX molecule incorporated into the RNAi machinery can destroy hundreds or thousands of mRNAs from the targeted gene.

We believe that our DsiRNA and DsiRNA-EX molecules have distinct traits in triggering the RNAi pathway to silence certain disease-driving genes, thereby providing advantages for triggering RNA interference compared to other types of double-stranded RNAs used to induce RNAi. Our DsiRNA and DsiRNA-EX molecules are structured to be optimal for processing by the Dicer enzyme. We believe that other RNAi-inducing molecules currently in development mimic the output of a Dicer enzyme processing event, and thus act at a later point in the RNAi pathway. By contrast, DsiRNA and DsiRNA-EX molecules enter the RNAi pathway through being presented to Dicer itself, the pathway's natural initiation point. By entering the RNAi pathway at that point, we believe that DsiRNA and DsiRNA-EX molecules are able to maximize the efficacy of the RNAi mechanism, making DsiRNA and DsiRNA-EX molecules inherently more potent than traditional RNAi-inducing molecules. This potency advantage derives from the structure of the DsiRNA and DsiRNA-EX molecules and how they interact with the Dicer enzyme. Specifically, the structure of the DsiRNA and DsiRNA-EX molecule is able to indicate to the Dicer enzyme which of the two RNA strands should be used to guide the selective destruction of disease gene target mRNAs by the RNAi machinery. We have found in animal tests that this benefit both increases the potency of our DsiRNA and DsiRNA-EX molecules relative to other RNAi-inducing molecules and enables many more sequences to be used to generate our potent DsiRNAs compared to other RNAi-inducing molecules. We therefore believe that the nature of the interaction of our DsiRNA and DsiRNA-EX molecules with the RNAi pathway intervention facilitates the discovery of new DsiRNA and DsiRNA-EX therapeutic candidates and further strengthens our intellectual property position.

Schematic representation of our DsiRNA

DsiRNAs are precisely-sized double-stranded RNA molecules that are asymmetric. In the form we use for some of our therapeutic programs, the longer strand is 27 bases long and is complementary to the target gene we seek to silence, known as the Guide Strand. The shorter strand is 25 bases long and known as the Passenger Strand. The two strands are complementary across their length, with the two additional bases of the 27-mer forming a two-base overhang at the 3'-end of the molecule. For our product candidates we use chemical modifications (for example, 2'-OMe, 2'-F and phosphorothioates) and we also use two bases of DNA at the 3' end of the Passenger Strand. These DNA bases, along with the two-base overhang on the 27-mer, cause the Dicer enzyme preferentially to take up the Guide Strand, leading to several advantages for DsiRNAs compared to other RNAi-inducing molecules.

Schematic representation of our DsiRNA-EX



In addition to 25/27-mer duplex DsiRNAs, we have developed the DsiRNA-EX technology, where extensions to one or more of the ends of the RNA strands can provide added functionality including sites for conjugation and other modifications. Chemical modifications (for example, 2'-OMe, 2'-F and phosphorothioates) are located on both strands at specific positions.

In addition, due to the nature of how the Dicer enzyme processes a DsiRNA or DsiRNA-EX molecule, our DsiRNA and DsiRNA-EX molecules may provide advantages for targeted delivery methods that do not use lipid nanoparticles. Our DsiRNA molecules present chemical conjugation points, which can be used to attach targeting agents or other agents that facilitate delivery or enhance the "drug-like" properties of the molecules. Our DsiRNA-EX molecules include extensions to one or more of the ends of the RNA strands, which allows even further potential for chemical modification. Notably, the extensions enable the development of subcutaneously delivered molecules that are conjugated to targeting ligands and possess enhanced biological stability, and that can be administered subcutaneously or intravenously without LNPs. These and other favorable features are introduced into the DsiRNA and DsiRNA-EX molecules while maintaining high RNAi activity. Due to how the Dicer enzyme processes a DsiRNA or DsiRNA-EX molecule, we can use stable covalent non-cleavable linkers for conjugation instead of less stable cleavable linkers that other RNAi molecules may require.

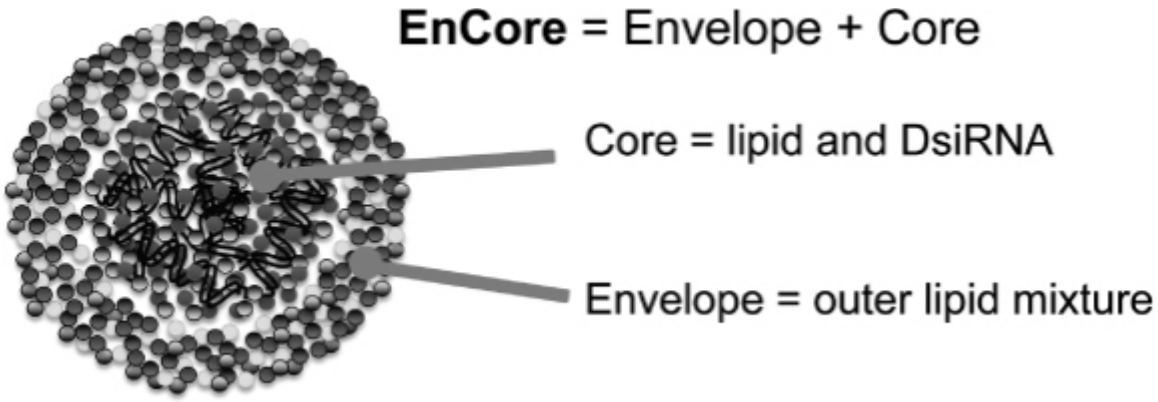
Optimization of our DsiRNA and DsiRNA-EX molecules

For therapeutic use in humans, our DsiRNA and DsiRNA-EX molecules are optimized both with respect to base sequence and chemical modifications to increase stability and mask them from mechanisms that recognize foreign RNAs, inducing immune system stimulation. Our optimization process begins with the screening of 300 to 600 RNA sequences predicted to have good activity based on a proprietary DsiRNA prediction algorithm. Through optimization and chemical modification we identify the most active RNAi molecules while engineering in enhanced stability and engineering out immunostimulatory activity. Our DsiRNA and DsiRNA-EX molecules routinely achieve high potencies, with IC50 values (the amount of material required to silence a target gene by 50 percent) typically in the 0.1 to 3.0 picomolar range in *in vitro* studies. Owing to the enzymatic nature of the RNAi pathway, this is 100 to 1,000 times as great as, or greater than, the potency of most traditional small molecule therapeutics. Furthermore, our research and testing to date suggest that our optimized DsiRNA and DsiRNA-EX molecules are significantly reduced in their ability to induce an immune system response in humans.

Our drug delivery technologies

Our process of delivery

From the initial discovery of the RNAi pathway in mammals through more recent attempts at creating RNAi-based therapeutics, drug delivery has been a profound challenge. Most nucleic acids, including our DsiRNA and DsiRNA-EX molecules, are unable to enter cells on their own, but cell entry is required to access the RNAi machinery in the cytoplasm and thus to silence the targeted genes. An effective drug delivery technology is required to ferry the DsiRNA and DsiRNA-EX molecules into cells, through the cell internalization pathway and ultimately release the DsiRNA and DsiRNA-EX molecules into the cell cytoplasm. We believe that our drug delivery technologies overcome these challenges. Effective RNAi drug delivery requires the following three steps: Step 1. Accumulation in the target tissue, Step 2. Binding to and internalization by the target tissue cells, Step 3. Release from the internalization compartment into the cytoplasm.



EnCore lipid nanoparticles are composed of a lipid-DsiRNA or lipid-DsiRNA-EX core surrounded by an envelope of different lipids which mediate the accumulation, internalization and release into the cytoplasm of the DsiRNA or DsiRNA-EX molecules in the core of the particle.

EnCore lipid nanoparticles

We believe that our EnCore lipid nanoparticles (LNPs) effectively mediate all steps required for delivery of our DsiRNA product candidates: accumulation, binding and internalization, and release into the cytoplasm. Our EnCore LNPs also have beneficial properties such as high tolerability (low toxicity), ease of manufacturing, effective RNAi payload loading, and protection of the DsiRNA or DsiRNA-EX payload. We have successfully demonstrated each of these properties of EnCore LNPs and have used them to achieve effective delivery of our DsiRNA and DsiRNA-EX molecules in animal models.

EnCore structure and function

The EnCore LNPs are comprised of a “Core” of lipid and DsiRNA or DsiRNA-EX molecules, surrounded by an “Envelope” of chemically distinct lipids that are designed to interact with the target tissue. The Core allows EnCore to carry a large payload of DsiRNA or DsiRNA-EX molecules while simultaneously protecting them from degrading enzymes. The envelope interacts with the target tissue to mediate accumulation, binding and internalization, and release into the cytoplasm.

Delivery to solid tumors with EnCore

We are using our EnCore LNPs for delivery to solid tumors. Historically, LNPs have also been used to deliver RNAi molecules to the liver. By adjusting the lipid components in the EnCore envelope, we have been

able to adjust whether EnCore mediates delivery to the liver or to solid tumors in animal models. In each case, the first step of delivery is accumulation in the target tissue. Both liver tissue and tumor tissue have porous vasculature that allows the EnCore lipid nanoparticles to exit the vasculature and accumulate in the target tissue. Our studies to date indicate that other tissues do not accumulate EnCore lipid nanoparticles in significant amounts. EnCore lipid nanoparticles with a low level of polyethylene glycol (PEG) on their surface immediately enter the liver tissue and mediate delivery of DsiRNAs to liver cells. EnCore lipid nanoparticles with a high level of PEG on their surface are blocked from immediate liver uptake, allowing them to continue circulating and to accumulate in tumors. Over time, the PEG is shed from the surface of the EnCore lipid nanoparticles, allowing them to internalize in the tumor cells and mediate delivery of DsiRNAs. We have found that particular lipid structures also facilitate delivery to tumor cells, instead of liver cells, and we have incorporated such lipids in our EnCore LNPs.

Delivery to the liver with Tekmira Pharmaceuticals Corporation's LNP

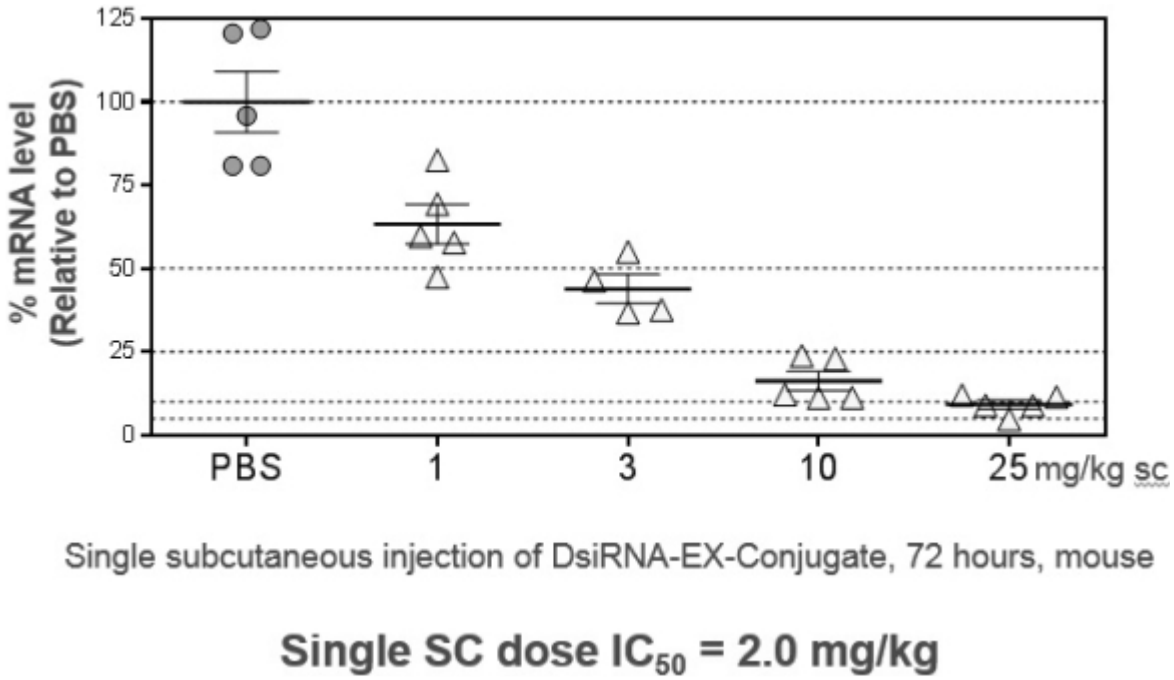
Our licensing agreement with Tekmira Pharmaceuticals Corporation (Tekmira) and one of its subsidiaries enables us to use Tekmira's proprietary LNP for delivery of DCR-PH1 to treat PH1. Tekmira's lipid nanoparticle system has been shown in other human clinical studies to provide potent, safe and effective RNA delivery to hepatocytes (liver cells). We anticipate that our licensing of Tekmira's LNP technology will help streamline the development path for DCR-PH1 and allows us to focus our EnCore LNP efforts on our oncology pipeline.

Subcutaneous delivery to the liver by DsiRNA-EX Conjugates

We believe that the structure of DsiRNA-EX molecules are well suited for direct conjugation to delivery agents. We are working to develop a delivery system based on conjugation of a targeting agent to the extended region of the DsiRNA-EX molecules. We call such molecules DsiRNA-EX Conjugates. If our development efforts are successful, this system would provide for generalized subcutaneous administration in humans of DsiRNA-EX Conjugates to the liver. The initial application will be delivery via conjugation to a GalNAc (n-acetyl galactosamine) targeting agent that provides for highly specific uptake in hepatocyptes and can be administered by subcutaneous administration. For example, we have administered DsiRNA-EX Conjugate molecules subcutaneously in mice and have seen IC_{50} values as low as 2.0 milligrams per kilograms of body weight.

Table of Contents

DsiRNA-EX Conjugate Potency Supports Convenient Subcutaneous Administration



DsiRNA-EX Conjugates yield high-potency gene silencing agents. The data shows a dose response curve for silencing of a therapeutic liver target after subcutaneous administration of a DsiRNA-EX Conjugate in mice. In this example the calculated IC_{50} value is 2.0 milligrams per kilogram of body weight.

Our Product Candidates

In choosing clinical programs to pursue using our DsiRNA and drug delivery technologies, we apply the criteria listed below. We believe that our current development programs meet most or all of these criteria.

- **Strength of therapeutic hypothesis.** Our current product candidate gene targets, and those we intend to pursue in the future, are a well-understood part of the disease process where a therapeutic intervention is likely to have substantial benefit for the patient. Because our RNAi technology platform allows us to pursue product candidate gene targets that have historically been difficult to inhibit using conventional approaches, we believe that there are a substantial number of such targets without existing pharmaceuticals on the market.
- **Readily-identified patient population.** We seek disease indications where patients can be readily identified by the presence of characteristic genetic mutations. In the case of genetic diseases, these are heritable genetic traits. In the case of oncology, these are genetic changes that have occurred in tumor cells as part of the tumor-formation process. In both cases, available genetic tests and techniques can identify patients that carry these mutations.
- **Predictivity of biomarkers for early efficacy assessment.** We seek indications where there is a clear relationship between the disease status and an associated biomarker that we can readily measure. This approach will allow us to determine in early stages of clinical development whether our DsiRNA molecules are likely to have the expected biological and clinical effects in patients.
- **Unmet medical need.** We seek to provide patients with significant benefit and alleviation of disease. The indications we choose to approach have high unmet medical need, which is intended to enable us to better access patients and qualify for pricing and reimbursement that justify our development efforts.

- **Competitive positioning.** We seek indications where we believe we have the opportunity to develop either a first-in-class product or a clearly differentiated therapy.
- **Rapid development path to approval.** To reach commercialization expeditiously and to help ensure our ability to finance development of our product candidates, we have identified indications with the potential for rapid development through marketing approval. Specifically, we believe that certain of our product candidates have the potential to obtain Breakthrough Therapy Designation as well as accelerated approval from the U.S. Food and Drug Administration (FDA).

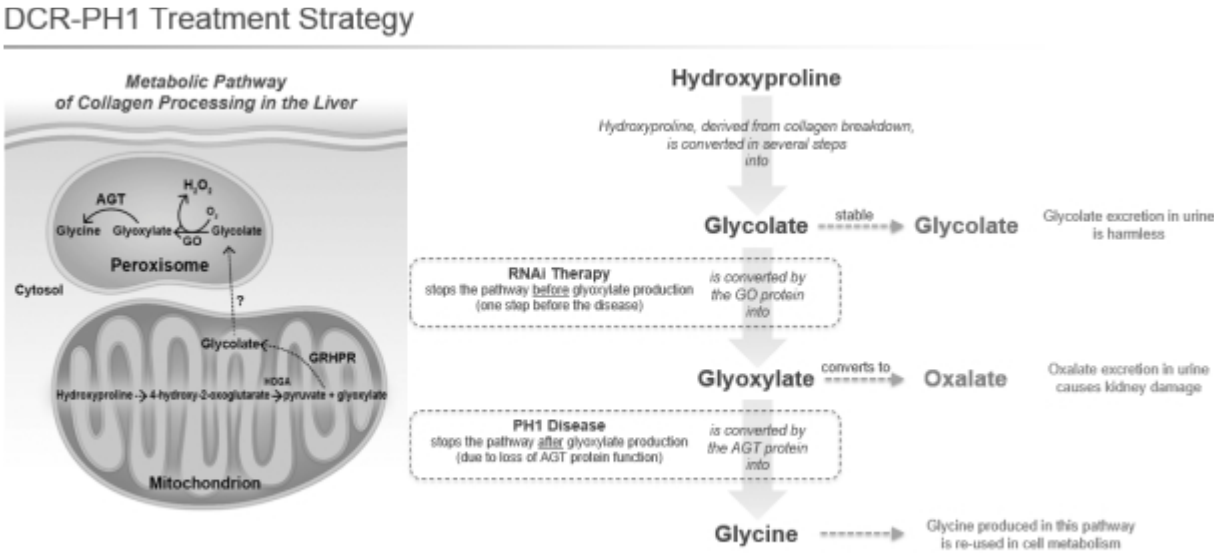
DCR-PH1 for PH1

PH1 is a rare, inherited autosomal recessive disorder of metabolism in the liver that usually results in severe damage to the kidneys. PH1 is caused by the failure of the liver to metabolize a precursor of oxalate, a highly insoluble metabolic end-product in humans, resulting in excess oxalate and high levels of oxalate in the urine. This oxalate is formed during the metabolic breakdown of hydroxyproline, a naturally occurring component of collagen. In individuals with PH1, crystals of calcium oxalate form in the renal tubules, leading to chronic and painful cases of kidney stones and subsequent fibrosis, known as nephrocalcinosis. Despite the typical interventions of a large daily intake of water to dilute the oxalate and other interventions, many patients eventually enter kidney failure (end-stage renal disease, or ESRD) and become eligible for transplant. While in ESRD, besides having to endure frequent dialysis, patients are afflicted with a build-up of oxalate in the bone, skin, heart and retina with concomitant debilitating complications, a condition known as systemic oxalosis. Some patients show partial disease amelioration with oral pyridoxine supplementation, although disease progression usually continues. Supportive care treatments are available, generally with only minor or no effect on disease progression. Currently, aside from dual liver and kidney organ transplantation, there are no highly efficacious therapeutic options for most patients with PH1. Dual liver and kidney transplantation presents a challenge in identifying a donor and is associated with high co-morbidity rates. Even in those U.S. patients treated with dual liver and kidney transplant, five-year post-transplant survival is 64 percent. For patients treated with kidney transplant alone, five-year survival is 45 percent.

While the true prevalence of PH1 is unknown, according to estimates recently published by the New England Journal of Medicine the prevalence of PH1 is at least one to three per million of population. Based on the frequency of occurrence of disease mutations in the population derived from genome sequence databases, the estimated genetic incidence is six and half per million of population, which we believe suggests that PH1 is under-diagnosed. Roughly consistent with the genetic incidence estimate, the disease is thought to have an

incidence of one per 120,000 live births a year in Europe. Certain populations, for example in the Canary Islands (Spain) or Kuwait, have higher incidences due to founder effects or consanguinity. We believe approximately 800 patients total are currently in two distinct disease registries in North America and Europe, although these registries do not capture all afflicted patients. Incidence is believed to be similar in Asia. Given the severity of PH1, we believe this disease represents a significant market opportunity. The patient advocacy group, the Oxalosis and Hyperoxaluria Foundation, based in New York City, New York, seeks to represent patients with PH1.

Therapeutic rationale for PH1



The DCR-PH1 treatment strategy is to block the metabolic pathway at glycolate production, by silencing the HAO1 gene which encodes for the GO protein

We believe that there is a strong rationale for focusing our RNAi technology on the development of product candidates for the treatment of PH1. The hydroxyproline breakdown metabolic pathway that is disrupted in PH1 consists of a number of enzymes. The gene encoding the final enzyme in the pathway, alanine-glyoxylate aminotransferase 1 (AGT1), is mutated in patients with PH1. Under normal circumstances, AGT1 metabolizes oxalate precursors into the harmless amino acid glycine, which is then used by the body or excreted. But when AGT1 function is disrupted due to mutation, oxalate begins to build up, resulting in progressive loss of kidney function and, ultimately, kidney failure. Approximately 50 percent of PH1 patients have kidney failure by age 30 to 35.

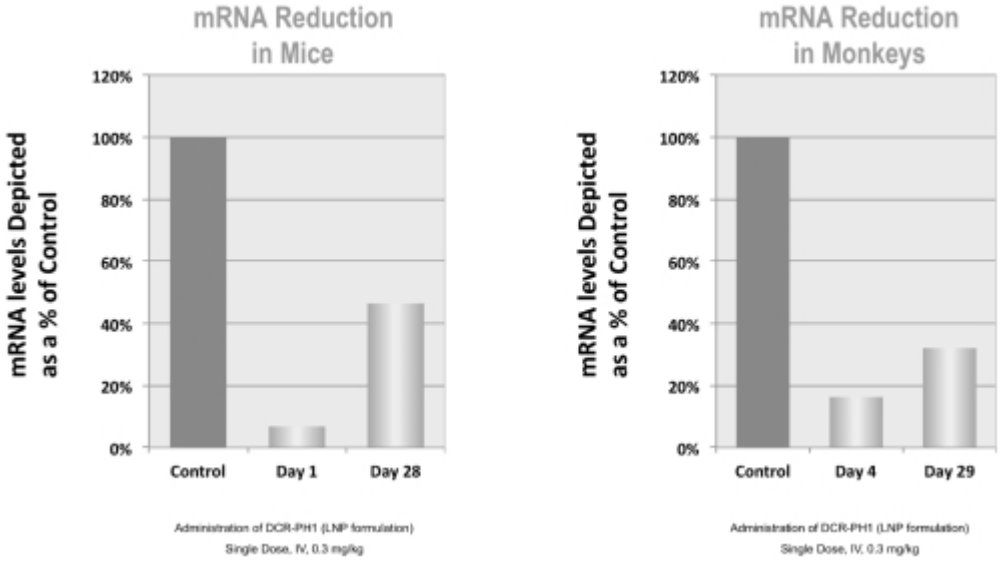
Animal studies have shown that intervening one step earlier in the metabolic pathway can reduce or eliminate the abnormally high oxalate production caused by the absence of AGT1 enzyme activity. These studies employ mice in which the gene encoding AGT1 has been genetically deleted to create an animal model of PH1. Similar to human patients, these mice have elevated levels of oxalate in their urine. When the enzyme one step earlier in the metabolic pathway than AGT1 is eliminated by genetic deletion in this animal model of PH1, oxalate levels in the urine are substantially reduced. These studies demonstrate that genetic deletion of the enzyme prior to AGT1 in the pathway prevents the formation of the oxalate precursor and the buildup of oxalate. The enzyme upstream of AGT1 is known as glycolate oxidase (GO) and is encoded by the gene HAO1. In normal animals and humans HAO1 is expressed exclusively or nearly exclusively in the liver.

Preclinical data for DCR-PH1

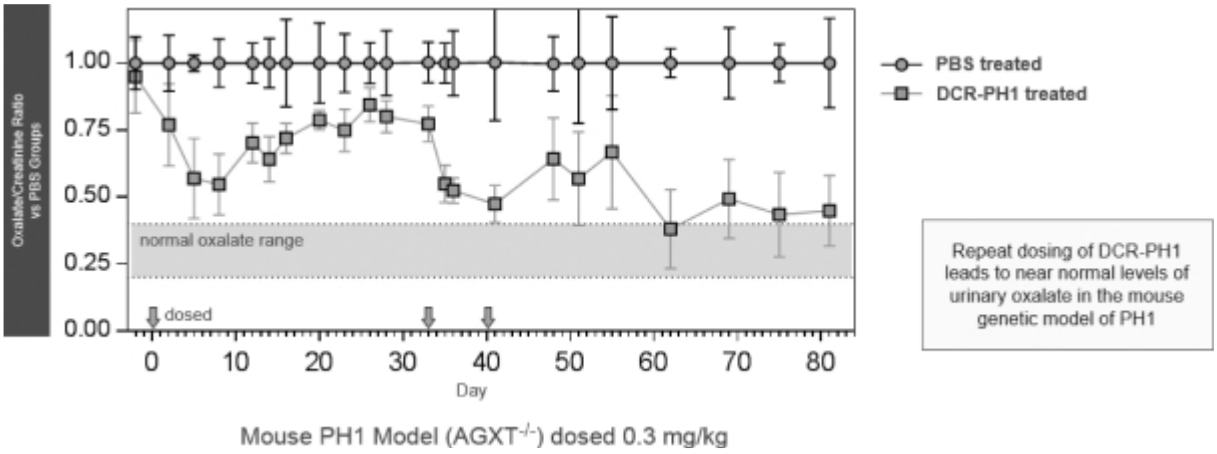
We are using our DsiRNA-EX technology and licensed lipid nanoparticle delivery technology to develop DCR-PH1, a product candidate designed to specifically inhibit the gene HAO1, which encodes GO. We have generated highly potent and specific DsiRNA-EX molecules targeting HAO1 and believe we have optimized these molecules to enhance their pharmaceutical properties. We are conducting manufacturing scale-up and Good Laboratory Practice (GLP) toxicity studies in anticipation of filing an IND application in mid to late of 2015 and initiating clinical trials in mid to late of 2015.

We have demonstrated the efficacy of DCR-PH1 in both mice and in non-human primates (monkeys). The data demonstrate that after a single intravenous dose of 0.3 milligrams per kilogram body weight of DCR-PH1 the average reduction of HAO1 gene expression was 95% in mice and 84% in monkeys soon after dosing. At a much later time, 28 and 29 days after dosing, the target gene expression was still significantly reduced by an average of 54% in mice and 68% in monkeys. These data are supportive of an infrequent clinical dosing regimen.

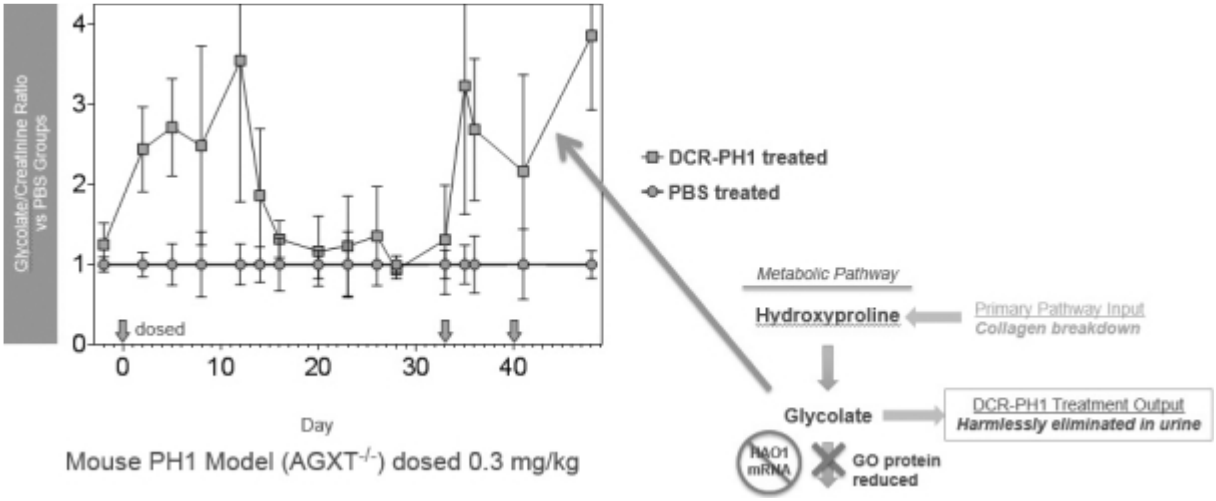
DCR-PH1 consists of a DsiRNA-EX payload formulated in a lipid nanoparticle delivery system



A. Long-duration Reduction in Urinary Oxalate after HAO1 Knockdown



B. Urinary Glycolate Elevation – a Biomarker of HAO1 mRNA and GO Protein Reduction



In the mouse model of PH1, treatment with DCR-PH1 results in a reduction in levels of urinary oxalate and, as expected by the mechanism of action, elevation in levels of urinary glycolate. Increased urinary glycolate alone may indicate a positive treatment effect; in PH1 patients treated with DCR-PH1, elevation of urinary glycolate may precede reduction in urinary oxalate as accumulated oxalate is flushed out in urine over time.

Phase 1 Clinical Development plan for DCR-PH1

We intend to initiate a development program for DCR-PH1 for patients who have PH1 in 2015, including both an observational natural history study and clinical studies.

We plan to initiate a natural history study for patients with genetically confirmed diagnosis of PH1 and mild to moderate renal impairment to (1) characterize the baseline variability and factors that influence changes in urine and blood oxalate and glycolate levels and renal function over time; (2) characterize the systemic complications associated with PH1 . Currently, enrollment is scheduled for the second quarter of 2015. We anticipate that up to 50 patients will be enrolled. We anticipate a majority of the patients enrolled in the natural history study will be subsequently enrolled in the First in Human (FIH) study which will be a Phase 1, open label study with dose escalation in a Single Ascending Dose (SAD) and Multiple Ascending Dose (MAD) level

cohorts. We intend to file an IND application and enroll the first patient in the second half of 2015. We intend for the study to be conducted in the US, EU, and other countries. The primary objective of the study is to determine the safety profile and recommended Phase 2 dose (RP2D) of DCR-PH1. Secondary objectives include the determination of pharmacokinetics (PK) and the pharmacodynamics (PD) profile of DCR-PH1, including changes in urine oxalate levels.

Additional programs under investigation involving the liver

We are investigating a number of other rare diseases involving disease target genes expressed in the liver. We have selected these diseases and disease target genes based on our stated criteria, including having a strong of therapeutic hypothesis, a readily-identified patient population, the availability of predictive biomarkers, high unmet medical need, favorable competitive positioning, and a rapid path to approval. We are currently optimizing DsiRNA-EX Conjugate molecules directed toward multiple disease target genes. Based on the results of our investigations, we plan to select additional development programs.

DCR-MYC for solid tumors

For the treatment of cancer we are developing the product candidate DCR-MYC, which utilizes our DsiRNA and EnCore LNP technologies to target the oncogene MYC. We believe that DCR-MYC has the potential to be used broadly in solid tumors from many tissues of origin, based on observed patterns of MYC oncogene amplification across diverse tumor types.

There is abundant evidence that the MYC oncogene is a driver of human cancer. The MYC oncogene, originally identified as a transformative agent in naturally-occurring tumor viruses, is one of the most frequently mutated oncogenes found in human cancers. A therapy that reduces or eliminates elevated MYC activity has the potential to generate therapeutic benefits for patients with various tumor types that include MYC amplifications or other elevations of MYC activity. Inhibition of MYC activity has generated strong anti-tumor responses in a variety of animal models of cancer, which we have also observed in our own labs. Genetic techniques in mice which reduce MYC expression or inhibit MYC protein activity have been shown to prevent tumor formation or cause substantial tumor shrinkage, depending on the mouse genetic model of cancer employed in the experiment. These results have been obtained from mouse tumor models where MYC is not responsible for tumor initiation. We believe that this animal model data is supportive of the use of MYC-targeted therapy to treat cancer in humans.

Association of U.S. cancer patients with aberrant MYC expression

CANCER TYPE	APPROXIMATE PERCENTAGE OF PATIENTS
Liver (hepatocellular)	50%
Breast	80%
Colorectal	70%
Gastric	51-77%
Gynecological	90%
Prostate	80-90%
Small cell lung	18-30%

The frequently observed mutations in the MYC gene usually result in the duplication or higher-order amplification of the MYC oncogene within the tumor cell DNA, resulting in elevated levels of MYC activity. Other types of mutations have also been shown to cause elevated levels of MYC activity, such as chromosomal translocations that result in the activation of the MYC oncogene. In addition, human genetic variants known as single-nucleotide polymorphisms in the MYC gene have been identified that are believed to predispose humans

to various cancers. Based on these genetic data in humans, we believe that a therapy that reduces or eliminates elevated MYC activity has the potential to generate therapeutic benefits for patients with various tumor types that include MYC amplifications or other elevations of MYC activity.

Recent molecular work demonstrates that MYC over-expression drives the cancer process by selectively amplifying expression of genes typically expressed by a cell type. Based on this property, MYC is sometimes described as a “universal amplifier,” which can boost the activity of other cancer-related genes and push a cell to abnormal levels of growth. This model for MYC function suggests that an intervention that could bring down the expression of MYC to normal levels could have therapeutic benefit for cancer patients.

Despite its obvious attractiveness as a therapeutic target, MYC has not been successfully targeted by conventional small molecule drugs and is not amenable to antibody therapeutics. Others have attempted to develop small molecules that inhibit MYC but to date these have not been sufficiently potent and specific to be viable product candidates. We believe that the reason for this is likely due to the absence of a good binding pocket on the MYC protein. MYC is a member of a protein family known as transcription factors, and these proteins generally lack good binding pockets for small molecules. MYC is not amenable to treatment with antibodies; MYC is only found inside the cell and antibodies are limited to extracellular and cell surface targets.

Therapeutic rationale for DCR-MYC in hepatocellular carcinoma (HCC)

For several reasons, we believe that HCC presents an excellent starting point for clinical development of an MYC-targeted therapeutic. First, HCC patients frequently show amplifications of the MYC oncogene, suggesting an important role for MYC activity in a significant fraction of HCC patients. Second, in animal models of disease, we have observed strong anti-tumor responses after treatments with our product candidate DCR-MYC. Finally, there is high unmet medical need for effective treatments for advanced HCC.

Liver cancer is the second leading cause of cancer-related deaths worldwide, with 745,000 deaths per year. HCC is the most common form of liver cancer in adults, accounting for 85-90% of primary liver cancers. Many cases of HCC result from inflammation associated with infection with the hepatitis B or C virus, which can lead to cirrhosis of the liver. However, non-alcoholic fatty liver disease, associated with obesity and diabetes, is also an important risk factor for HCC.

Early-stage HCC is generally treated with surgery that has the potential to be curative. However, given the non-specific symptoms characteristic of HCC, the majority of patients are diagnosed only after HCC is at an advanced stage. Advanced HCC has limited treatment options and is associated with poor patient outcome and high mortality. Chemotherapies have demonstrated poor efficacy in HCC and there is no FDA-approved chemotherapeutic regime. Nexavar (marketed by Amgen Inc. and Bayer AG) is the only FDA-approved drug for the treatment of advanced or unresectable HCC. Unmet medical needs include the identification and development of additional and more effective treatments for patients not eligible for surgical resection, a reduction in relapse rates and an increase in overall survival rates.

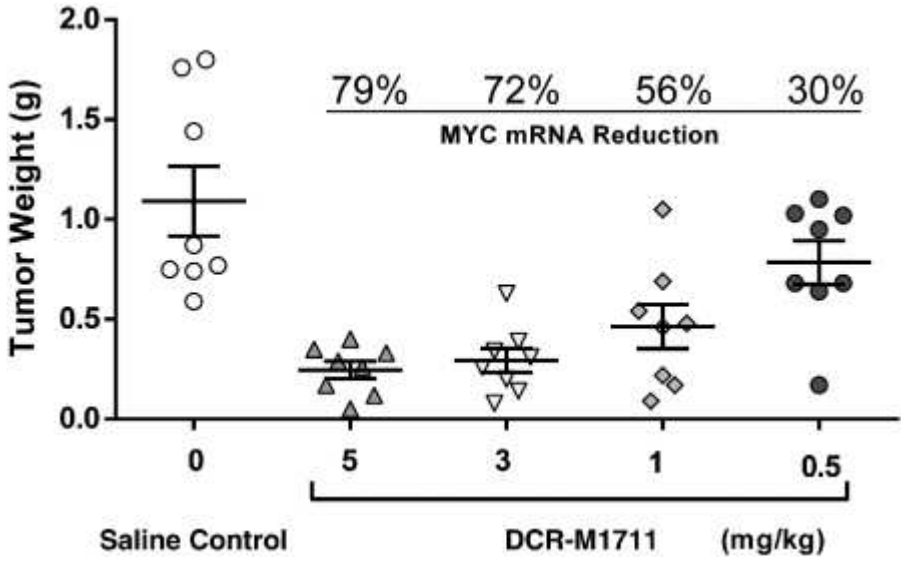
Preclinical data for DCR-MYC

We have used our DsiRNA and EnCore LNP delivery technology to develop a product candidate that is designed to serve as a potent and specific inhibitor of the MYC oncogene. We have performed extensive screening and optimization of DsiRNAs targeting MYC, resulting in a proprietary, highly potent,stable and non-immunostimulatory DsiRNA that inhibits MYC in animal studies. We have packaged the DsiRNA targeting MYC in a tumor-delivery formulation of EnCore that has exhibited the ability to effectively deliver DsiRNAs to multiple mouse tumor models, including both xenograft models and a genetically-engineered mouse tumor model. The resulting product candidate that we have selected for development is known as DCR-MYC.

We have conducted extensive preclinical studies that have demonstrated the efficacy of DCR-MYC in tumor-bearing animals, while demonstrating good tolerability in multiple animal species, including non-human

primates. We have directly observed up to 70 percent reductions in the level of the MYC oncogene transcript in xenograft-bearing animal models and also strong reductions in MYC transcript level in a genetically engineered mouse tumor model. Based on these studies, we believe that DCR-MYC has the properties that justify advancement into clinical development.

Anti-tumor efficacy of DCR-MYC in a xenograft model of HCC



The graph shows the reduction in tumor weight in mice treated with DCR-MYC at the dose levels shown, compared to tumor weight in mice treated with saline. Also shown on the graph are the mean MYC mRNA reduction percentages for each dose level, demonstrating a strong correlation between the reduction of MYC mRNA activity and the reduction of tumor weight in tumor-bearing mice. This preclinical experiment shows efficacy after DCR-MYC treatment. These mice have xenograft tumors of the human Hep3B HCC cell line in their livers, which were allowed to establish for 14 days prior to the commencement of dosing. Tumor-bearing mice were dosed with 5.0 to 0.5 milligrams per kilogram of DCR-MYC or saline control administered intravenously three times per week for two weeks for a total of six doses.

Phase 1 clinical development plan for DCR-MYC

We have initiated a clinical development program of DCR-MYC for the treatment of MYC-related cancers. The DCR-MYC development program includes two separate Phase 1 trials: one trial in patients with solid tumors, multiple myeloma or lymphoma, and one trial in patients with advanced Hepatocellular carcinoma (HCC). Each Phase 1 trial is an open label study with two parts. The first part is a standard dose escalation study to determine the maximum tolerated dose. The second part is an expansion cohort treated at the maximum tolerated dose determined from the dose escalation portion of the study. We submitted an IND application for DCR-MYC to the FDA in the second quarter of 2014 for the First in Human Study (FIH) which is indicated for the treatment patients with solid tumors, multiple myeloma, or lymphoma without other alternative therapeutic options. The FIH trial enrolled the first patient shortly thereafter in the second quarter of 2014.

Our FIH Phase 1 trial has a primary objective of determining the safety and tolerability of DCR-MYC in patients and to determine the maximum tolerated dose when administered in a cycle of two weekly infusions followed by one week without an infusion. Secondary objectives of the trial include: (1) evaluating the action in the body of the active ingredient in DCR-MYC (a DsiRNA known as DCR-M1711), such as absorption,

distribution, metabolism and elimination over time. (2) observing decreases in the level of MYC transcript when comparing pre- and post-treatment biopsies of tumor tissues; (3) observing a decrease in tumor metabolic activity by imaging techniques, as a biomarker for inhibition of MYC function in tumors; (4) evaluating evidence of anti-tumor activity in patients treated with DCR-MYC; and (5) evaluating the potential use of blood biomarkers to assess activity of DCR-MYC.

Our FIH study has enrolled patients at the South Texas Accelerated Research Therapeutics (START) in San Antonio, Texas, and at the University of Chicago. Additional trial sites may be added to the study during the dose escalation or expansion portions of the trial in order to focus on particular tumor types or, if needed, to meet enrollment goals. Review of response data will be evaluated after completion of the dose-escalation phase of the study, which we expect to be completed by the end of 2015. Once the dose-escalation phase results have been evaluated, and assuming no problems, we intend to enroll additional patients at the maximum tolerated dose. We expect this expansion cohort to be completed and results evaluated by the end of 2016.

The second study of DCR-MYC is a Phase 1b/2 trial in patients with locally advanced or metastatic HCC. This study has a primary objective of determining the safety and tolerability of DCR-MYC in patients with late stage HCC and to determine a maximum tolerated dose when administered in a cycle of two weekly infusions followed by one week without an infusion. Secondary objectives of the trial include: (1) evaluating the action in the body of the active ingredient in DCR-MYC, DCR-M1711, such as absorption, distribution, metabolism and elimination over time ; (2) observing decreases in the level of MYC transcript when comparing pre- and post-treatment biopsies of tumor tissues; (3) evaluating evidence of anti-tumor activity in patients treated with DCR-MYC; and (4) evaluating the potential use of blood biomarkers to assess activity of DCR-MYC.

The first patient was enrolled in this trial during the first quarter of 2015 at the South Texas Accelerated Research Therapeutics (START) in San Antonio, Texas. We will conduct this trial in additional US sites and at sites in one or more East Asian countries, such as Singapore and South Korea. Additional trial sites may be added to the study during the dose escalation or expansion portions of the trial if needed to meet enrollment goals.

As with most Phase 1 trials, ours are not designed to yield statistically significant efficacy or molecular marker results. Accordingly, any observed results may be due to chance and not efficacy of DCR-MYC. The principal purpose of our Phase 1 trials will be to provide the basis for design of larger, definitive trials. Those trials will enroll more patients and they will be designed to demonstrate potential efficacy of the product candidate with statistical significance.

Product candidate for KRAS-related solid tumors

We believe that the KRAS oncogene represents an excellent target for our RNAi-based therapy because it is a frequently-mutated oncogene found in several common cancers, but it has historically been difficult to inhibit by the pharmaceutical industry. We are pursuing a DsiRNA-based product candidate targeting KRAS in conjunction with our collaborator KHK. Under the terms of our collaboration, KHK is responsible for selection of the clinical product candidate (including delivery system), all preclinical and clinical development activities and the choice of patient population and disease indications for clinical trials. We have an option to co-promote any KRAS product in the U.S. for an equal share of the profits from U.S. net sales.

Therapeutic rationale for KRAS-related solid tumors

Activating mutations in the KRAS gene are commonly found in a wide variety of tumor types. Among cancer indications with large patient populations, KRAS is found to be mutated in approximately 90 percent of pancreatic cancers, approximately 40 percent of colorectal cancers and approximately 25 percent of non-small cell lung cancers. KRAS mutations are also found in cancers with smaller patient numbers, such as bile duct cancers. In general, the presence of a KRAS mutation correlates with poorer disease prognosis. In the case of non-small cell lung cancer, certain therapeutics approved by the FDA and other global regulatory agencies which

have demonstrated clinical efficacy in non-small cell lung cancer are known to be ineffective in patients with KRAS mutations. While our collaborator KHK will decide which disease indications to pursue, we believe the potential market for a KRAS therapeutic is highly significant. In the U.S. alone, there are estimated to be over 43,000 cases of pancreatic cancer, 125,000 cases of colorectal cancer and over 202,000 cases of non-small cell lung cancer diagnosed each year.

Association of U.S. cancer patients with activating KRAS mutations

CANCER TYPE	APPROXIMATE PERCENTAGE WITH ACTIVATING KRAS MUTATIONS	IMPLIED PATIENT NUMBERS BASED ON INCIDENCE AND MUTATION FREQUENCY
Pancreatic adenocarcinoma	90%	38,700
Colorectal	40%	50,000
Non-small cell lung	25%	50,500

We believe that our DsiRNA for KRAS-related solid tumors will be developed and used with a companion diagnostic that allows for the selection of patients carrying tumors with KRAS mutations. Clinical diagnostic tests for the presence of KRAS mutations have already been approved by the FDA and other global regulatory agencies and are commercially available.

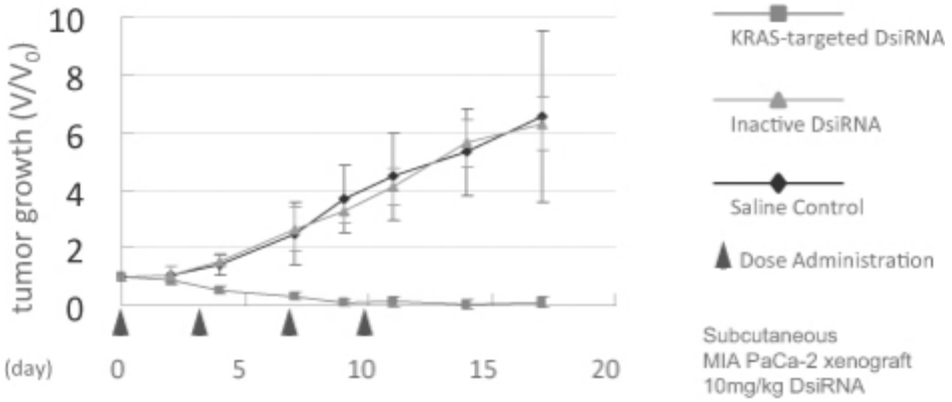
As with MYC, Numerous studies have indicated that KRAS is a transformative agent in tumor viruses, which led to the identification of the human KRAS oncogene in the 1980s. Yet despite being known as an important drug target since that time, traditional small molecule approaches have not yielded effective KRAS inhibitors. Also, similar to MYC, KRAS is an intracellular protein and thus is not amenable to antibody therapeutics, which are limited to extracellular and cell surface drug targets

In its normal non-mutant form, the KRAS protein plays a key role in the promotion and regulation of cell growth and division. The KRAS protein acts in a keystone position in an intracellular signaling pathway often called the Ras-MAP Kinase pathway. This pathway is responsible for receiving growth-promoting signals from outside the cell and communicating those signals within the cell so that the cell can respond appropriately to the cell growth signals.

Preclinical data for product candidate for KRAS-related solid tumors

KRAS was the initial target of our collaboration with KHK, signed in December 2009. During the first two years of the collaboration KHK and Dicerna scientists worked to identify optimal DsiRNAs against the KRAS oncogene and to optimize an LNP delivery technology containing KHK's proprietary lipids for tumor delivery. These DsiRNAs and LNP formulations were tested both in cell culture and in animals using human tumor cell lines, from different tumor types, carrying activating mutations in the KRAS oncogene.

Full tumor regression shown in the KRAS-positive pancreatic tumor model MIA PaCa-2



Xenograft pancreatic tumors were grown subcutaneously in mice, followed by intravenous treatment with an LNP formulated KRAS DsiRNA . Treated animals showed full tumor regression, while saline control treated animals showed rapid tumor growth.

The KRAS DsiRNAs and LNP formulations have shown good activity in both cell culture and xenograft animal tumor models. For example, full regression of subcutaneously implanted xenograft pancreatic tumors has been achieved with the formulated KRAS DsiRNAs. These results were independently generated at our facility in Massachusetts and at KHK's facility in Japan and have been observed using five independent KRAS sequences. As expected, KRAS oncogene knockdown is observed in tumors after a single dose of KRAS DsiRNA, further validating the observed efficacy.

Based on these preclinical efficacy data, KHK has advanced a product candidate resulting from this program into development. KHK has assumed responsibility for preclinical and clinical development of the program and bears the expense of that effort.

Additional product candidates for cancer gene targets

We are developing a second product candidate targeting a cancer-related gene in collaboration with KHK. We have not disclosed the identity of this target. In January 2013 we announced that KHK elected to advance this second therapeutic oncology product candidate from the research to the development stage. The achievement of this milestone triggered a $5.0 million payment from KHK to Dicerna. KHK is responsible for all development costs associated with this product candidate and has worldwide commercialization rights. We are eligible to receive royalties on worldwide net sales of the product candidate and payments of up to $110.0 million based on achievement of certain clinical, regulatory and commercialization milestones.

We have developed an additional product candidate using our DsiRNA-EX technology and EnCore tumor delivery technology. We have not disclosed the identity of this target. We are currently awaiting additional data from our DCR-MYC clinical trials before deciding how or whether to advance this product candidate forward in development.

Strategic Partnerships and Collaborations

KHK research collaboration and license agreement

In December 2009, we entered into a research collaboration and license agreement (the collaboration agreement) with KHK for the research, development and commercialization of drug delivery platforms and DsiRNA molecules for therapeutic targets, primarily in oncology. Under the collaboration agreement, we

engaged in the discovery of DsiRNA molecules against KRAS and other gene targets nominated by KHK. In 2011, KHK exercised its option for one additional target, the identity of which has not been publicly disclosed. As part of the research we are conducting in the collaboration, we are using our specific RNAi-inducing double-stranded DsiRNA molecules with a lipid nanoparticle drug delivery platform proprietary to KHK. KHK is responsible for all costs it incurs to develop any compound that is directed against a target included in the collaboration that KHK designates for development, subject to our exercise of our co-promotion option with respect to that compound if that compound is directed against KRAS.

We have granted KHK an exclusive license to certain of our technology and patents relating to compounds resulting from the collaboration. KHK has granted us certain non-exclusive licenses in its technology as necessary for us to perform research and development activities as part of the research collaboration.

Under the terms of the collaboration agreement, we have received total payments of $17.5 million. We are entitled to receive up to an additional $110.0 million for each product candidate resulting from the collaboration of certain clinical, regulatory and commercialization milestones. KHK is also obligated to pay us royalties on net sales of products resulting from the research collaboration. These royalties vary depending on the total net sales and range from percentages of net sales in the high single digits to the teens. None of the previously paid milestones are subject to reimbursement.

We have the option to elect to co-promote the KRAS product in the U.S. for an equal share of the profits resulting from U.S. net sales of the product.

If we exercise our option to co-promote a KRAS product in the U.S., the collaboration agreement will remain in effect pursuant to its terms in the U.S. for as long as any product is being sold by either KHK or us in the U.S. For each country outside of the U.S., the agreement will remain in effect pursuant to its terms on a product-by-product and country-by-country basis until the later of the last to expire of any patent rights licensed under the agreement applicable to the manufacture, use or sale of the product or twelve years after the date of the first commercial sale of such product in the applicable country. In the event we do not exercise our option to co-promote an oncogene KRAS product in the U.S., the collaboration agreement will remain in effect pursuant to its terms on a product-by-product and country-by-country basis until the later of the last to expire of any patent rights licensed under the agreement applicable to the manufacture, use or sale of the product or twelve years after the date of the first commercial sale of such product in the applicable country.

KHK may terminate the agreement at any time upon prior written notice to us. We may terminate the agreement if KHK challenges the validity or enforceability of any patents licensed by us to KHK. Either we or KHK may terminate the agreement in the event of the bankruptcy or uncured material breach by the other party. Finally, KHK may terminate the agreement in its entirety at the end of the research collaboration if it determines not to proceed with further development of compounds.

City of Hope license agreement

In September 2007, we entered into a license agreement with City of Hope (COH), an academic research and medical center, pursuant to which COH has granted to us an exclusive (subject to the exception described below), royalty-bearing, worldwide license under certain patent rights in relation to DsiRNA, including the core DsiRNA patent (U.S. 8,084,599), to manufacture, use, offer for sale, sell and import products covered by the licensed patent rights for the prevention and treatment of any disease in humans. COH is restricted from granting any additional rights to develop, manufacture, use, offer to sell, sell or import products covered by the licensed patent rights for the prevention and treatment of any disease in humans. Prior to entering into the license with us, COH had entered into a non-exclusive license with respect to such patent rights to manufacture, use, import, offer for sale and sell products covered by the licensed patent rights for the treatment or prevention of disease in humans (excluding viruses and delivery of products into the eye or ear). While that non-exclusive license has been terminated, a sublicensee to that non-exclusive license was permitted to enter into an equivalent non-

exclusive license which, to our knowledge, is subsisting with Arrowhead Research Corporation, (Arrowhead) as successor to the non-exclusive license holder. In addition, COH has granted to us an exclusive, royalty-bearing, worldwide license under the licensed patent rights providing certain rights for up to 20 licensed products selected by us for human diagnostic uses, provided that COH has not granted or is not negotiating a license of rights to diagnostic uses for such licensed products to a third party. The exclusive licenses granted by COH to us under the agreement are subject to any retained rights of the U.S. government in the licensed patent rights and a royalty-free right of COH to practice the licensed patent rights for educational, research and clinical uses. We have the right to sublicense the licensed patent rights to third parties with COH's written consent. The core DsiRNA patent (U.S. 8,084,599), titled "methods and compositions for the specific inhibition of gene expression by double-stranded RNA," describes RNA structures having a 25 to 30 nucleotides sense strand, a blunt end at the 3' end of the sense strand and a one to four nucleotides overhang at the 3' end of the antisense strand. The expiration date of this patent is July 17, 2027. The COH license is applicable to our DCR-MYC and KHK programs.

Pursuant to the terms of the agreement, we paid COH a one-time, non-refundable license fee and issued shares of our common stock to COH and a co-inventor of the core DsiRNA patent. COH is entitled to receive milestone payments in an aggregate amount of up to $5.25 million for each licensed product upon achievement of certain clinical and regulatory milestones. COH is further entitled to receive royalties at a low single-digit percentage of any net sale revenue of the licensed products sold by us and our sublicensees. If we sublicense the licensed patent rights to a third party, COH has the right to receive a double digit percentage of sublicense income, the percentage of which decreases after we have expended $12.5 million in development and commercialization costs. We are also obligated to pay COH an annual license maintenance fee, which may be credited against any royalties due to COH in the same year, and reimburse COH for expenses associated with the prosecution and maintenance of the license patent rights. Royalties shall be paid on a product-by-product and country-by-country basis until the expiration in each country of the last to expire of the licensed patent rights.

Under the agreement, we are obligated to use commercially reasonable efforts to develop and commercialize the licensed products in certain major markets. COH has the right to terminate the agreement in its entirety if we fail to enroll patients for clinical trials of one or more licensed products at various phases before certain specified deadlines unless we exercise the right to extend the deadlines in one-year increments by making a payment of $0.5 million to COH for each one-year extension. We have extended one milestone deadline for three one-year extensions, paying an aggregate of $1.5 million to COH for such extensions.

The agreement will remain in effect pursuant to its terms until all of the obligations under the agreement with respect to the payment of milestones or royalties related to licensed products have terminated or expired. Either party may terminate the license agreement for any uncured material breach by the other party. COH may terminate the agreement upon our bankruptcy or insolvency. We may terminate the agreement without cause upon written notice to COH.

Tekmira Pharmaceuticals Corporation license agreement

In November 2014, we entered into a licensing and collaboration agreement with Tekmira and one of its subsidiaries to license their LNP delivery technology for exclusive use in our PH1 development program. We will use Tekmira's LNP technology to deliver DCR-PH1, for the treatment of PH1. As of December 31, 2014, we paid $3.0 million in license fees. Tekmira is entitled to receive additional payments of $22.0 million in aggregate development milestones, plus a mid-single-digit royalty on future PH1 sales. This new partnership also includes a supply agreement with Tekmira and one of its subsidiaries providing clinical drug supply and regulatory support.

Under the agreement, we are obligated to use commercially reasonable efforts to develop and commercialize the product.

The agreement will remain in effect pursuant to its terms until all of the obligations under the agreement with respect to the payment of milestones or royalties related to licensed products have terminated or expired.

Either party may terminate the license agreement for any uncured material breach by the other party. Tekmira may terminate the agreement upon our bankruptcy or insolvency. We may terminate the agreement without cause upon written notice to Tekmira.

In addition to the license agreement, we entered into a development and supply agreement with Tekmira and one of its subsidiaries. Tekmira and its subsidiary will perform certain development and manufacture processes in accordance with the specifications in development and supply agreement. There is no minimum purchase requirement for the services provided by Tekmira or its subsidiaries.

Intellectual Property

We invest significant amounts in research and development. Our research and development expenses were approximately $29.5 million, $11.6 million and $11.6 million in 2014, 2013 and 2012, respectively.

We are seeking multifaceted protection for our intellectual property that includes licenses, confidentiality and non-disclosure agreements, copyrights, patents, trademarks and common law rights, such as trade secrets. We enter into confidentiality and proprietary rights agreements with our employees, consultants, collaborators, subcontractors and other third parties and generally control access to our documentation and proprietary information.

Patents and proprietary rights

We own three U.S. patents and a number of pending patent applications with claims to methods and compositions of matters that cover various aspects of our RNAi technology and our discovery technologies, including our proprietary DsiRNA and DsiRNA-EX molecules and lipid and DsiRNA-EX conjugate delivery technologies. These U.S. patents are U.S. 8,349,809 (issued in January 2013 with an expiration date of January 2030), U.S. 8,513,207 (issued in August 2013 with an expiration date of May 2030) and U.S. 8,927,705 (issued in January 2015 with an expiration date of July 2030). We also own numerous patents and patent applications covering specific DsiRNA sequences that drive activity against high value disease targets, including MYC, KRAS (U.S. 8,372,816; issued in February 2013, with projected expiration in April 2030), CTNNB1 (ß-catenin; U.S. 8,815,825; issued in August 2014, with projected expiration in July 2031), Androgen Receptor (US 8,927,515; issued in January 2015, with projected expiration in September 2031). Further, we own seven U.S. patents expiring between 2015 and 2017 and numerous patent applications with claims to methods and compositions of matters related to our lipid delivery technology, such as lipid compositions and particle formulations and the EnCore formulation process. We have issued or pending claims to DsiRNA molecules, pharmaceutical compositions/formulations, methods of use, including *in vitro* and *in vivo* methods of reducing target gene expression, methods of treatment, methods of inhibiting cell growth and methods of synthesis.

We jointly own with KHK U.S. and foreign patent applications pursuant to our research collaboration and license agreement claiming developments made in the course of the collaboration focused on delivery of KRAS specific DsiRNA molecules. Depending on the subject matter of future issued claims, we may also jointly own patents issuing from patent applications filed under the research collaboration and license agreement with KHK.

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

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

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

See “— Risk Factors — Risks Related to Intellectual Property” for a more detailed discussion of the risks to our intellectual property.

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

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

Additional licenses

In addition to the license agreement with COH described above, we have entered into license agreements for RNA technology that may benefit us as we advance our programs.

Plant Bioscience Limited license agreement

In September 2013, we entered into a commercial license agreement with Plant Bioscience Limited (PBL), pursuant to which PBL has granted to us a nominated-target-limited, worldwide, non-exclusive, fee-bearing license to certain of its U.S. patents (the Baulcombe patent estate) and patent applications to research, discover, develop, manufacture, sell, import and export, for human diagnostic and therapeutic uses, products incorporating

one or more short RNA molecules (SRMs) designed to target and modify the expression of a human gene or genes nominated by us from time to time. We are entitled to nominate multiple SRMs and have so far nominated one gene as the first SRM under the agreement. We are not obligated to nominate any additional genes.

We have paid PBL a one-time, non-refundable signature fee and will pay PBL a nomination fee for any additional SRMs nominated by us under the agreement. We are further obligated to pay PBL milestone payments in an aggregate amount of up to $3.85 million for each licensed product upon achievement of certain clinical and regulatory milestones. In addition, PBL is entitled to receive royalties at a low single-digit percentage of any net sale revenue of any licensed products sold by us. The agreement will expire on a country-by-country basis in each country where any licensed products are used, provided, manufactured or sold upon the date of the last to expire of applicable valid claim. Each party may terminate the agreement for any uncured material breach by the other party. We may terminate the agreement at any time for convenience upon prior written notice to PBL. The PBL license is applicable to our DCR-MYC and KHK programs.

Carnegie Institution of Washington license agreement

In January 2009, we entered into a license agreement with the Carnegie Institution of Washington (Carnegie), pursuant to which Carnegie has granted to us a worldwide, non-exclusive license under certain of its patents and patent applications (the Fire and Mello patent estate) relating to genetic inhibition by double-stranded RNA molecules for internal research, screening and development of product candidates for human and non-human diagnostic and therapeutic uses. We have paid Carnegie a one-time upfront fee and will in addition pay an annual license fee during the term of the agreement. We are further obligated to make two one-time additional payments in the aggregate amount of $100,000 upon achievement of the filing with the FDA of an NDA for a licensed product candidate and the first commercial sale of a licensed product candidate or licensed method. Carnegie is entitled to receive royalties on any net sale revenue from licensed product candidates sold by us, with the royalty rate to be further negotiated between Carnegie and us in good faith reflecting customary rates in the industry.

The agreement will terminate with respect to each licensed product candidate upon the last to expire of any valid claim within the licensed patent rights. Each party may terminate the agreement upon any uncured material breach by the other party. We may terminate the agreement at any time for any reason upon written notice to Carnegie. Any patents associated with this license will expire in 2018, removing any obligations.

Manufacturing and Supply

We do not currently own or operate manufacturing facilities for the production of preclinical, clinical or commercial quantities of any of our product candidates. For each product candidate, we currently contract with only one drug product formulation manufacturer for the encapsulation of the oligonucleotide in a lipid nanoparticle and we expect to continue to do so to meet the preclinical and any clinical requirements of our product candidates. We do not have a long term agreement with this third party.

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

In November 2014, we entered into a development and supply agreement with Tekmira and one of its subsidiaries. Tekmira’s subsidiary will perform certain development and manufacture processes in accordance with the specifications in development and supply agreement. There is no minimum purchase requirement for the services provided by Tekmira or its subsidiaries.

KHK is responsible for all manufacturing under our collaboration agreement with KHK both for the KRAS DsiRNA and the oncology program selected by KHK for development under the agreement.

Manufacturing is subject to extensive regulations that impose various procedural and documentation requirements, which govern record keeping, manufacturing processes and controls, personnel, quality control and quality assurance, among others. Our contract manufacturing organizations manufacture our product candidates under current Good Manufacturing Practice (cGMP) conditions. cGMP is a regulatory standard for the production of pharmaceuticals that will be used in humans.

Competition

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

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

RNA-based therapeutics

To our knowledge, there are no other companies developing DsiRNA and DsiRNA-EX molecules for therapeutic use. However, there are several companies that are currently developing RNAi-based therapies for various indications. We believe that Arrowhead, Tekmira and Alnylam through their company specific development or through various partnerships with the aforementioned companies are developing RNAi-based therapies that are competing against our current programs or potential future programs.

Among these, Alnylam, in partnership with Genzyme (a Sanofi company), is developing its ALN-TTR program, which is an RNAi-based therapy for the treatment of transthyretin-mediated amyloidosis (ATTR) and is currently in Phase 3 trials. Alnylam has continued its enrollment in its APOLLO Phase 3 study of patisiran in ATTR patients with Familial Amyloidotic Polyneuropathy (FAP) and its ENDEAVOUR Phase 3 study to evaluate the efficacy and safety of revusiran in ATTR patients with Familial Amyloidotic Cardiomyopathy (FAC). Alnylam is also developing RNAi-based therapies for other indications, including PH1, paroxysmal nocturnal hemoglobinuria (PNH), acute intermittent porphyria (AIP) hemophilia, porphyria, hypercholesterolemia, hemoglobinopathies, and alpha-1-antitrypsin (AAT) deficiency hepatocyte inclusions, among others. In addition, Alnylam has selected a development candidate for ALN-HBV, and expanded its hepatic infectious disease pipeline with ALN-HDV for Hepatitis Delta Virus (HDV) infection and ALN-PDL for chronic liver infections. In addition, Alnylam announced a new agreement with Isis Pharmaceuticals, extending the companies' alliance to further the development and commercialization of RNA therapeutics.

Tekmira also is clinically investigating its RNAi molecules for use in treating serious human diseases, such as cancer and viral infections, including hepatitis B virus (HBV) and Ebola. In January 2015 Tekmira announced a merger with Oncore Biopharma, Inc, to create a new HBV company focused on developing a curative regimen

for hepatitis B patients by combining multiple therapeutic approaches. Tekmira has rights under Alnylam's intellectual property to develop thirteen RNAi therapeutic products.

Additionally, Arrowhead is developing ARC-520 for chronic hepatitis B (HBV) and in December 2014, announced the filing of an IND to begin a Phase 2b Multiple-Dose clinical trial, and previously announced an IND filing to begin a Phase 1 study with ARC-AAT for the treatment of liver disease associated with alpha-1 antitrypsin deficiency. Following a partial clinical hold on its Phase 2b study involving ARC-520, Arrowhead announced in January 2015, that it was cleared to begin a modified study. The ongoing Phase 2a study of ARC 520 continues as planned, and Arrowhead has indicated that it expects to file with Asian and European agencies to begin additional Phase 2b studies in 2015. In March 2015 Arrowhead announced the acquisition of Novartis' RNAi research and development portfolio and associated assets. The acquisition includes assignment of certain intellectual property owned or controlled by Novartis, including access to non-delivery Alnylam RNAi IP for 30 targets, and three pre-clinical RNAi candidates for which Novartis has developed varying amounts of preclinical data.

In addition to RNAi therapies, there are other intracellular technologies focused on silencing the activity of specific genes by targeting mRNAs copied from them. Companies such as miRagen Therapeutics, Inc., Mirna Therapeutics, Inc., Regulus Therapeutics Inc. and Santaris Pharma A/S, which was acquired by Roche in 2014 and is now known as Roche Innovation Center Copenhagen –(RICC), target or inhibit or replace microRNAs, which are approximately 22 nucleotides in length, short, non-coding RNAs, to alter mRNA expression levels. The product candidates being developed by these companies are currently in preclinical and clinical trials for various indications. If our lead product candidates are approved for the indications for which we undertake clinical trials, they will compete with therapies that are either in development or currently marketed, such as the following.

Hepatocellular Carcinoma

There are limited treatments for HCC in the U.S. and abroad. If diagnosed as early-stage HCC, the disease is generally treated with surgical resection of the liver and has the potential to be curative. The majority of patients diagnosed with HCC, however, are in the advanced stages, for which chemotherapies have demonstrated poor efficacy. There is no FDA-approved chemotherapeutic regimen. Nexavar is the only FDA-approved drug for the treatment of advanced or unresectable HCC in our belief. Given the high unmet medical need and the commercial success of Nexavar, numerous targeted therapies for the treatment of hepatocellular carcinoma (HCC) are under development. Targeted therapies represent the largest proportion of the HCC pipeline.

Primary Hyperoxaluria Type 1

The current standard of care for treating PH1 is dual-organ transplant, namely a kidney and liver transplant in patients with PH1, which is often difficult to perform due to lack of donors and the threat of organ rejection. Other treatments include pyridoxine regimens and intensive dialysis, as well as treatments generally used in kidney stone disorders such as high-volume fluid intake and oral citrate. These other treatments do not halt disease progression. OxThera has a competing approach to PH1 treatment, currently in Phase 2 clinical trials, that is not RNAi-based. In late 2014, Alnylam presented pre-clinical data for an investigational RNAi therapeutic targeting glycolate oxidase in development for the treatment of PH1. Alnylam also plans to select a formal development candidate for its program in PH1 in the first half of the year.

Solid tumors

There are a number of pharmaceuticals and biologics that are marketed or in clinical development for the treatment of solid tumors. The most common treatments for solid tumors are various chemotherapeutic agents, radiation therapy and certain targeted therapies. Target therapies include monoclonal antibodies such as Avastin, Erbitux, Herceptin and Vectibix, and small molecules, such as Nexavar, Sutent and Tarceva. Immunotherapy

regimens are also on the market and in development for the treatment of solid tumors. In contrast, our proprietary DsiRNA molecules target tumors in which there is dependence on the MYC and KRAS oncogenes. To our knowledge, only one small molecule (salirasib (KD032)) is being evaluated by Kadmon Corporation, LLC in clinical trials for the treatment of KRAS-specific non-small cell lung cancer, pancreatic cancer and other solid tumors. We are not aware of any clinical trial that is currently evaluating a therapy for the treatment of solid tumors in which the MYC oncogene is specifically targeted.

Government Regulation and Product Approval

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

U.S. government regulation

NDA approval processes

In the U.S., the FDA regulates drugs under the Federal Food, Drug, and Cosmetic Act (the FDCA) and implementing regulations. Failure to comply with the applicable U.S. requirements at any time during the product development or approval process, or after approval, may result in a delay of approval or subject an applicant to administrative or judicial sanctions, any of which could have a material adverse effect on us. These sanctions could include:

- refusal to approve pending applications;
- withdrawal of an approval;
- imposition of a clinical hold;
- issuance of warning or untitled letters;
- product recalls;
- product seizures;
- refusals of government contracts;
- total or partial suspension of production or distribution; or
- injunctions, fines, restitution, disgorgement, civil penalties or criminal prosecution.

The process required by the FDA before a drug may be marketed in the U.S. generally includes the following:

- completion of nonclinical laboratory tests, animal studies and formulation studies conducted according to Good Laboratory Practices (GLPs) or other applicable laws and regulations;
- submission to the FDA of an investigational new drug application (IND), which must become effective before human clinical trials may begin;
- performance of adequate and well-controlled human clinical trials according to FDA regulations and Good Clinical Practices (GCP) to establish the safety and efficacy of the product candidate for its intended use;
- submission of an NDA to FDA and FDA’s acceptance of the NDA for filing;

- satisfactory completion of an FDA inspection of the manufacturing facility or facilities at which the product candidate is produced to assess compliance with current Good Manufacturing Practices (cGMPs) to assure that the facilities, methods and controls are adequate to preserve the product candidate's identity, strength, quality and purity; and
- FDA review and approval of the NDA.

Once a pharmaceutical candidate is identified for development, it enters the preclinical or nonclinical testing stage. Nonclinical tests include laboratory evaluations of product chemistry, stability, toxicity and formulation, as well as animal studies. An IND sponsor must submit the results of the nonclinical tests, together with manufacturing information and analytical data, to the FDA as part of the IND. Some nonclinical testing may continue even after the IND is submitted. In addition to including the results of the nonclinical studies, the IND will also include a protocol detailing, among other things, the objectives of the clinical trial, the parameters to be used in monitoring safety and the effectiveness criteria to be evaluated if the first phase lends itself to an efficacy determination. The IND automatically becomes effective 30 days after receipt by the FDA, unless the FDA, within the 30-day time period, places the IND on clinical hold. In such a case, the IND sponsor and the FDA must resolve any outstanding concerns before clinical trials can begin. A clinical hold may occur at any time during the life of an IND and may affect one or more specific studies or all studies conducted under the IND.

All clinical trials must be conducted under the supervision of one or more qualified investigators in accordance with FDA regulations and GCPs. They must be conducted under protocols detailing the objectives of the trial, dosing procedures, research subject selection and exclusion criteria and the safety and effectiveness criteria to be evaluated. Each protocol and protocol amendments must be submitted to the FDA as part of the IND, and progress reports detailing the status of the clinical trials must be submitted to the FDA annually. Sponsors also must timely report to FDA serious and unexpected adverse reactions, any clinically important increase in the rate of a serious suspected adverse reaction over that listed in the protocol or investigation brochure or any findings from other studies or animal or *in vitro* testing that suggest a significant risk in humans exposed to the drug. All research subjects or their legally authorized representatives must provide their informed consent in writing prior to their participation in a clinical trial. An institutional review board (IRB) at each institution participating in the clinical trial must review and approve the protocol and the informed consent form before a clinical trial commences at that institution, monitor the study until completed and otherwise comply with IRB regulations. Information about most clinical trials must be submitted within specific timeframes to the National Institutes of Health (NIH) to be publicly posted on the ClinicalTrials.gov website.

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

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

Human clinical trials are inherently uncertain and Phase 1, Phase 2 and Phase 3 testing may not be successfully completed. The FDA, the sponsor, or a data safety monitoring board, may suspend a clinical trial at

any time for a variety of reasons, including a finding that the research subjects or patients are being exposed to an unacceptable health risk. Similarly, an IRB can suspend or terminate approval of a clinical trial at its institution if the clinical trial is not being conducted in accordance with the IRB's requirements or if the product candidate has been associated with unexpected serious harm to patients.

During the development of a new product candidate, sponsors are given opportunities to meet with the FDA at certain points. These points may be prior to the submission of an IND, at the end of Phase 2 and before an NDA is submitted. Meetings at other times may be requested. These meetings can provide an opportunity for the sponsor to share information about the data gathered to date and for the FDA to provide advice on the next phase of development. Sponsors typically use the meeting at the end of Phase 2 to discuss their Phase 2 clinical results and present their plans for the pivotal Phase 3 clinical trial that they believe will support the approval of an NDA. If a Phase 2 clinical trial is the subject of discussion at the end of Phase 2 meeting with the FDA, a sponsor may be able to request a Special Protocol Assessment (SPA), the purpose of which is to reach agreement with the FDA on the Phase 3 clinical trial protocol design and analysis that will form the primary basis of an efficacy claim.

Concurrent with clinical trials, sponsors usually complete additional animal safety studies and also develop additional information about the chemistry and physical characteristics of the product candidate and finalize a process for manufacturing commercial quantities of the product candidate in accordance with cGMP requirements. The manufacturing process must be capable of consistently producing quality batches of the product candidate and the manufacturer must develop methods for testing the safety, identity, strength, purity, and quality of the product candidate. Additionally, appropriate packaging must be selected and tested and stability studies must be conducted to demonstrate that the product candidate does not undergo unacceptable deterioration over its proposed shelf-life. Before approving an NDA, the FDA will inspect the facility or facilities where the product is manufactured and tested and will not approve the product unless cGMP compliance is satisfactory. The FDA will also typically inspect one or more clinical sites to assure compliance with FDA regulations and GCPs.

The results of product development, nonclinical studies and clinical trials, along with descriptions of the manufacturing process, analytical tests and other control mechanisms, proposed labeling and other relevant information are submitted to the FDA as part of an NDA requesting approval to market the product. The submission of an NDA is subject to the payment of user fees, but a waiver of such fees may be obtained under specified circumstances. The FDA reviews all NDAs submitted to ensure that they are sufficiently complete for substantive review before it accepts them for filing. It may request additional information rather than accept an NDA for filing. In this event, the NDA must be resubmitted with the additional information. The resubmitted application also is subject to review before the FDA accepts it for filing.

Once the submission is accepted for filing, the FDA begins an in-depth review. The FDA reviews an NDA to determine, among other things, whether a product is safe and effective for its intended use and whether its manufacturing is cGMP-compliant. The FDA typically requires that an NDA include data from two adequate and well-controlled clinical trials, but approval may be based upon a single adequate and well-controlled clinical trial in certain circumstances. The FDA may refuse to approve an NDA if the applicable regulatory criteria are not satisfied or may require additional clinical or other data. Even if such data are submitted, the FDA may ultimately decide that the NDA does not satisfy the criteria for approval. The FDA may refer the NDA to an advisory committee for review and recommendation as to whether the application should be approved and under what conditions. The FDA is not bound by the recommendation of an advisory committee, but it generally follows such recommendations.

If a product receives regulatory approval, the approval may be significantly limited to specific diseases and dosages or the indications for use may otherwise be limited, which could restrict the commercial value of the

product. Further, the FDA may require that certain contraindications, warnings or precautions be included in the product labeling. In addition, the FDA may condition approval on the completion of post approval studies. Such studies may involve clinical trials designed to further assess a product's safety and effectiveness and may require testing and surveillance programs to monitor the safety of approved products that have been commercialized. If FDA determines that it is necessary to ensure the safe use of the drug, FDA may also condition approval on the implementation of a risk evaluation and mitigation strategy, or REMS. The REMS could include medication guides, physician communication plans or elements to assure safe use, such as restricted distribution methods, patient registries, or other risk minimization tools.

Expedited review and approval

The FDA has various programs, including Fast Track, priority review, breakthrough, and accelerated approval, which are intended to expedite or simplify the process for reviewing product candidates. Generally, product candidates that are eligible for these programs are those for serious or life-threatening conditions, those with the potential to address unmet medical needs and those that offer meaningful benefits over existing treatments. A sponsor can request application of these programs either alone or in combination with each other, depending on the circumstances. Even if a product candidate qualifies for one or more of these programs, the FDA may later decide that the product candidate no longer meets the conditions for qualification or that the time period for FDA review or approval will be shortened. None of the expedited approval programs change the NDA approval standard applied to a product.

New drugs are eligible for Fast Track status 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 status entitles such a drug to expedited review and frequent contact with the FDA review division. Unlike other expedited review programs, Fast Track designation allows FDA to accept for review individual sections of the NDA on a rolling basis. The FDA may also grant a priority review designation to drugs that offer major advances in treatment, or provide a treatment where no adequate therapy exists. A priority review means that the goal for the FDA to review an application is six months from filing of an NDA, rather than the standard review of ten months from filing under current PDUFA guidelines. Most products that are eligible for fast track designation are also likely to be considered appropriate to receive a priority review.

Drug products studied for their safety and effectiveness in treating serious or life-threatening diseases or conditions may receive accelerated approval upon a determination that the product has an effect on a surrogate endpoint that is reasonably likely to predict clinical benefit, or on a clinical endpoint that can be measured earlier than irreversible morbidity or mortality, that is reasonably likely to predict an effect on irreversible morbidity or mortality or other clinical benefit, taking into account the severity, rarity, or prevalence of the condition and the availability or lack of alternative treatments. As a condition of approval, the FDA typically requires that a sponsor of a product candidate receiving accelerated approval conduct post-approval clinical trials. As an additional condition of approval, the FDA currently requires pre-approval of all promotional materials, which could adversely impact the timing of the commercial launch of the product.

The FDA may expedite the approval of a designated breakthrough therapy, which is a drug that is intended, to treat a serious or life-threatening disease or condition for which 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. If FDA designates a drug as a breakthrough therapy, FDA must take actions appropriate to expedite the development and review of the application, which may include holding meetings with the sponsor and the review team throughout the development of the drug; providing timely advice to the sponsor regarding the development of the drug to ensure that the development program is as efficient as practicable; involving senior managers and experienced review staff, as appropriate, in a collaborative, cross-disciplinary review; and taking steps to ensure that the design of the clinical trials is as efficient as practicable.

Patent term restoration and marketing exclusivity

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

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

Orphan drug designation

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

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

product candidate as defined by the FDA or if our product candidate is determined to be contained within the competitor's product candidate for the same indication or disease.

Pediatric exclusivity and pediatric use

Under the Best Pharmaceuticals for Children Act (BPCA), certain product candidates may obtain an additional six months of exclusivity if the sponsor submits information requested in writing by the FDA (a Written Request) relating to the use of the active moiety of the product candidate in children. The FDA may not issue a Written Request for studies on unapproved or approved indications or where it determines that information relating to the use of a product candidate in a pediatric population, or part of the pediatric population, may not produce health benefits in that population.

In addition, the Pediatric Research Equity Act (PREA) requires a sponsor to conduct pediatric studies for most product candidates and biologics, for a new active ingredient, new indication, new dosage form, new dosing regimen or new route of administration. Under PREA, original NDAs, biologics license application and supplements thereto must contain a pediatric assessment unless the sponsor has received a deferral or waiver. The required assessment must assess the safety and effectiveness of the product candidate for the claimed indications in all relevant pediatric subpopulations and support dosing and administration for each pediatric subpopulation for which the product candidate is safe and effective. The sponsor or FDA may request a deferral of pediatric studies for some or all of the pediatric subpopulations. A deferral may be granted for several reasons, including a finding that the product candidate or biologic is ready for approval for use in adults before pediatric studies are complete or that additional safety or effectiveness data needs to be collected before the pediatric studies begin. After April 2013, the FDA must send a noncompliance letter to any sponsor that fails to submit the required assessment, keep a deferral current or fails to submit a request for approval of a pediatric formulation. PREA does not apply to any drug for an indication for which orphan designation has been granted. However, if only one indication for a product has orphan designation, a pediatric assessment may still be required for any applications to market that same product for the non-orphan indication(s).

Post-approval requirements

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

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

- record-keeping requirements;
- reporting of adverse experiences with the product candidate;
- providing the FDA with updated safety and efficacy information;
- drug sampling and distribution requirements;
- notifying the FDA and gaining its approval of specified manufacturing or labeling changes; and
- complying with statutory and regulatory requirements for promotion and advertising.

Drug manufacturers and other entities involved in the manufacture and distribution of approved product candidates are required to register their establishments and provide product listing information to the FDA and certain state agencies and are subject to periodic unannounced inspections by the FDA and some state agencies for compliance with cGMPs and other laws.

Regulation outside of the U.S.

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

Under European Union regulatory systems, a company may submit marketing authorization applications either under a centralized or decentralized procedure. The centralized procedure, which is compulsory for certain medicines, including those produced by biotechnology or those intended to treat HIV, AIDS, cancer, neurodegenerative disorders, autoimmune and other immune dysfunctions, viral diseases or diabetes and is optional for those medicines which are a significant therapeutic, scientific or technical innovation or whose authorization would be in the interest of public health, provides for the grant of a single marketing authorization that is valid for all European Union member states. The decentralized procedure provides for mutual recognition of national approval decisions. Under this procedure, the holder of a national marketing authorization may submit an application to the remaining member states. Within 90 days of receiving the applications and assessment reports, each member state must decide whether to recognize the approval. If a member state does not recognize the marketing authorization, the disputed points are eventually referred to the European Commission, whose decision is binding on all member states.

As in the U.S., we may apply for designation of a product candidate as an orphan drug for the treatment of a specific indication in the European Union before the application for marketing authorization is made. Sponsors of orphan drugs in the European Union can enjoy economic and marketing benefits, including up to ten years of market exclusivity for the approved indication unless another applicant can show that its product is safer, more effective or otherwise clinically superior to the orphan-designated product.

Reimbursement

Sales of our products 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, commercial insurance and managed healthcare organizations. These third-party payors are 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, restrictions on reimbursement and requirements for substitution of generic products. Adoption of price controls and cost-containment measures, and adoption of more restrictive policies in jurisdictions with existing controls and measures, could further limit our net revenue and results. If these third-party payors do not consider our products to be cost-effective compared to other therapies, they may not cover our products after approved as a benefit under their plans or, if they do, the level of payment may not be sufficient to allow us to sell our products on a profitable basis.

The Medicare Prescription Drug, Improvement, and Modernization Act of 2003 (MMA) imposed new requirements for the distribution and pricing of prescription drugs for Medicare beneficiaries. Under Part D,

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

The American Recovery and Reinvestment Act of 2009 provides funding for the federal government to compare the effectiveness of different treatments for the same illness. A plan for the research will be developed by the Department of Health and Human Services, the Agency for Healthcare Research and Quality and the National Institutes for Health, and periodic reports on the status of the research and related expenditures will be made to the U.S. Congress. Although the results of the comparative effectiveness studies are not intended to mandate coverage policies for public or private payors, it is not clear what effect, if any, the research will have on the sales of any product, if any such product or the condition that it is intended to treat is the subject of a study. It is also possible that comparative effectiveness research demonstrating benefits in a competitor's product could adversely affect the sales of our product candidates. If third-party payors do not consider our products to be cost-effective compared to other available therapies, they may not cover our products as a benefit under their plans or, if they do, the level of payment may not be sufficient to allow us to sell our products on a profitable basis.

The Patient Protection and Affordable Care Act, as amended by the Health Care and Education Affordability Reconciliation Act of 2010, collectively referred to as the ACA, enacted in March 2010, is expected to have a significant impact on the health care industry. ACA is expected to expand coverage for the uninsured while at the same time containing overall healthcare costs. With regard to pharmaceutical products, among other things, ACA is expected to expand and increase industry rebates for drugs covered under Medicaid programs and make changes to the coverage requirements under the Medicare Part D program. We cannot predict the impact of ACA on pharmaceutical companies, as many of the ACA reforms require the promulgation of detailed regulations implementing the statutory provisions which has not yet occurred. In addition, although the U.S. Supreme Court upheld the constitutionality of most of the ACA, some states have indicated that they intend to not implement certain sections of the ACA, and some members of the U.S. Congress are still working to repeal parts of the ACA. These challenges add to the uncertainty of the legislative changes enacted as part of ACA.

In addition, in some non-U.S. jurisdictions, the proposed pricing for a product candidate must be approved before it may be lawfully marketed. The requirements governing drug pricing vary widely from country to country. For example, the European Union provides options for its member states to restrict the range of medicinal products for which their national health insurance systems provide reimbursement and to control the prices of medicinal products for human use. A member state may approve a specific price for the medicinal product or it may instead adopt a system of direct or indirect controls on the profitability of the company placing the medicinal product on the market. There can be no assurance that any country that has price controls or reimbursement limitations for pharmaceutical products will allow favorable reimbursement and pricing arrangements for any of our product candidates. Historically, product candidates launched in the European Union do not follow price structures of the U.S. and generally tend to be significantly lower.

Environment

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

Sales and Marketing

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

Scientific Advisors

We seek advice from our scientific advisory board, which consists of a number of leading scientists and physicians, on scientific and medical matters. We also seek advice on an as-needed basis from other leading scientists and physicians, who are not on our scientific advisory board, based on their particular knowledge and expertise. Our scientific advisory board meets periodically to assess:

- our research and development programs;
- the design and implementation of our clinical programs;
- our patent and publication strategies;
- new technologies relevant to our research and development programs; and
- specific scientific and technical issues relevant to our business.

The current members of our scientific advisory board are as follows.

NAME	POSITION AND INSTITUTIONAL AFFILIATION
Mark Behlke, M.D., Ph.D.	Chief Scientific Officer, Integrated DNA Technologies
Frank McCormick, Ph.D., F.R.S., D.Sc. (Hon)	Director, University of California, San Francisco Helen Diller Family Comprehensive Cancer Center
John Rossi, Ph.D.	Co-Founder of Dicerna and Professor and Dean of Irell and Manella Graduate School of Biological Sciences at City of Hope’s Beckman Research Institute

Employees

As of December 31, 2014, we had 42 full-time employees, of whom 33 are engaged in research and development and nine in administration. None of our employees is represented by a labor union or covered by a collective bargaining agreement. Geographically, all employees are located in Massachusetts. We consider our relationship with our employees to be good.

Corporate Information

We were incorporated in Delaware in 2006. We maintain our executive offices at 87 Cambridgepark Drive, Cambridge, MA 02140, and our main telephone number is (617) 621-8097. Our website is located at www.dicerna.com, which contains information about us. The information contained in, or that can be accessed through, our website is not part of, and is not incorporated in, this Annual Report on Form 10-K.

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 on February 4, 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 exceeds $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 herein as the "JOBS Act," and references herein to "emerging growth company" shall have the meaning associated with it in the JOBS Act.

Our website address is *http://www.dicerna.com* . The information in, or that can be accessed through, our website is not part of this Annual Report on Form 10-K. Our annual reports on Form 10-K, quarterly reports on Form 10-Q and current reports on Form 8-K and amendments to those reports are available, free of charge, on or through our website as soon as reasonably practicable after we electronically file such material with, or furnish it to, the Securities Exchange Commission (SEC). The public may read and copy any materials we file with the SEC at the SEC's Public Reference Room at 100 F Street, NE, Washington, D.C. 20549. Information on the operation of the Public Reference Room can be obtained by calling 1-800-SEC-0330. The SEC maintains an Internet site that contains reports, proxy and information statements and other information regarding our filings at *www.sec.gov* .

Item 1A. *Risk Factors*

We are providing the following cautionary discussion of risk factors, uncertainties and assumptions that we believe are relevant to our business. These are factors that, individually or in the aggregate, we think could cause our actual results to differ materially from expected and historical results and our forward-looking statements. We note these factors for investors as permitted by Section 21E of the Securities Exchange Act of 1934, as amended (Exchange Act), and Section 27A of the Securities Act of 1933, as amended (Securities Act). You should understand that it is not possible to predict or identify all such factors. Consequently, you should not consider this section to be a complete discussion of all potential risks or uncertainties that may substantially impact our business. Moreover, we operate in a competitive and rapidly changing environment. New factors emerge from time to time and it is not possible to predict the impact of all of these factors on our business, financial condition or results of operations.

Risks Related to Our Business

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

We are a clinical stage biopharmaceutical company with a limited operating history, focused on the discovery and development of treatments based on the emerging therapeutic modality RNA interference (RNAi), a biological process in which ribonucleic acid (RNA) molecules inhibit gene expression. Since our inception in October 2006, we have devoted our resources to the development of Dicer substrate RNA (DsiRNA) molecules and delivery technologies. We have had significant operating losses since our inception. As of December 31, 2014, we had an accumulated deficit of $133.4 million. For the years ended December 31, 2014, 2013 and 2012, our net loss was $47.9 million, $18.5 million and $10.1 million, respectively. Substantially all of our losses have resulted from expenses incurred in connection with our research programs and from general and administrative costs associated with our operations. Our technologies and product candidates are in early stages of development, and we are subject to the risks of failure inherent in the development of product candidates based on novel technologies.

To date, we have generated revenue primarily from the receipt of upfront research funding, license and option exercise fees and preclinical payments under our research collaboration and license agreement with Kyowa Hakko Kirin Co., Ltd. (KHK). We have not generated, and do not expect to generate, any product revenue for the foreseeable future, and we expect to continue to incur significant operating losses for the foreseeable future due to the cost of research and development, preclinical studies and clinical trials and the regulatory approval process for product candidates. The amount of future losses is uncertain. Our ability to achieve profitability, if ever, will depend on, among other things, us or our existing collaborator, or any future collaborators, successfully developing product candidates, obtaining regulatory approvals to market and commercialize product candidates, manufacturing any approved products on commercially reasonable terms, establishing a sales and marketing organization or suitable third party alternatives for any approved product and raising sufficient funds to finance business activities. If we or our existing collaborator, or any future collaborators, are unable to develop and commercialize one or more of our product candidates or if sales revenue from any product candidate that receives approval is insufficient, we will not achieve profitability, which could have a material adverse effect on our business, financial condition, results of operations and prospects.

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

We will need substantial additional funds to expand our development, regulatory, manufacturing, marketing and sales capabilities or contract with other organizations to provide these capabilities for us. We have used substantial funds to develop our product candidates and delivery technologies and will require significant funds

to conduct further research and development and preclinical testing and clinical trials of our product candidates, to seek regulatory approvals for our product candidates and to manufacture and market products, if any, that are approved for commercial sale. As of December 31, 2014, we had $98.6 million in cash and cash equivalents and held-to-maturity investments, including $92.7 million of net proceeds, after deducting the underwriting commissions and discounts and the offering expenses, we received from the initial public offering of 6,900,000 shares of our common stock, which closed on February 4, 2014. Based on our current operating plan, we believe that our available cash, cash equivalents and held-to-maturity investments will be sufficient to fund our anticipated level of operations through 2016. Our future capital requirements and the period for which we expect our existing resources to support our operations may vary significantly from what we expect. Our monthly spending levels vary based on new and ongoing development and corporate activities. Because the length of time and activities associated with successful development of our product candidates is highly uncertain, we are unable to estimate the actual funds we will require for development and any approved marketing and commercialization activities. To execute our business plan, we will need, among other things:

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

If we are unable to obtain funding on a timely basis or on acceptable terms, we may have to delay, reduce or terminate our research and development programs and preclinical studies or clinical trials, if any, limit strategic opportunities or undergo reductions in our workforce or other corporate restructuring activities. We also could be required to seek funds through arrangements with collaborators or others that may require us to relinquish rights to some of our technologies or product candidates that we would otherwise pursue on our own. We do not expect to realize revenue from product sales, milestone payments or royalties in the foreseeable future, if at all. Our revenue sources are, and will remain, extremely limited unless and until our product candidates are clinically tested, approved for commercialization and successfully marketed. To date, we have primarily financed our operations through the sale of securities, debt financings, credit and loan facilities and payments received under our collaboration and license agreement with KHK. We will be required to seek additional funding in the future and intend to do so through either collaborations, equity offerings or debt financings, credit or loan facilities or a combination of one or more of these funding sources. Our ability to raise additional funds will depend on financial, economic and other factors, many of which are beyond our control. Additional funds may not be available to us on acceptable terms or at all. If we raise additional funds by issuing equity securities, our stockholders will suffer dilution and the terms of any financing may adversely affect the rights of our stockholders. In addition, as a condition to providing additional funds to us, future investors may demand, and may be granted, rights superior to those of existing stockholders. Debt financing, if available, may involve restrictive covenants limiting our flexibility in conducting future business activities, and, in the event of insolvency, debt holders would be repaid before holders of equity securities receive any distribution of corporate assets.

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

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

- variations in the level of expense related to our product candidates or future development programs;
- results of clinical trials, or the addition or termination of clinical trials or funding support by us, our existing collaborator or any future collaborator or licensing partner;
- the timing of the release of results from any clinical trials conducted by us or our collaborator KHK;
- our execution of any collaboration, licensing or similar arrangement, and the timing of payments we may make or receive under such existing or future arrangements or the termination or modification of any such existing or future arrangements;
- any intellectual property infringement lawsuit or opposition, interference or cancellation proceeding in which we may become involved;
- additions and departures of key personnel;
- strategic decisions by us or our competitors, such as acquisitions, divestitures, spin-offs, joint ventures, strategic investments or changes in business strategy;
- if any of our product candidates receive regulatory approval, market acceptance and demand for such product candidates;
- regulatory developments affecting our product candidates or those of our competitors; and
- changes in general market and economic conditions.

If our quarterly operating results fall below the expectations of investors or securities analysts, the price of our common stock could decline substantially. Furthermore, any quarterly fluctuations in our operating results may, in turn, cause the price of our stock to fluctuate substantially. We believe that quarterly comparisons of our financial results are not necessarily meaningful and should not be relied upon as an indication of our future performance.

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

We plan to develop a pipeline of product candidates using our DsiRNA molecules and delivery technologies for rare inherited diseases involving the liver and cancers that are genetically defined. We believe that product candidates identified with our drug discovery and delivery platform may offer an improved therapeutic approach to small molecules and monoclonal antibodies, as well as several advantages over earlier generation RNAi molecules. However, the scientific research that forms the basis of our efforts to develop product candidates based on the therapeutic modality RNAi and the identification and optimization of DsiRNA is relatively new. Further, the scientific evidence to support the feasibility of developing therapeutic treatments based on RNAi and DsiRNA is both preliminary and limited.

Relatively few product candidates based on RNAi have been tested in animals or humans, and a number of clinical trials conducted by other companies using RNAi technologies have not been successful. We may discover that DsiRNA does not possess certain properties required for a drug to be effective, such as the ability to remain stable in the human body for the period of time required for the drug to reach the target tissue or the ability to cross the cell wall and enter into cells within the target tissue for effective delivery. We currently have only limited data, and no conclusive evidence, to suggest that we can introduce these necessary drug-like properties into DsiRNA. We may spend substantial funds attempting to introduce these properties and may never succeed in doing so. In addition, product candidates based on DsiRNA may demonstrate different chemical and

pharmacological properties in patients than they do in laboratory studies. Even if product candidates, such as DCR-PH1 and DCR-MYC, have successful results in animal studies, they may not demonstrate the same chemical and pharmacological properties in humans and may interact with human biological systems in unforeseen, ineffective or harmful ways. As a result, we may never succeed in developing a marketable product, we may not become profitable and the value of our common stock will decline.

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

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

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

- the timing of our receipt of any marketing and commercialization approvals;
- the terms of any approvals and the countries in which approvals are obtained;
- the safety and efficacy of our product candidates;
- the prevalence and severity of any adverse side effects associated with our product candidates;
- limitations or warnings contained in any labeling approved by the FDA or other regulatory authority;
- relative convenience and ease of administration of our product candidates;
- the willingness of patients to accept any new methods of administration;
- the success of our physician education programs;
- the availability of adequate government and third-party payor reimbursement;
- the pricing of our products, particularly as compared to alternative treatments; and
- availability of alternative effective treatments for the disease indications our product candidates are intended to treat and the relative risks, benefits and costs of those treatments.

With our focus on the emerging therapeutic modality RNAi, these risks may increase to the extent the space becomes more competitive or less favored in the commercial marketplace. Additional risks apply in relation to any disease indications we pursue which are classified as rare diseases and allow for orphan drug designation by regulatory agencies in major commercial markets, such as the U.S., the European Union and Japan. For instance,

we are in the preliminary stages of developing a treatment for the rare genetic disorder Primary Hyperoxaluria Type 1 (PH1) with the gene encoding the liver metabolic enzyme glycolate oxidase as our target. Because of the small patient population for a rare disease, if pricing is not approved or accepted in the market at an appropriate level for an approved product with orphan drug designation, such drug may not generate enough revenue to offset costs of development, manufacturing, marketing and commercialization despite any benefits received from the orphan drug designation, such as market exclusivity, assistance in clinical trial design or a reduction in user fees or tax credits related to development expense. Market size is also a variable in disease indications not classified as rare. Our estimates regarding potential market size for any indication may be materially different from what we discover to exist at the time we commence commercialization, if any, for a product, which could result in significant changes in our business plan and have a material adverse effect on our business, financial condition, results of operations and prospects.

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

As in the U.S., we may apply for designation of a product candidate as an orphan drug for the treatment of a specific indication in the European Union before the application for marketing authorization is made. Sponsors of orphan drugs in the European Union can enjoy economic and marketing benefits, including up to ten years of market exclusivity for the approved indication unless another applicant can show that its product is safer, more effective or otherwise clinically superior to the orphan-designated product.

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

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

A product candidate can unexpectedly fail at any stage of preclinical and clinical development. The historical failure rate for product candidates is high due to scientific feasibility, safety, efficacy, changing standards of medical care and other variables. The results from preclinical testing or early clinical trials of a product candidate may not predict the results that will be obtained in later phase clinical trials of the product

candidate. We, the FDA, IRB, an independent ethics committee, or other applicable regulatory authorities may suspend clinical trials of a product candidate at any time for various reasons, including a belief that subjects participating in such trials are being exposed to unacceptable health risks or adverse side effects. We may not have the financial resources to continue development of, or to enter into collaborations for, a product candidate if we experience any problems or other unforeseen events that delay or prevent regulatory approval of, or our ability to commercialize, product candidates, including:

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

To date, our revenue has been primarily derived from our research collaboration and license agreement with KHK, and we are dependent on KHK for the successful development of product candidates in the collaboration.

In December 2009, we entered into a research collaboration and license agreement with KHK for the research, development and commercialization of DsiRNA molecules and drug delivery technologies for therapeutic targets, primarily in oncology. Under the research collaboration and license agreement with KHK, KHK has paid us a total of $17.5 million. During the first two years of the collaboration, we worked together with KHK to optimize KHK's lipid nanoparticles for tumor delivery and to identify DsiRNAs optimized against oncology and KRAS targets. Based on the results of this research, KHK exercised options to advance two separate DsiRNAs into the development stage, including one with a KRAS target. For each product candidate under the research collaboration and license agreement, we have the potential to receive clinical, regulatory and commercialization milestone payments of up to $110.0 million and royalties on net sales of such product candidate. The success of our collaboration programs with KHK depends entirely upon the efforts of KHK. Except for certain co-promotion and profit sharing rights we retain with respect to the KRAS product candidate if it is approved for marketing and commercialization in the U.S., KHK has sole discretion in determining and

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

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

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

If we cannot contract with acceptable third parties on commercially reasonable terms, or at all, or if these third parties do not carry out their contractual duties, satisfy legal and regulatory requirements for the conduct of preclinical studies or clinical trials or meet expected deadlines, our clinical development programs could be delayed and otherwise adversely affected. In all events, we are responsible for ensuring that each of our preclinical studies and clinical trials is conducted in accordance with the general investigational plan and protocols for the trial. The FDA requires preclinical studies to be conducted in accordance with applicable Good Laboratory Practices (GLPs) and clinical trials to be conducted in accordance with applicable FDA regulations and good clinical practices (GCPs), including requirements for conducting, recording and reporting the results of preclinical studies and clinical trials to assure that data and reported results are credible and accurate and that the rights, integrity and confidentiality of clinical trial participants are protected. Our reliance on third parties that we do not control does not relieve us of these responsibilities and requirements. Any such event could have a material adverse effect on our business, financial condition, results of operations and prospects.

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

We rely on third party supply and manufacturing partners to supply the materials and components for, and manufacture, our research and development, preclinical and clinical trial drug supplies. Pursuant to our development and supply agreement with Tekmira and its subsidiary Protiva Biotherapeutics Inc. (Protiva).

Protiva manufactures lipid nanoparticles that we are seeking to use for delivery of DCR-PH1 to the liver. In the event that we are unable to use the technology we licensed from Tekmira to deliver DCR-PH1 to the liver or if Tekmira or Protiva experience difficulty in manufacturing lipid nanoparticles, our DCR-PH1 program would suffer delays, which could have a material adverse effect on our business, financial condition, results of operations and prospects.

We do not own manufacturing facilities or supply sources for such components and materials. Our manufacturing requirements include lipid nanoparticle components and nucleic acid, each of which we procure from a single source supplier on a purchase order basis. In addition, for each product candidate we currently contract with only one drug product formulation manufacturer for the encapsulation of the oligonucleotide in a lipid particle. There can be no assurance that our supply of research and development, preclinical and clinical development drugs and other materials will not be limited, interrupted, restricted in certain geographic regions or of satisfactory quality or continue to be available at acceptable prices. In particular, any replacement of our drug product formulation manufacturer could require significant effort and expertise because there may be a limited number of qualified replacements.

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

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

- an inability to initiate or continue clinical trials of product candidates under development;
- delay in submitting regulatory applications, or receiving regulatory approvals, for product candidates;
- loss of the cooperation of a collaborator;
- subjecting our product candidates to additional inspections by regulatory authorities;
- requirements to cease distribution or to recall batches of our product candidates; and
- in the event of approval to market and commercialize a product candidate, an inability to meet commercial demands for our products.

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

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

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

The development and commercialization of drugs is highly competitive. We compete with a variety of multinational pharmaceutical companies and specialized biotechnology companies, as well as technology being developed at universities and other research institutions. Our competitors have developed, are developing or will develop product candidates and processes competitive with our product candidates. Competitive therapeutic treatments include those that have already been approved and accepted by the medical community and any new treatments that enter the market. We are aware of multiple companies that are working in the field of RNAi therapeutics, including a major pharmaceutical company, Takeda Pharmaceutical Company Limited, and biopharmaceutical companies such as Alnylam, which in March 2014 acquired Sirna Therapeutics, Inc. from Merck & Co., Inc., Tekmira, with which we have license and development and supply agreements, Arrowhead, Silence Therapeutics plc, RXi Pharmaceuticals Corporation, Quark Pharmaceuticals, Inc. and Marina Biotech, Inc. In particular, Arrowhead holds a non-exclusive license to the same patent rights of City of Hope (COH) and Integrated Data Technologies, Inc. (IDT) as we are licensed under our license agreement with COH. As a result, we cannot rely on those patent rights to prevent Arrowhead or third parties working with Arrowhead from developing, marketing and selling products that compete directly with our product candidates. In March 2015 Arrowhead announced the acquisition of Novartis' RNAi research and development portfolio and associated assets. The acquisition includes assignment of certain intellectual property owned or controlled by Novartis, including access to non-delivery Alnylam RNAi IP for 30 targets, and three pre-clinical RNAi candidates for which Novartis has developed varying amounts of preclinical data.

We believe that a significant number of products are currently under development, and may become commercially available in the future, for the treatment of conditions for which we may try to develop product candidates. There are also competitors to our proprietary product candidates currently in development, some of which may become commercially available before our product candidates. For example, Alnylam announced in the third quarter of 2014 a new RNAi-based program for treatment of PH1. OxThera also has a competing approach to PH1 treatment, currently in Phase 2 clinical trials, that is not RNAi-based. The drug candidates of either Alnylam or OxThera may become commercially available before or perform more effectively than DCR- PH1, our investigational treatment for PH1.

We also compete with companies working to develop antisense and other RNA-based drugs. Like RNAi therapeutics, antisense drugs target messenger RNA (mRNA) with the objective of suppressing the activity of specific genes. The development of antisense drugs is more advanced than that of RNAi therapeutics, and antisense technology may become the preferred technology for products that target mRNAs. Significant competition also exists from companies such as Arrowhead to discover and develop safe and effective means to deliver therapeutic RNAi molecules, such as DsiRNAs, to the relevant cell and tissue types.

If our lead product candidates are approved for the indications we are currently pursuing, they will compete with a range of therapeutic treatments that are either in development or currently marketed. For example, Nexavar, marketed by Amgen Inc. and Bayer AG, is currently in use for the treatment of hepatocellular carcinoma (HCC). Given the high unmet medical need and the commercial success of Nexavar, numerous targeted therapies for the treatment of HCC are under development. Targeted therapies represent the largest proportion of the HCC pipeline. There are also a number of pharmaceuticals and biologics that are marketed or in clinical development for the treatment of solid tumors. The most common treatments for solid tumors are various chemotherapeutic agents, radiation therapy and certain targeted therapies. Targeting therapies include monoclonal antibodies such as Avastin, Erbitux, Herceptin and Vectibix, and small molecules, such as Nexavar, Sutent and Tarceva. Immunotherapy regimens are also on the market and in development for the treatment of solid tumors. In addition, we believe that Kadmon Corporation, LLC is evaluating salirasib (KD032) in clinical trials for the treatment of KRAS-specific non-small cell lung cancer, pancreatic cancer and other solid tumors.

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

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

Our success largely depends on the continued service of key management and other specialized personnel, including Douglas M. Fambrough, III, Ph.D., our chief executive officer, Theodore T. Ashburn, M.D., Ph.D, our senior vice president, product strategy and operations, Pankaj Bhargava, M.D., our chief medical officer, Bob D. Brown, Ph.D., our chief scientific officer, James E. Dentzer, our chief financial officer, and James B. Weissman, our chief business officer. The loss of one or more members of our management team or other key employees or advisors could delay our research and development programs and materially harm our business, financial condition, results of operations and prospects. The relationships that our key managers have cultivated within our industry make us particularly dependent upon their continued employment with us. We are dependent on the

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

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

We have limited experience in drug development and did not begin our first clinical trial of a product candidate until 2014. As our product candidates enter and advance through preclinical studies and any clinical trials, we will need to expand our development, regulatory and manufacturing capabilities or contract with other organizations to provide these capabilities for us. In the future, we expect to have to manage additional relationships with collaborators or partners, suppliers and other organizations. Our ability to manage our operations and future growth will require us to continue to improve our operational, financial and management controls, reporting systems and procedures. We may not be able to implement improvements to our management information and control systems in an efficient or timely manner and may discover deficiencies in existing systems and controls.

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

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

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

The company, our product candidates, our suppliers, and our contract manufacturers, distributors, and contract testing laboratories are subject to extensive regulation by governmental authorities in the European Union, the United States, and other countries, with the regulations differing from country to country.

Even if we receive marketing and commercialization approval of a product candidate, we and our third-party services providers will be subject to continuing regulatory requirements, including a broad array of regulations related to establishment registration and

product listing, manufacturing processes, risk management measures, quality and pharmacovigilance systems, pre- and post-approval clinical data, labeling, advertising and promotional activities for such product, will, record keeping, distribution, and import and export of pharmaceutical products for any product for which we obtain marketing approval. We are required to submit safety and other post market information and reports and are subject to continuing regulatory review, including in relation to adverse patient experiences with the product and clinical results that are reported after a product is made commercially available, both in the U.S. and any foreign jurisdiction in which we seek regulatory approval. The FDA has significant post-market authority, including the authority to require labeling changes based on new safety information and to require post-market studies or clinical trials to evaluate safety risks related to the use of a product or to require withdrawal of the product from the market. The FDA also has the authority to require a risk evaluation and mitigation strategies (REMS) plan after approval, which may impose further requirements or restrictions on the distribution or use of an approved drug. The manufacturer and manufacturing facilities we use to make a future product, if any, will also be subject to periodic review and inspection by the FDA and other regulatory agencies, including for continued compliance with cGMP requirements. The discovery of any new or previously unknown problems with our third-party manufacturers, manufacturing processes or facilities may result in restrictions on the product, manufacturer or facility, including withdrawal of the product from the market. If we rely on third-party manufacturers, we will not have control over compliance with applicable rules and regulations by such manufacturers. Any product promotion and advertising will also be subject to regulatory requirements and continuing regulatory review. If we or our collaborators, manufacturers or service providers fail to comply with applicable continuing regulatory requirements in the U.S. or foreign jurisdictions in which we seek to market our products, we or they may be subject to, among other things, fines, warning and untitled letters, clinical holds, delay or refusal by the FDA to approve pending applications or supplements to approved applications, suspension or withdrawal of regulatory approval, product recalls and seizures, refusal to permit the import or export of products, operating restrictions and total or partial suspension of production or distribution, injunction, restitution, disgorgement, debarment, civil penalties and criminal prosecution.

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

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

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

Our business exposes us to significant product liability risks inherent in the development, testing, manufacturing and marketing of therapeutic treatments. Product liability claims could delay or prevent completion of our development programs. If we succeed in marketing products, such claims could result in an investigation by certain regulatory authorities, such as FDA or foreign regulatory authorities, of the safety and effectiveness of our products, our manufacturing processes and facilities or our marketing programs and

potentially a recall of our products or more serious enforcement action, limitations on the approved indications for which they may be used or suspension or withdrawal of approvals. Regardless of the merits or eventual outcome, liability claims may also result in decreased demand for our products, injury to our reputation, costs to defend the related litigation, a diversion of management's time and our resources, substantial monetary awards to trial participants or patients and a decline in our stock price. We currently have product liability insurance that we believe is appropriate for our stage of development and may need to obtain higher levels prior to marketing any of our product candidates. Any insurance we have or may obtain may not provide sufficient coverage against potential liabilities. Furthermore, clinical trial and product liability insurance is becoming increasingly expensive. As a result, we may be unable to obtain sufficient insurance at a reasonable cost to protect us against losses caused by product liability claims that could have a material adverse effect on our business.

Our employees may engage in misconduct or other improper activities, including noncompliance with regulatory standards and requirements.

We are exposed to the risk of employee fraud or other misconduct. Misconduct by employees could include, but is not limited to, intentional failures to comply with FDA regulations or applicable laws, regulations, guidance or codes of conduct set by foreign governmental authorities or self-regulatory industry organizations, provide accurate information to any governmental authorities such as FDA, comply with manufacturing standards we may establish, comply with federal and state healthcare fraud and abuse laws and regulations, report financial information or data accurately or disclose unauthorized activities to us. In particular, sales, marketing and business arrangements in the healthcare industry are subject to extensive laws, regulations, guidance and codes of conduct intended to prevent fraud, kickbacks, self-dealing and other abusive practices. These laws, regulations, guidance and codes of conduct may restrict or prohibit a wide range of pricing, discounting, marketing and promotion, sales commission, customer incentive programs and other business arrangements. Employee misconduct could also involve the improper use of information obtained in the course of clinical trials, which could result in regulatory sanctions and serious harm to our reputation. It is not always possible to identify and deter employee misconduct, and the precautions we take to detect and prevent this activity may not be effective in controlling unknown or unmanaged risks or losses or in protecting us from governmental investigations or other actions or lawsuits stemming from a failure to be in compliance with such laws, regulations, guidance or codes of conduct. If any such actions are instituted against us, and we are not successful in defending ourselves or asserting our rights, those actions could have a significant impact on our business, including the imposition of significant fines or other sanctions.

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

Despite the implementation of security measures, our internal computer systems and those of our CROs and other contractors and consultants are vulnerable to damage from computer viruses, unauthorized access, natural disasters, terrorism, war and telecommunication and electrical failures. Such events could cause interruptions of our operations. For instance, the loss of preclinical data or data from any future clinical trial involving our product candidates could result in delays in our development and regulatory filing efforts and significantly increase our costs. To the extent that any disruption or security breach were to result in a loss of, or damage to, our data, or inappropriate disclosure of confidential or proprietary information, we could incur liability and the development of our product candidates could be delayed.

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

Our research, development and manufacturing involve the use of hazardous materials and various chemicals. We maintain quantities of various flammable and toxic chemicals in our facilities in Cambridge, Massachusetts, that are required for our research, development and manufacturing activities. We are subject to federal, state and local laws and regulations governing the use, manufacture, storage, handling and disposal of

these hazardous materials. We believe our procedures for storing, handling and disposing these materials in our Cambridge facilities comply with the relevant guidelines of Cambridge, the Commonwealth of Massachusetts and the Occupational Safety and Health Administration of the U.S. Department of Labor. Although we believe that our safety procedures for handling and disposing of these materials comply with the standards mandated by applicable regulations, the risk of accidental contamination or injury from these materials cannot be eliminated. If an accident occurs, we could be held liable for resulting damages, which could be substantial. We are also subject to numerous environmental, health and workplace safety laws and regulations, including those governing laboratory procedures, exposure to blood-borne pathogens and the handling of animals and biohazardous materials. Although we maintain workers' compensation insurance to cover us for costs and expenses we may incur due to injuries to our employees resulting from the use of these materials, this insurance may not provide adequate coverage against potential liabilities. We do not maintain insurance for environmental liability or toxic tort claims that may be asserted against us in connection with our storage or disposal of biological or hazardous materials. Additional federal, state and local laws and regulations affecting our operations may be adopted in the future. We may incur substantial costs to comply with, and substantial fines or penalties if we violate any of these laws or regulations.

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

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

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

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

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

We have incurred substantial losses during our history, do not expect to become profitable for the foreseeable future and may never achieve profitability. To the extent that we continue to generate taxable losses, unused losses will carry forward to offset future taxable income, if any, until such unused losses expire. We may be unable to use these losses to offset income before such unused losses expire. Under Section 382 of the Internal Revenue Code of 1986, as amended, if a corporation undergoes an "ownership change," which is generally defined as a greater than 50 percentage point change by value in its equity ownership over a three-year period, the corporation's ability to use its pre-change net operating loss carryforwards and other pre-change tax attributes to offset its post-change income may be further limited. We have not performed an analysis on whether we have experienced any ownership changes in the past. It is possible that we have experienced an ownership change,

including pursuant to the initial public offering of our common stock, which closed on February 4, 2014, and our net operating losses are subject to such limitation. As of December 31, 2014, we had U.S. federal and Massachusetts net operating loss carryforwards of $57.8 million and $53.4 million, respectively. Any limit on these loss carryforwards if we have or do experience an ownership change could have an adverse effect on our business, financial position, results of operations and prospects.

The investment of our cash and cash equivalents and held-to-maturity investments is subject to risks which may cause losses and affect the liquidity of these investments.

As of December 31, 2014, we had $98.6 million in cash and cash equivalents and held-to-maturity investments. We historically have invested substantially all of our available cash and cash equivalents in corporate bonds, commercial paper, securities issued by the U.S. government, certificates of deposit and money market funds meeting the criteria of our investment policy, which is focused on the preservation of our capital. These investments are subject to general credit, liquidity, market and interest rate risks, including the impact of U.S. sub-prime mortgage defaults that have affected various sectors of the financial markets and caused credit and liquidity issues. We may realize losses in the fair value of these investments or a complete loss of these investments, which would have a negative effect on our condensed consolidated financial statements.

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

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

Accounting methods and policies for biopharmaceutical companies, including policies governing revenue recognition, research and development and related expenses and accounting for stock-based compensation, are subject to review, interpretation and guidance from our auditors and relevant accounting authorities, including the Securities and Exchange Commission and the Public Company Accounting Oversight Board. Changes to accounting methods or policies, or interpretations thereof, may require us to reclassify, restate or otherwise change or revise our financial statements, including those contained in this Annual Report on Form 10-K.

Risks Related to Intellectual Property

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

Our success depends in part on our ability to obtain and maintain patents and other forms of intellectual property rights, including in-licenses of intellectual property rights of others, for our product candidates, methods used to manufacture our product candidates and methods for treating patients using our product candidates, as well as our ability to preserve our trade secrets, to prevent third parties from infringing upon our proprietary rights and to operate without infringing upon the proprietary rights of others. As of February 1, 2015, our patent estate, including the patents and patent applications that we have licensed from COH included over 20 issued patents and over 70 pending patent applications for research and development of our DsiRNA molecules and delivery technologies. We may not be able to apply for patents on certain aspects of our product candidates or delivery technologies in a timely fashion or at all. Our existing issued and granted patents and any future patents we obtain may not be sufficiently broad to prevent others from using our technology or from developing competing products and technology. There is no guarantee that any of our pending patent applications will result in issued or granted patents, that any of our issued or granted patents will not later be found to be invalid or unenforceable or that any issued or granted patents will include claims that are sufficiently broad to cover our product candidates or delivery technologies or to provide meaningful protection from our competitors. Moreover, the patent position of biotechnology and pharmaceutical companies can be highly uncertain because it involves

complex legal and factual questions. We will be able to protect our proprietary rights from unauthorized use by third parties only to the extent that our current and future proprietary technology and product candidates are covered by valid and enforceable patents or are effectively maintained as trade secrets. If third parties disclose or misappropriate our proprietary rights, it may materially and adversely impact our position in the market.

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

In addition, there are numerous recent changes to the patent laws and proposed changes to the rules of the USPTO which may have a significant impact on our ability to protect our technology and enforce our intellectual property rights. For example, the Leahy-Smith America Invents Act (AIA) enacted in 2011 involves significant changes in patent legislation. The Supreme Court has ruled on several patent cases in recent years, some of which cases either narrow the scope of patent protection available in certain circumstances or weaken the rights of patent owners in certain situations. The 2013 decision by the Supreme Court in *Association for Molecular Pathology v. Myriad Genetics, Inc.* precludes a claim to a nucleic acid having a stated nucleotide sequence which is identical to a sequence found in nature and unmodified. We currently are not aware of an immediate impact of this decision on our patents or patent applications because we are developing nucleic acid products which contain modifications that we believe are not found in nature. However, this decision has yet to be clearly interpreted by courts and by the USPTO. We cannot assure you that the interpretations of this decision or subsequent rulings will not adversely impact our patents or patent applications. In addition to increasing uncertainty with regard to our ability to obtain patents in the future, this combination of events has created uncertainty with respect to the value of patents, once obtained. Depending on decisions by the U.S. Congress, the federal courts and the USPTO, the laws and regulations governing patents could change in unpredictable ways that would weaken our ability to obtain new patents or to enforce our existing patents and patents that we might obtain in the future.

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

- Others will not or may not be able to make, use or sell compounds that are the same as or similar to our product candidates but that are not covered by the claims of the patents that we own or license.
- We or our licensors, collaborators or any future collaborators are the first to make the inventions covered by each of our issued patents and pending patent applications that we own or license.
- We or our licensors, collaborators or any future collaborators are the first to file patent applications covering certain aspects of our inventions.
- Others will not independently develop similar or alternative technologies or duplicate any of our technologies without infringing our intellectual property rights.
- A third party may not challenge our patents and, if challenged, a court may not hold that our patents are valid, enforceable and infringed.

- Any issued patents that we own or have licensed will provide us with any competitive advantages, or will not be challenged by third parties.
- We may develop additional proprietary technologies that are patentable.
- The patents of others will not have an adverse effect on our business.
- Our competitors do not conduct research and development activities in countries where we do not have enforceable patent rights and then use the information learned from such activities to develop competitive products for sale in our major commercial markets.

Intellectual property rights of third parties could adversely affect our ability to commercialize our product candidates, and we might be required to litigate or obtain licenses from third parties in order to develop or market our product candidates. Such litigation could be costly and licenses may be unavailable on commercially reasonable terms.

Because the RNAi intellectual property landscape is still evolving, it is difficult to conclusively assess our freedom to operate without infringing on third party rights. There are numerous companies that have pending patent applications and issued patents broadly directed to RNAi generally and to RNAi delivery technologies. Our competitive position may suffer if patents issued to third parties or other third party intellectual property rights cover our products or elements thereof, or our manufacture or uses relevant to our development plans. In such cases, we may not be in a position to develop or commercialize products or product candidates unless we successfully pursue litigation to nullify or invalidate the third party intellectual property right concerned, or enter into a license agreement with the intellectual property right holder, if available on commercially reasonable terms. For instance, in reference to our DsiRNA technology, Alnylam previously demanded that we cease and desist from alleged infringing activities unless we obtain a license from Alnylam for certain intellectual property. We disputed Alnylam's claims and engaged in discussions with Alnylam, but have not received any further correspondence from Alnylam regarding this claim. There can be no assurance that Alnylam will not pursue claims against us. We are aware of issued patents, and there may be others of which we are not aware, held by third parties that, if found to be valid and enforceable, could be alleged to be infringed by our DsiRNA molecules. For example, Alnylam recently received US Patent No. 8,895,721 which claims molecules that have a double-stranded region of up to 25 base pairs and are capable of target-specific RNA interference and US Patent No. 8,853,384 which claims molecules of a length of between 19-52 bases that are capable of target-specific RNA interference. We are also aware of pending patent applications, and there may be others of which we are not aware, that if they result in issued patents, could be alleged to be infringed by our DsiRNA molecules (but not our DsiRNA-EX molecules). If such an infringement claim should be brought and be successful, we may be required to pay substantial damages, be forced to abandon our product candidates or seek a license from any patent holders. No assurances can be given that a license will be available on commercially reasonable terms, if at all.

We are aware of a European patent, granted in 2006, and assigned to Alnylam (EP 1 352 061 B1) (EP '061 patent), that broadly covers various RNAi constructs, including potentially our DsiRNA molecules (but not our DsiRNA-EX molecules).). The EP '061 patent has been validated and is currently in force in Austria, Germany, Ireland, Liechtenstein, Switzerland, and the United Kingdom and could potentially be validated in other European countries. If the EP '061 patent remains in force in each validated European country, we could be prevented from commercializing programs based on our DsiRNA platform (DCR-MYC and KHK programs) products in each of those countries and we could be sued for patent infringement in such countries. We are aware that others are pursuing patent applications directed to similar subject matter in the U.S. and other jurisdictions and reinstatement of a revoked European patent broadly covering various RNA constructs. If any one of these applications were ultimately to issue as patents or the revoked patent were reinstated with claims that cover our DsiRNA molecules, their methods of use or methods of delivery, we could be sued for patent infringement in each of those countries as well. If we were unsuccessful in defending ourselves in any of these actions, we may be required to pay substantial damages, be forced to abandon our product candidates or seek a license from any patent holders, in each case, in such countries. We believe that the expected expiration date of the EP '061 patent and any foreign counterparts that might issue is early 2022.

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

RNAi therapeutics is a relatively new scientific field, the commercial exploitation of which has resulted in many different patents and patent applications from organizations and individuals seeking to obtain patent protection in the field. Our efforts are based on RNAi technology that we have licensed (DsiRNA) and that we have developed internally and own (DsiRNA-EX). We have chosen this approach to increase our likelihood of technical success and our freedom to operate. We have obtained grants and issuances of RNAi, RNAi therapeutic and DsiRNA patents and have licensed many of these patents from third parties on an exclusive or non-exclusive basis. The issued patents and pending patent applications in the U.S. and in key markets around the world that we own or license claim many different methods, compositions and processes relating to the discovery, development, manufacture and commercialization of RNAi therapeutics and DsiRNA therapeutics. Specifically, we own and have licensed a portfolio of patents, patent applications and other intellectual property covering: (1) certain aspects of the structure and uses of DsiRNA and DsiRNA-EX molecules, including their manufacture and use as therapeutics, and RNAi-related mechanisms, (2) chemical modifications to DsiRNA and DsiRNA-EX molecules that improve their suitability for therapeutic uses, (3) DsiRNA and DsiRNA-EX molecules directed to specific gene sequences and drug targets as treatments for particular diseases and (4) delivery technologies, such as in the field of lipid chemistry, lipid nanoparticles and lipid nanoparticle formulation.

As the field of RNAi therapeutics matures, patent applications are being processed by national patent offices around the world. There is uncertainty about which patents will issue, and, if they do, as to when, to whom, and with what claims. It is likely that there will be significant litigation in the courts and other proceedings, such as interference, reexamination and opposition proceedings, in various patent offices relating to patent rights in the RNAi therapeutics field. In many cases, the possibility of appeal or opposition exists for either us or our opponents, and it may be years before final, unappealable rulings are made with respect to these patents in certain jurisdictions. The timing and outcome of these and other proceedings is uncertain and may adversely affect our business if we are not successful in defending the patentability and scope of our pending and issued patent claims or if third parties are successful in obtaining claims that cover our DsiRNA technology or any of our product candidates. In addition, third parties may attempt to invalidate our intellectual property rights. Even if our rights are not directly challenged, disputes could lead to the weakening of our intellectual property rights. Our defense against any attempt by third parties to circumvent or invalidate our intellectual property rights could be costly to us, could require significant time and attention of our management and could have a material adverse effect on our business and our ability to successfully compete in the field of RNAi therapeutics.

There are many issued and pending patents that claim aspects of oligonucleotide chemistry and modifications that we may need to apply to our DsiRNA and DsiRNA-EX therapeutic candidates. There are also many issued patents that claim targeting genes or portions of genes that may be relevant for DsiRNA drugs we

wish to develop. Thus, it is possible that one or more organizations will hold patent rights to which we will need a license. If those organizations refuse to grant us a license to such patent rights on reasonable terms, we may be unable to market products or perform research and development or other activities covered by these patents.

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

We do, and will continue to, rely on intellectual property rights licensed from third parties to protect our technology. We are a party to a number of licenses that give us rights to third-party intellectual property that is necessary or useful for our business. In particular, we have a license from COH (on behalf of itself and IDT) to certain patent rights, which provide platform intellectual property for research and development of our DsiRNA molecules, as employed in our DCR-MYC programs and collaborative programs with KHK. Pursuant to this agreement, we have a worldwide license from COH (subject to the pre-existing non-exclusive license) for the exploitation of key intellectual property rights in this respect, and COH and IDT retain ownership of the patents and patent applications to which we are licensed under the agreement. In addition, we have an exclusive worldwide license from Tekmira and Protiva to their LNP technology for delivery of certain therapeutics to treat PH1, and Tekmira and Protiva retain ownership of their patents. This technology could be important to us as we are seeking to use it to deliver DCR-PH1 to the liver. If we are unable to do so, our DCR-PH1 program would suffer delays, which could have a material adverse effect on our business, financial condition, results of operations and prospects. We also intend to license additional third-party intellectual property in the future. Our success will depend in part on the ability of our licensors to obtain, maintain and enforce patent protection for our licensed intellectual property, in particular, those patents to which we have secured exclusive rights. Our licensors may not successfully prosecute the patent applications licensed to us. Even if patents issue or are granted, our licensors may fail to maintain these patents, may determine not to pursue litigation against other companies that are infringing these patents, or may pursue litigation less aggressively than we would. Further, we may not obtain exclusive rights, which would allow for third parties to develop competing products. Without protection for, or exclusive right to, the intellectual property we license, other companies might be able to offer substantially identical products for sale, which could adversely affect our competitive business position and harm our business prospects. In addition, we sublicense our rights under our third-party licenses to KHK and may sublicense such rights to current or future collaborators or any future strategic partners. Any impairment of these sublicensed rights could result in reduced revenue under our collaboration agreement with KHK or result in termination of an agreement by one or more of our collaborators or any future strategic partners.

Certain third parties may also have rights in the patents related to DsiRNA included in the license granted to us by COH, including the core DsiRNA patent (U.S. 8,084,599), which could allow them to develop, market and sell product candidates in competition with ours.

To the extent that we do not have exclusive rights in the patents covered by the license granted to us by COH, we cannot prevent third parties from developing DsiRNA based product candidates in competition with ours. Prior to entering into the license with us, COH had entered into a non-exclusive license with a third party with respect to such patent rights to manufacture, use, import, offer for sale and sell products covered by the licensed patent rights for the treatment or prevention of disease in humans (excluding viruses and delivery of products into the eye or ear). While we believe that such non-exclusive license has been terminated, COH has informed us that a sublicensee to that non-exclusive license was permitted to enter into an equivalent non-exclusive license which, to our knowledge, is subsisting with Arrowhead, as successor to the non-exclusive license holder. As successor to the non-exclusive license holder, we believe that Arrowhead has substantially similar access to the same patent rights related to DsiRNA technology granted to us under our license with COH. Arrowhead is developing RNA-based therapeutics for the treatment of diseases of the liver, which may directly compete with our product candidates. In addition, the U.S. government has certain rights to the inventions covered by the patent rights and COH, as an academic research and medical center, has the right to practice the licensed patent rights for educational, research and clinical uses. If Arrowhead or another party develops,

manufactures, markets and sells any product covered by the same patent rights and technologies that compete with ours, it could significantly undercut the value of any of our product candidates, which would materially adversely affect our revenue, financial condition and results of operations.

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

Obtaining a valid and enforceable issued or granted patent covering our technology in the U.S. and worldwide can be extremely costly. In jurisdictions where we have not obtained patent protection, competitors may use our technology to develop their own products and further, may export otherwise infringing products to territories where we have patent protection, but where it is more difficult to enforce a patent as compared to the U.S. Competitor products may compete with our future products in jurisdictions where we do not have issued or granted patents or where our issued or granted patent claims or other intellectual property rights are not sufficient to prevent competitor activities in these jurisdictions. The legal systems of certain countries, particularly certain developing countries, make it difficult to enforce patents and such countries may not recognize other types of intellectual property protection, particularly that relating to biopharmaceuticals. This could make it difficult for us to prevent the infringement of our patents or marketing of competing products in violation of our proprietary rights generally in certain jurisdictions. Proceedings to enforce our patent rights in foreign jurisdictions could result in substantial cost and divert our efforts and attention from other aspects of our business.

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

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

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

We or our licensors, collaborators or any future strategic partners may be subject to third-party claims for infringement or misappropriation of patent or other proprietary rights. We are generally obligated under our license or collaboration agreements to indemnify and hold harmless our licensors or collaborators for damages

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

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

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

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

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

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

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

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

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

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

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

Risks Related to Government Regulation

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

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

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

Because the drugs we are developing may represent a new class of drug, the FDA and its foreign counterparts have not yet established any definitive policies, practices or guidelines in relation to these drugs. While we believe the product candidates that we are currently developing are regulated as new drugs under the Federal Food, Drug, and Cosmetic Act, the FDA could decide to regulate them or other products we may develop as biologics under the Public Health Service Act. The lack of policies, practices or guidelines may hinder or slow review by the FDA or foreign regulatory authorities of any regulatory filings that we may submit. Moreover, the FDA or foreign regulatory authorities may respond to these submissions by defining requirements we may not have anticipated. Such responses could lead to significant delays in the clinical development of our product candidates. In addition, because there may be approved treatments for some of the diseases for which we may seek approval, in order to receive regulatory approval, we may need to demonstrate through clinical trials that the product candidates we develop to treat these diseases, if any, are not only safe and effective, but safer or more effective than existing products. Furthermore, in recent years, there has been increased public and political pressure on the FDA with respect to the approval process for new drugs, and the FDA’s standards, especially regarding drug safety, appear to have become more stringent.

Any delay or failure in obtaining required approvals could have a material adverse effect on our ability to generate revenues from the particular product candidate for which we are seeking approval. Furthermore, any regulatory approval to market a product may be subject to limitations on the approved uses for which we may market the product or the labeling or other restrictions. Regulatory authority also may impose requirements for costly post-marketing studies or clinical trials and surveillance to monitor the safety or efficacy of the product. In addition, the FDA has the authority to require a Risk Evaluation and Mitigation Strategy (REMS) plan as part of an NDA or biologics license application (BLA) or after approval, which may impose further requirements or restrictions on the distribution or use of an approved drug or biologic, such as limiting prescribing to certain physicians or medical centers that have undergone specialized training, limiting treatment to patients who meet

certain safe-use criteria and requiring treated patients to enroll in a registry. These limitations and restrictions may limit the size of the market for the product and affect reimbursement by third-party payors.

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

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

We and our collaborators are subject to federal, state, and foreign healthcare laws and regulations pertaining to fraud and abuse and patients' rights. These laws and regulations include, but are not limited to:

- the U.S. federal healthcare program anti-kickback law, which prohibits, among other things, persons from soliciting, receiving or providing remuneration, directly or indirectly, to induce either the referral of an individual for a healthcare item or service, or the purchasing or ordering of an item or service, for which payment may be made under a federal healthcare program such as Medicare or Medicaid;
- the U.S. federal false claims law, which prohibits, among other things, individuals or entities from knowingly presenting or causing to be presented, claims for payment by government funded programs such as Medicare or Medicaid that are false or fraudulent, and which may apply to us by virtue of statements and representations made to customers or third parties;

  the Federal Food, Drug and Cosmetic Act and other laws, which prohibit use from making claims, proactively discussing, or disseminating information about off-label uses, or uses outside of our products' approved indications, with very specific and limited exceptions;
- the U.S. federal Health Insurance Portability and Accountability Act (HIPAA) and Health Information Technology for Economic and Clinical Health (HITECH) Act, which prohibit executing a scheme to defraud healthcare programs, impose requirements relating to the privacy, security, and transmission of individually identifiable health information, and require notification to affected individuals and regulatory authorities of certain breaches of security of individually identifiable health information;
- the federal Open Payments regulations under the National Physician Payment Transparency Program have been issued under the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Affordability Reconciliation Act, and will require that manufacturers of pharmaceutical and biological drugs covered by Medicare, Medicaid, and Children's Health Insurance Programs report all consulting fees, travel reimbursements, research grants, and other payments or gifts with values over $10 made to physicians and teaching hospitals; and
- state laws comparable to each of the above federal laws, such as, for example, anti-kickback and false claims laws applicable to commercial insurers and other non-federal payors, requirements for mandatory corporate regulatory compliance programs, and laws relating to patient data privacy and security.

If our operations are found to be in violation of any such requirements, we may be subject to penalties, including civil or criminal penalties, monetary damages, the curtailment or restructuring of our operations, loss of eligibility to obtain approvals from the FDA, or exclusion from participation in government contracting, healthcare reimbursement or other government programs, including Medicare and Medicaid, any of which could adversely our financial results. Although effective compliance programs can mitigate the risk of investigation

and prosecution for violations of these laws, these risks cannot be entirely eliminated. Any action against us for an alleged or suspected violation could cause us to incur significant legal expenses and could divert our management's attention from the operation of our business, even if our defense is successful. In addition, achieving and sustaining compliance with applicable laws and regulations may be costly to us in terms of money, time and resources.

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

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

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

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

Our ability to commercialize any products successfully also will depend in part on the extent to which coverage and reimbursement for these products and related treatments will be available from government health administration authorities, private health insurers and other organizations. However, there may be significant delays in obtaining coverage for newly-approved drugs. Moreover, eligibility for coverage does not necessarily signify that a drug will be reimbursed in all cases or at a rate that covers our costs, including research, development, manufacture, sale and distribution costs. Also, interim payments for new drugs, if applicable, may be insufficient to cover our costs and may not be made permanent. Thus, even if we succeed in bringing one or

more products to the market, these products may not be considered cost-effective, and the amount reimbursed for any products may be insufficient to allow us to sell our products on a competitive basis. Because our programs are in the early stages of development, we are unable at this time to determine their cost effectiveness or the likely level or method of reimbursement. Increasingly, the third-party payors who reimburse patients or healthcare providers, such as government and private insurance plans, are seeking greater upfront discounts, additional rebates and other concessions to reduce the prices for pharmaceutical products. If the price we are able to charge for any products we develop, or the reimbursement provided for such products, is inadequate in light of our development and other costs, our return on investment could be adversely affected.

We currently expect that certain/some drugs we develop may need to be administered under the supervision of a physician on an outpatient basis. Under currently applicable U.S. law, certain drugs that are not usually self-administered (including injectable drugs) may be eligible for coverage under the Medicare Part B program if certain requirements, including the following, have been satisfied:

- they are furnished incident to a physician's services;
- they are reasonable and necessary for the diagnosis or treatment of the illness or injury for which they are administered according to accepted standards of medical practice;
- they are included or approved for inclusion in certain Medicare-designated pharmaceutical compendia; and
- they have been approved by the FDA.

Under current law, as a condition of receiving Medicare Part B reimbursement for a manufacturer's eligible drugs or biologicals, the manufacturer is required to participate in other government healthcare programs, including the Medicaid Drug Rebate Program (MDRP) and the 340B Drug Discount Program. Average prices for drugs may be reduced by mandatory discounts or rebates required by government healthcare programs or private payors and by any future relaxation of laws that presently restrict imports of drugs from countries where they may be sold at lower prices than in the U.S. Reimbursement rates under Medicare Part B would depend in part on whether the newly approved product would be eligible for a unique billing code. Self-administered drugs are typically reimbursed under Medicare Part D, and drugs that are administered in a hospital setting are typically reimbursed under Medicare Part A under a bundled payment. It is difficult for us to predict how Medicare coverage and reimbursement policies will be applied to our products in the future and coverage and reimbursement under different federal healthcare programs are not always consistent. Medicare reimbursement rates may also reflect budgetary constraints placed on the Medicare program.

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

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

For example, in the U.S., Congress passed the Patient Protection and Affordable Care Act of 2010, as amended by the Health Care and Education Affordability Reconciliation Act (ACA), which contains provisions

that affect companies in the pharmaceutical industry and other healthcare-related industries in a variety of ways. Provisions that may affect pharmaceutical companies include, but are not limited to, the following.

- Mandatory rebates for drugs sold under the Medicaid program have been increased, and the rebate requirement has been extended to drugs used in risk-based Medicaid managed care plans.
- The 340B Drug Discount Program has been extended to require discounts for "covered outpatient drugs" sold to certain children's hospitals, critical access hospitals, freestanding cancer hospitals, rural referral centers, and sole community hospitals.
- Pharmaceutical companies are required to offer discounts on brand-name drugs to patients who fall within the Medicare Part D coverage gap, commonly referred to as the "Donut Hole."
- Pharmaceutical companies are required to pay an annual non-tax-deductible fee to the federal government based on each company's market share of prior year total sales of branded drugs to certain federal healthcare programs, such as Medicare, Medicaid, Department of Veterans Affairs and Department of Defense. Since we expect our branded pharmaceutical sales to constitute a small portion of the total federal healthcare program pharmaceutical market, we do not expect this annual assessment to have a material impact on our financial condition.
- For product candidates classified as biologics, marketing approval for a follow-on biologic product may not become effective until 12 years after the date on which the reference innovator biologic product was first licensed by the FDA, with a possible six-month extension for pediatric products. After this exclusivity ends, it will be easier for biosimilar manufacturers to enter the market, which is likely to reduce the pricing for such products and could affect our profitability.

In addition, in recent years, U.S. Congress has enacted various laws seeking to reduce the federal debt level and contain healthcare expenditures. For example, the Budget Control Act of 2011 (BCA) called for the establishment of a Joint Select Committee on Deficit Reduction, tasked with reducing the federal debt level. However, because the Committee did not draft a proposal by the BCA's deadline, President Obama issued a sequestration order on March 1, 2013 that imposed automatic spending cuts on various federal programs. Under the Bipartisan Budget Act of 2013 and a bill signed by the President on February 15, 2014, sequestration has been extended through fiscal year 2024. Medicare payments to providers are subject to such cuts, although the BCA generally limited the Medicare cuts to two percent. For fiscal year 2024, however, Medicare sequestration amounts will be realigned such that there will be a 4.0 percent sequester for the first six months and a zero percent sequester for the second six months.

The financial impact of the U.S. healthcare reform legislation over the next few years will depend on a number of factors, including the policies reflected in implementing regulations and guidance and changes in sales volumes for products affected by the legislation. Moreover, we cannot predict what healthcare reform initiatives may be adopted in the future. Further federal and state legislative, regulatory, or judicial developments are likely, and we expect ongoing initiatives in the U.S. to reduce healthcare expenditures. Such reforms could have an adverse effect on anticipated revenues from product candidates that we may successfully develop and for which we may obtain regulatory approval and may affect our overall financial condition and ability to develop product candidates.

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

As a healthcare company, our operations, clinical trial activities and interactions with healthcare providers may be subject to extensive regulation in the U.S., particularly if the company receives FDA approval for any of its products in the future. For example, if we receive FDA approval for a product for which reimbursement is available under a federal healthcare program (e.g., Medicare, Medicaid), it would be subject to a variety of federal laws and regulations, including those that prohibit the filing of false or improper claims for payment by federal healthcare programs (e.g. the False Claims Act), prohibit unlawful inducements for the referral of

business reimbursable by federal healthcare programs (e.g. the Anti-Kickback Statute), and require disclosure of certain payments or other transfers of value made to U.S.-licensed physicians and teaching hospitals (the Physician Payments Sunshine Act). We are not able to predict how third parties will interpret these laws and apply applicable governmental guidance and may challenge our practices and activities under one or more of these laws. If our past or present operations are found to be in violation of any of these laws, we could be subject to civil and criminal penalties, which could hurt our business, our operations and financial condition.

Similarly, the Health Insurance Portability and Accountability Act of 1996 (HIPAA) prohibits, among other offenses, knowingly and willfully executing a scheme to defraud any health care benefit program, including private payors, or falsifying, concealing or covering up a material fact or making any materially false, fictitious or fraudulent statement in connection with the delivery of or payment for items or services under a health care benefit program. To the extent that the company acts as a business associate to a healthcare provider, the company may also be subject to the privacy and security provisions of HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act of 2009, which restricts the use and disclosure of patient-identifiable health information, mandates the adoption of standards relating to the privacy and security of patient-identifiable health information, and requires the reporting of certain security breaches to healthcare provider customers with respect to such information. Additionally, many states have enacted similar laws that may impose more stringent requirements on entities like ours. Failure to comply with applicable laws and regulations could result in substantial penalties and adversely affect the company's financial condition and results of operations.

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

U.S. federal government agencies currently face potentially significant spending reductions. The Budget Control Act of 2011 (BCA) established a Joint Select Committee on Deficit Reduction, which was tasked with achieving a reduction in the federal debt level of at least $1.2 trillion. That committee did not draft a proposal by the BCA's deadline. As a result, automatic cuts (sequestration) in various federal programs were scheduled to take place, beginning in January 2013, although the American Taxpayer Relief Act of 2012 delayed the BCA's automatic cuts until March 1, 2013. While the Medicare program's eligibility and scope of benefits are generally exempt from these cuts, Medicare payments to providers and Part D health plans are not exempt. The BCA did, however, provide that the Medicare cuts to providers and Part D health plans would not exceed two percent. President Obama issued the sequestration order on March 1, 2013, and cuts went into effect on April 1, 2013. Additionally, the Bipartisan Budget Act of 2013 extended sequestration for Medicare for another two years, through 2023, and a bill signed by the President on February 15, 2014, further extended these cuts for an additional year, through fiscal year 2024. On January 21, 2014, President Obama signed the fiscal year 2014 omnibus appropriations bill, modifying for fiscal year 2014 and fiscal year 2015 the cuts that went into effect under the sequester on March 1, 2013.

The situation with the federal budget remains in flux. From October 1, 2013 through October 16, 2013, the U.S. federal government ceased the majority of its operations after Congress failed to enact legislation appropriating funds for fiscal year 2014. On October 17, 2013, President Obama signed into law the Continuing Appropriations Act of 2014, which included a continuing resolution to fund the government until January 15, 2014 and suspended the statutory debt ceiling until February 7, 2014. After extending the government funding expiration date to January 18, 2014, Congress passed a $1.1 trillion spending bill that was signed into law on January 17, 2014 and funds the government through September 30, 2014. While on December 9, 2014, Congress passed the Consolidated and Further Continuing Appropriations Act of 2015, which funds the government through September 30, 2015, this new law is a temporary measure that does not resolve the debt-limit issue. Many Members of Congress have made public statements indicating that some or all of these budget-related deadlines should be used as leverage to negotiate additional cuts in federal spending. The Medicare program is frequently mentioned as a target for spending cuts. The full impact on our business of any future cuts in Medicare or other programs would be uncertain. If federal spending is reduced, anticipated budgetary shortfalls may also

impact the ability of relevant agencies, such as the FDA or the National Institutes of Health to continue to function at current levels. Amounts allocated to federal grants and contracts may be reduced or eliminated. These reductions may also impact the ability of relevant agencies to timely review and approve drug research and development, manufacturing, and marketing activities, which may delay our ability to develop, market and sell any products we may develop.

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

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

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

Risks Related to Our Common Stock

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

We are an “emerging growth company” as defined in the Jumpstart Our Business Act (JOBS Act). For as long as we continue to be an emerging growth company, we may take advantage of exemptions from various reporting requirements that are applicable to other public companies that are not emerging growth companies, including (1) not being required to comply with the auditor attestation requirements of Section 404(b) of the Sarbanes-Oxley Act of 2002 (Sarbanes-Oxley Act), (2) reduced disclosure obligations regarding executive compensation in our periodic reports and proxy statements and (3) exemptions from the requirements of holding a nonbinding advisory vote on executive compensation and stockholder approval of any golden parachute payments not previously approved. We could be an emerging growth company for up to five years, although circumstances could cause us to lose that status earlier, including if the market value of our common stock held by non-affiliates exceeds $700.0 million as of any June 30 before that time or if we have total annual gross revenue of $1.0 billion or more during any fiscal year before that time, in which cases we would no longer be an emerging growth company as of the following December 31, or if we issue more than $1.0 billion in non-convertible debt during any three-year period before that time, in which case we would no longer be an emerging growth company immediately. Even after we no longer qualify as an emerging growth company, we may still

qualify as a "smaller reporting company" which would allow us to take advantage of many of the same exemptions from disclosure requirements including not being required to comply with the auditor attestation requirements of Section 404(b) of the Sarbanes-Oxley Act and reduced disclosure obligations regarding executive compensation in our periodic reports and proxy statements. We cannot predict if investors will find our common stock less attractive because we may rely on these exemptions. If some investors find our common stock less attractive as a result, there may be a less active trading market for our common stock and our share price may be more volatile.

Under the JOBS Act, emerging growth companies can also delay adopting new or revised accounting standards until such time as those standards apply to private companies. We have irrevocably elected not to avail ourselves of this exemption from new or revised accounting standards and, therefore, will be subject to the same new or revised accounting standards as other public companies that are not emerging growth companies.

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

Our stock price is volatile. From January 30, 2014, the first day of trading of our common stock, through March 11, 2015, our stock had high and low closing sale prices in the range of $46.00 and $8.14 per share. The market price for our common stock may be influenced by many factors, including the other risks described in this section titled "Risk Factors" and the following:

- the success of competitive products or technologies;
- results of preclinical and clinical studies of our product candidates, or those of our competitors, our existing collaborator or any future collaborators;
- regulatory or legal developments in the U.S. and other countries, especially changes in laws or regulations applicable to our products;
- introductions and announcements of new products by us, our commercialization partners, or our competitors, and the timing of these introductions or announcements;
- actions taken by regulatory agencies with respect to our products, clinical studies, manufacturing process or sales and marketing terms;
- actual or anticipated variations in our financial results or those of companies that are perceived to be similar to us;
- the success of our efforts to acquire or in-license additional technologies, products or product candidates;
- developments concerning our collaborations, including but not limited to those with our sources of manufacturing supply and our commercialization partners;
- announcements by us or our competitors of significant acquisitions, strategic partnerships, joint ventures or capital commitments;
- developments concerning our collaborations, including those with our sources of manufacturing supply and our commercialization partners;
- our ability or inability to raise additional capital and the terms on which we raise it;
- the recruitment or departure of key personnel;
- changes in the structure of healthcare payment systems;
- market conditions in the pharmaceutical and biotechnology sectors;
- actual or anticipated changes in earnings estimates or changes in stock market analyst recommendations regarding our common stock, other comparable companies or our industry generally;

- our failure or the failure of our competitors to meet analysts' projections or guidance that we or our competitors may give to the market;
- fluctuations in the valuation of companies perceived by investors to be comparable to us;
- announcement and expectation of additional financing efforts;
- speculation in the press or investment community;
- trading volume of our common stock;
- sales of our common stock by us or our stockholders;
- the absence of lock-up agreements in connection with the initial public offering of our common stock with the holders of substantially all of our outstanding shares;
- the concentrated ownership of our common stock;
- changes in accounting principles;
- terrorist acts, acts of war or periods of widespread civil unrest;
- natural disasters and other calamities; and
- general economic, industry and market conditions.

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

The future issuance of equity or of debt securities that are convertible into equity will dilute our share capital.

We may choose to raise additional capital in the future, depending on market conditions, strategic considerations and operational requirements. To facilitate potentially raising additional capital, contemporaneously with the filing of this Form 10-K, we are filing with the SEC a universal shelf registration statement on Form S-3 permitting the sale of 10,000,000 shares of our common stock and $50,000,000 of other securities. To the extent that additional capital is raised through the issuance of shares or other securities convertible into shares, our stockholders will be diluted. Future issuances of our common stock or other equity securities, or the perception that such sales may occur, could adversely affect the trading price of our common stock and impair our ability to raise capital through future offerings of shares or equity securities. We cannot predict the effect, if any, that future sales of common stock or the availability of common stock for future sales will have on the trading price of our common stock.

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

Our executive officers are parties to employment agreements providing, in the event of a termination of employment in connection with a change of control of us, for significant cash payments for severance and other benefits and acceleration of vesting of up to all outstanding stock options. The accelerated vesting of options could result in dilution to our existing stockholders and reduce the market price of our common stock. The payment of these severance benefits could harm our financial condition. In addition, these potential severance payments may discourage or prevent third parties from seeking a business combination with us.

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

The trading market for our common stock will be influenced by the research and reports that industry or securities analysts publish about us or our business. If any of the analysts who cover us issue an adverse or

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

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

As of March 11, 2015, our executive officers and directors, together with holders of five percent or more of our outstanding common stock and their respective affiliates, beneficially own, in the aggregate, approximately 78.6 percent of our outstanding common stock, including shares subject to outstanding options and warrants that are exercisable within 60 days after such date, based on the Forms 3 and 4 and Schedules 13D and 13G filed by them with the SEC. As a result, these stockholders, if acting together, will continue to have significant influence over the outcome of corporate actions requiring stockholder approval, including the election of directors, any merger, consolidation or sale of all or substantially all of our assets and any other significant corporate transaction. The interests of these stockholders may not be the same as or may even conflict with the interests of our other stockholders. For example, these stockholders could delay or prevent a change of control of our company, even if such a change of control would benefit our other stockholders, which could deprive our stockholders of an opportunity to receive a premium for their common stock as part of a sale of our company or our assets and might affect the prevailing market price of our common stock. The significant concentration of stock ownership may adversely affect the trading price of our common stock due to investors' perception that conflicts of interest may exist or arise.

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

Provisions in our certificate of incorporation and our bylaws may delay or prevent an acquisition of us or a change in our management. In addition, these provisions may frustrate or prevent any attempts by our stockholders to replace or remove our current management by making it more difficult for stockholders to replace members of our board of directors. Because our board of directors is responsible for appointing the members of our management team, these provisions could in turn affect any attempt by our stockholders to replace current members of our management team. These provisions include:

- a prohibition on actions by our stockholders by written consent;
- a requirement that special meetings of stockholders, which the Company is not obligated to call more than once per calendar year, be called only by the chairman of our board of directors, our chief executive officer, our board of directors pursuant to a resolution adopted by a majority of the total number of authorized directors, or, subject to certain conditions, by our secretary at the request of the stockholders holding of record, in the aggregate, shares entitled to cast not less than ten percent of the votes at a meeting of the stockholders (assuming all shares entitled to vote at such meeting were present and voted);
- advance notice requirements for election to our board of directors and for proposing matters that can be acted upon at stockholder meetings; and
- the authority of the board of directors to issue preferred stock with such terms as the board of directors may determine.

Moreover, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporation Law, as amended, which prohibits a person who owns in excess of 15 percent of our outstanding voting stock from merging or combining with us for a period of three years after the date of the transaction in which the person acquired in excess of 15 percent of our outstanding voting stock, unless the

merger or combination is approved in a prescribed manner. These provisions would apply even if the proposed merger or acquisition could be considered beneficial by some stockholders.

We incur increased costs as a result of operating as a public company, and our management is required to devote substantial time to new compliance initiatives and corporate governance practices.

As a public company we incur, and particularly after we are no longer an emerging growth company, we will incur significant legal, accounting and other expenses that we did not incur as a private company. The Sarbanes-Oxley Act, the Dodd-Frank Wall Street Reform and Consumer Protection Act, the listing requirements of the NASDAQ and other applicable securities rules and regulations impose various requirements on public companies, including establishment and maintenance of effective disclosure and financial controls and corporate governance practices. Our management and other personnel need to devote a substantial amount of time to these compliance initiatives. Moreover, these rules and regulations increase our legal and financial compliance costs and make some activities more time-consuming and costly. For example, we expect that these rules and regulations make it more difficult and more expensive for us to obtain director and officer liability insurance, which in turn could make it more difficult for us to attract and retain qualified members of our board of directors. However, these rules and regulations are often subject to varying interpretations, in many cases due to their lack of specificity, and, as a result, their application in practice may evolve over time as new guidance is provided by regulatory and governing bodies. This could result in continuing uncertainty regarding compliance matters and higher costs necessitated by ongoing revisions to disclosure and governance practices.

We are not currently required to comply with the SEC's rules that implement Section 404(b) of the Sarbanes-Oxley Act (Section 404(b)), and are therefore not required to make a formal assessment of the effectiveness of our internal control over financial reporting for that purpose. Pursuant to Section 404(b), we will be required to furnish a report by our management on our internal control over financial reporting. However, while we remain an emerging growth company, we will not be required to include an attestation report on internal control over financial reporting issued by our independent registered public accounting firm. To achieve compliance with Section 404(b) within the prescribed period, we will be engaged in a process to document and evaluate our internal control over financial reporting, which is both costly and challenging. In this regard, we will need to continue to dedicate internal resources, potentially engage outside consultants and adopt a detailed work plan to assess and document the adequacy of internal control over financial reporting, continue steps to improve control processes as appropriate, validate through testing that controls are functioning as documented and implement a continuous reporting and improvement process for internal control over financial reporting. Despite our efforts, there is a risk that we will not be able to conclude, within the prescribed timeframe or at all, that our internal control over financial reporting is effective as required by Section 404(b). If we identify one or more material weaknesses, it could result in an adverse reaction in the financial markets due to a loss of confidence in the reliability of our financial statements. In addition, if we are not able to continue to meet these requirements, we may not be able to remain listed on The NASDAQ Market.

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

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

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

Our stock price has fluctuated and may fluctuate for many reasons, including as a result of public announcements regarding the progress of our development efforts or the development efforts of our collaborators or competitors, the addition or departure of our key personnel, variations in our quarterly operating results and changes in market valuations of pharmaceutical and biotechnology companies. This risk is especially relevant to

us because pharmaceutical and biotechnology companies have experienced significant stock price volatility in recent years. When the market price of a stock has been volatile as our stock price has been and may be, holders of that stock have occasionally brought securities class action litigation against the company that issued the stock. If any of our stockholders were to bring a lawsuit of this type against us, even if the lawsuit is without merit, we could incur substantial costs defending the lawsuit. The lawsuit could also divert the time and attention of our management.

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

Our amended and restated bylaws provide that, subject to limited exceptions, the Court of Chancery of the State of Delaware will be the sole and exclusive forum for any derivative action or proceeding brought on our behalf, any action asserting a claim of breach of a fiduciary duty owed by any of our directors, officers or other employees to us or our stockholders, any action asserting a claim against us arising pursuant to any provision of the Delaware General Corporation Law, as amended, our amended and restated certificate of incorporation or our amended and restated bylaws, any action to interpret, apply, enforce or determine the validity of our amended and restated certificate of incorporation or our amended and restated bylaws or any other action asserting a claim against us that is governed by the internal affairs doctrine. Any person or entity purchasing or otherwise acquiring any interest in shares of our capital stock shall be deemed to have notice of and to have consented to the provisions of our amended and restated certificate of incorporation described above. This 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 us and our directors, officers and employees. Alternatively, if a court were to find these provisions of our amended and restated certificate of incorporation inapplicable to, or unenforceable in respect of, one or more of the specified types of actions or proceedings, we may incur additional costs associated with resolving such matters in other jurisdictions, which could adversely affect our business and financial condition.

Item 1B. *Unresolved Staff Comments*

None.

Item 2. *Properties*

Our corporate headquarters are located in Cambridge, Massachusetts, where we lease 37,084 square feet of office and laboratory space. The lease term for our office and laboratory space in Cambridge, Massachusetts, commenced in December 2014 for a lease term of six years.

We believe that suitable additional or alternative space will be available as needed on commercially reasonable terms.

Item 3. *Legal Proceedings*

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

Item 4. *Mine Safety Disclosures*

Not applicable.

PART II

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

Market Information for Common Stock

Our common stock has been publicly traded on The NASDAQ Global Select Market under the symbol "DRNA" since January 30, 2014. Prior to that time, there was no public market for our common stock. As a result, we have not set forth information with respect to the high and low prices of our common stock for any full fiscal quarter during 2013 fiscal year. The following table sets forth the high and low sale prices per share for our common stock on The NASDAQ Global Select Market for the periods indicated:

Year Ended December 31, 2014:	High	Low
First Quarter (from January 30, 2014)	$46.00	$27.11
Second Quarter	$28.25	$15.00
Third Quarter	$22.40	$12.55
Fourth Quarter	$16.82	$ 8.00

Holders of Record

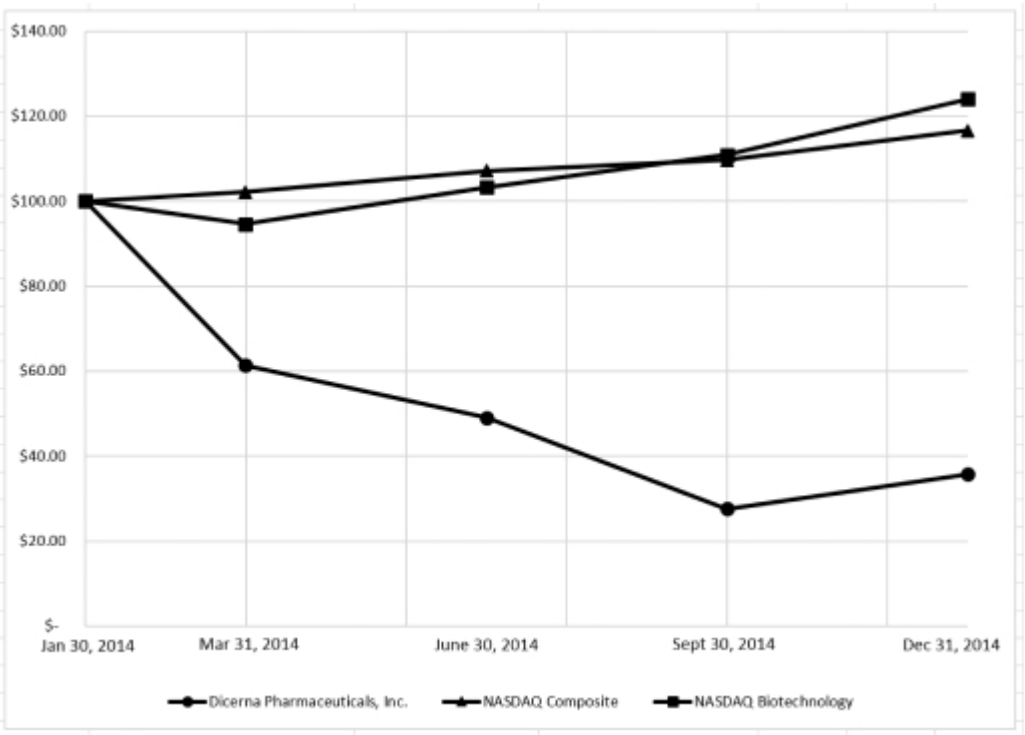
As of March 11, 2015, there were approximately 18 holders of record of our common stock. Because many of our shares of common stock are held by brokers and other institutions on behalf of stockholders, we are unable to estimate the total number of stockholders represented by these record holders.

Dividend Policy

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

Performance Graph

The following graph illustrates a comparison of the total cumulative stockholder return on our common stock since January 30, 2014 (the date our stock became publicly traded on The NASDAQ Global Select Market) to the NASDAQ composite and NASDAQ biotechnology indices. The graph assumes an initial investment of $100 on January 30, 2014. The stock price performance on the following graph is not necessarily indicative of future stock price performance. This performance graph shall not be deemed "filed" for purposes of Section 18 of the Securities Exchange Act of 1934, as amended (the "Exchange Act"), or incorporated by reference into any of our filings under the Securities Act of 1933, as amended, or the Exchange Act, except as shall be expressly set forth by specific reference in such filing.



Recent Sales of Unregistered Securities

The following sets forth information regarding all securities sold or granted by us during the fiscal year ended December 31, 2014, which were not registered under the Securities Act of 1933, as amended (Securities Act), and the consideration, if any, received by us for such securities.

During the twelve months ended December 31, 2014, we issued a total of 12,702 shares of common stock to Hercules Technology II, L.P. (Hercules) upon the cashless net exercise of certain warrants held by Hercules to purchase a total of 47,400 shares of our common stock at an exercise price of $25.00 per share. We deemed such issuance to be exempt from registration under the Securities Act of 1933, as amended (Securities Act), in reliance on Section 4(2) of the Securities Act, including Regulation D and Rule 506 promulgated thereunder, relative to transactions by an issuer not involving a public offering.

Use of Proceeds from Initial Public Offering of Common Stock

On February 4, 2014, we completed the initial public offering of our common stock and sold and issued a total of 6,900,000 shares of our common stock, including 900,000 shares sold pursuant to the exercise in full by

the underwriters of the option to purchase additional shares, at a public offering price of $15.00 per share for aggregate gross proceeds of $103.5 million before deducting underwriting commissions and discounts and offering expenses payable by us. The shares of common stock were registered under the Securities Act on a registration statement on Form S-1 (File No. 333-193150). The SEC declared the registration statement effective on January 29, 2014. Shares of our common stock began trading on The NASDAQ Global Select Market on January 30, 2014. On February 4, 2014, following the sale of 6,900,000 shares of our common stock, our initial public offering ended. There has been no material change in the planned use of proceeds from our initial public offering as described in the final prospectus dated as of January 29, 2014 for the initial public offering and filed with the SEC pursuant to Rule 424(b) under the Securities Act on January 30, 2014.

Purchases of Equity Securities by the Issuer and Affiliated Parties

None.

Item 6. ***Selected Financial Data***

DICERNA PHARMACEUTICALS, INC. AND SUBSIDIARIES
SELECTED FINANCIAL DATA

	YEARS ENDED DECEMBER 31,		
	2014	**2013**	**2012**
Results of operations			
Revenue	$ —	$ —	$ 7,015
Operating expenses:			
Research and development	29,453	11,558	11,565
General and administrative	15,648	5,820	4,700
Total operating expenses	45,101	17,378	16,265
Loss from operations	(45,101)	(17,378)	(9,250)
Other income (expense):			
Preferred stock warrant remeasurement	(2,559)	126	469
Loss on extinguishment of debt	(143)	(318)	—
Interest income	63	4	2
Interest expense	(199)	(952)	(1,342)
Total other income (expense)	(2,838)	(1,140)	(871)
Net loss	$ (47,939)	$(18,518)	$(10,121)
Less: Accretion and dividends on redeemable convertible preferred stock	204	2,388	4,097
Net loss attributable to common stockholders	(48,143)	(20,906)	(14,218)
Net loss per share attributable to common stockholders—Basic and diluted	$ (3.00)	$(709.57)	$(516.00)
Weighted average shares outstanding—Basic and diluted	16,070,054	29,463	27,554
Financial condition			
Cash and cash equivalents	$ 26,067	$ 46,595	$ 3,670
Held-to-maturity investments	$ 72,556	$ —	$ —
Total assets	$ 103,605	$ 49,794	$ 10,191
Long-term debt—including of current portion	$ —	$ 4,847	$ 4,660
Total stockholders' equity / (deficit)	$ 98,340	$(68,919)	$(64,719)

The financial data included within the tables above should be read in conjunction with our consolidated financial statements and related notes and the *"Management's Discussion and Analysis of Financial Condition and Results of Operations"* sections of this Form 10-K.

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

The following discussion contains forward-looking statements that involve risks and uncertainties. Our actual results could differ materially from those discussed here. Factors that could cause or contribute to such differences include, but are not limited to, those discussed in this section as well as factors described in "Part I, Item 1A— Risk Factors."

Overview

We are an RNA interference-based biopharmaceutical company focused on the discovery and development of innovative treatments for rare inherited diseases involving the liver and for cancers that are genetically defined. We are using our RNA interference (RNAi) technology platform to build a broad pipeline in these therapeutic areas. In both rare diseases and oncology, we are pursuing targets that have historically been difficult to inhibit using conventional approaches, but where we believe connections between targets and diseases are well understood and documented. We aim to discover, develop and commercialize these novel therapeutics either on our own or in collaboration with pharmaceutical partners. In indications such as rare diseases in which a small sales force will suffice, we seek to retain substantially all commercial rights in key markets. In oncology and other more prevalent disease areas, we may partner our products while seeking to retain significant portions of the commercial rights in North America.

In the rare disease field, we are developing a proprietary treatment, DCR-PH1, for the rare and serious inherited disorder PH1. We seek to begin clinical trials of DCR-PH1 in mid to late of 2015. We also have discovery and early development programs against a series of additional disease targets in the liver. In oncology, we are currently directing our development efforts towards our proprietary product candidate DCR-MYC for the treatment of MYC-related cancers, including hepatocellular carcinoma (HCC). We submitted an IND application for DCR-MYC for the treatment of solid tumors, multiple myeloma, and lymphoma to the U.S. Food and Drug Administration in the second quarter of 2014 and began our clinical trials of DCR-MYC shortly thereafter in the second quarter of 2014. In the fourth quarter of 2014 we initiated a global Phase 1b/2 clinical trial of DCR-MYC in patients with advanced HCC.

As part of our collaboration with Kyowa Hakko Kirin Co., Ltd. (KHK), a global pharmaceutical company, we are developing a product candidate that targets the oncogene KRAS, which is frequently mutated in numerous major cancers, including non-small cell lung cancer, colorectal cancer, and pancreatic cancer. KHK is responsible for global development of the KRAS program, including all development expenses. For the KRAS product candidate, we retain an option to co-promote in the U.S. for an equal share of the profits from U.S. net sales. We are also developing a product candidate targeting a cancer-related gene in collaboration with KHK. For each product candidate in our collaboration with KHK, we have the potential to receive clinical, regulatory and commercialization milestone payments of up to $110.0 million and royalties on net sales of each such product candidate. We expect that our strategy to partner the development of product candidates will help us fund the costs of clinical development and enable us to diversify risk across a number of programs.

Since our inception in October 2006, we have devoted substantial resources to the research and development of DsiRNA molecules and drug delivery technologies and the protection and enhancement of our intellectual property estate. We have no products approved for sale and all of our revenue to date has been collaboration revenue or government grant revenue. To date, we have funded our operations primarily through the recent initial public offering of our common stock, previous private placements of preferred stock and convertible debt securities, from research funding, license fees, option exercise fees and preclinical payments under our research collaboration and license agreement with KHK and from a government grant. In addition, we have borrowed under a secured term loan from Hercules Technology II, L.P. (Hercules loan) to fund our operations. More particularly, since our inception and through December 31, 2014, we have raised an aggregate of $233.2 million to fund our operations, of which $92.7 million was from the initial public offering of our common stock, which closed on February 4, 2014, $110.5 million was from the sale of preferred stock and convertible debt securities (including $3.0 million from the 2013 bridge note financing), $17.5 million was through our collaboration and

license agreement with KHK, $0.5 million was from a federal government grant for our Qualifying Therapeutic Discovery Project in November 2010 and $12.0 million was from borrowings under the Hercules loan. As of December 31, 2014, we had cash and cash equivalents and held-to-maturity investments of $98.6 million and we also had $1.4 million in assets held in restriction. On April 7, 2014, we repaid the remaining amount of the Hercules loan of approximately $3.6 million.

On February 4, 2014, we completed the initial public offering of our common stock, in which we issued and sold a total of 6,900,000 shares of common stock, including 900,000 shares sold pursuant to the exercise in full by the underwriters of an option to purchase additional shares, at a public offering price of $15.00 per share. We received net proceeds of approximately $92.7 million after deducting the underwriting commissions and discounts and offering expenses payable by us. All of the shares of our preferred stock were converted into shares of common stock and our warrants to purchase preferred stock became exercisable to purchase common stock immediately prior to the completion of our initial public offering.

Since inception, we have incurred significant operating losses. Our net loss was $47.9 million, $18.5 million and $10.1 million for the years ended December 31, 2014, 2013 and 2012, respectively. Substantially all of our operating losses resulted from expenses incurred in connection with our research programs and from general and administrative costs associated with our operations. We recognized no revenue for the years ended December 31, 2014 and 2013, respectively. We recognized revenue of $7.0 million for the year ended December 31, 2012. Our revenue to date has been generated through our research collaboration and license agreement with KHK and a government grant. We have not generated any commercial product revenue. As of December 31, 2014, we had an accumulated deficit of $133.4 million. We expect to continue to incur significant and increasing losses in the foreseeable future. Our net losses may fluctuate significantly from quarter to quarter and year to year. We anticipate that our expenses will increase substantially as we:

- advance our product candidates into preclinical development;
- conduct any clinical trials of DCR-PH1, DCR-MYC and other potential product candidates;
- continue our research and development efforts, including to expand our pipeline and to enhance our technology platform;
- increase research and development related activities for the discovery and development of additional product candidates;
- manufacture clinical study materials and develop large-scale manufacturing capabilities;
- seek regulatory approval for our product candidates that successfully complete clinical trials;
- maintain, expand and protect our intellectual property portfolio;
- add operational, financial and management information systems and personnel, including personnel to support our product development and planned future commercialization efforts; and
- operate as a public company.

We do not expect to generate substantial revenue from product sales unless and until we successfully complete development and obtain regulatory approval for one or more of our product candidates, which is subject to significant uncertainty and which could take several years. If we obtain regulatory approval for any of our product candidates, we expect to incur significant commercialization expenses related to product sales, marketing, manufacturing and distribution. Until such time, if ever, that we generate product revenue and positive cash flow from operations, we expect to finance our cash needs through a combination of public or private equity offerings, debt financings and research collaboration and license agreements. We may be unable to raise capital or enter into such other arrangements when needed or on favorable terms. Our failure to raise capital or enter into such other arrangements as and when needed would have a negative impact on our financial condition and our ability to develop our product candidates.

Collaboration agreement

In December 2009, we entered into a research collaboration and license agreement with KHK for the research, development and commercialization of DsiRNA molecules and drug delivery technologies for therapeutic targets in oncology. We have granted KHK an exclusive, worldwide, royalty-bearing and sub-licensable license to our DsiRNA molecules and drug delivery technologies and intellectual property for certain selected DsiRNA-based compounds. Under the research collaboration and license agreement, KHK is responsible for activities to develop, manufacture and commercialize the selected DsiRNA-based compounds and pharmaceutical products containing such compounds. For the KRAS product candidate, we have an option to co-promote in the U.S. for an equal share of the profits from U.S. net sales. In addition, for each product candidate under the research collaboration and license agreement, we have the potential to receive clinical, regulatory and commercialization milestone payments of up to $110.0 million and royalties on net sales of such product candidate.

Since the initiation of the research collaboration and license agreement, of the various targets in the collaboration, two target programs, including the initial target KRAS, have been nominated by KHK for formal development studies. Both programs utilize our specific RNAi-inducing double-stranded DsiRNA molecules and a lipid nanoparticle drug delivery technology proprietary to KHK. As of December 31, 2014, we have received total payments of $17.5 million from KHK under the research collaboration and license agreement.

License agreement

In September 2007, we entered into a license agreement with City of Hope (COH), an independent academic research and medical center, pursuant to which COH has granted to us an exclusive (subject to certain exceptions described below), royalty-bearing, worldwide license under certain patent rights in relation to DsiRNA, including the core DsiRNA patent (U.S. 8,084,599), to manufacture, use, offer for sale, sell and import products covered by the licensed patent rights for the prevention and treatment of any disease in humans. COH is restricted from granting any additional rights to develop, manufacture, use, offer to sell, sell or import products covered by the licensed patent rights for the prevention and treatment of any disease in humans. In addition, COH has granted to us an exclusive, royalty-bearing, worldwide license under the licensed patent rights providing certain rights for up to 20 licensed products selected by us for human diagnostic uses, provided that COH has not granted or is not negotiating a license of rights to diagnostic uses for such licensed products to a third party. The core DsiRNA patent (U.S. 8,084,599), titled “methods and compositions for the specific inhibition of gene expression by double-stranded RNA,” describes RNA structures having a 25 to 30 nucleotides sense strand, a blunt end at the 3’ end of the sense strand and a one to four nucleotides overhang at the 3’ end of the antisense strand. The expiration date of this patent is July 17, 2027.

Pursuant to the terms of the agreement, we paid COH a one-time, non-refundable license fee and issued shares of our common stock to COH and a co-inventor of the core DsiRNA patent. COH is entitled to receive milestone payments in an aggregate amount within the range of $5.0 million to $10.0 million upon achievement of certain clinical and regulatory milestones. COH is further entitled to receive royalties at a low single-digit percentage of any net sale revenue of the licensed products sold by us and our sublicensees. If we sublicense the licensed patent rights to a third party, COH has the right to receive a double digit percentage of sublicense income, the percentage of which decreases after we have expended $12.5 million in development and commercialization costs. We are also obligated to pay COH an annual license maintenance fee, which may be credited against any royalties due to COH in the same year, and reimburse COH for expenses associated with the prosecution and maintenance of the license patent rights. The license agreement will remain in effect until the expiration of the last to expire of the patents or copyrights licensed under the agreement. We have not included our obligations to make future milestone payments on our balance sheet because the achievement and timing of the related milestones is not probable and estimable.

In September 2013, we entered into a commercial license agreement with Plant Bioscience Limited (PBL), pursuant to which PBL has granted a license to us for certain of its U.S. patents and patent applications to research, discover, develop, manufacture, sell, import and export, products incorporating one or more short RNA molecules (SRMs).

We have paid PBL a one-time, non-refundable signature fee and will pay PBL a nomination fee for any additional SRMs nominated by us under the agreement. We are further obligated to pay PBL milestone payments upon achievement of certain clinical and regulatory milestones. In addition, PBL is entitled to receive royalties on any net sale revenue of any licensed product candidates sold by us. During 2014, the Company paid $0.1 million to PBL upon the commencement of our MYC clinical trial.

In November 2014, we entered into a licensing and collaboration agreement with Tekmira to license Tekmira's LNP delivery technology for exclusive use in our PH1 development program. We will use Tekmira's LNP technology to deliver DCR-PH1, for the treatment of PH1. As of December 31, 2014, we paid $3.0 million in license fees. Tekmira is entitled to receive additional payments of $22.0 million in aggregate development milestones, plus a mid-single-digit royalty on future PH1 sales. This new partnership also includes a supply agreement with Tekmira providing clinical drug supply and regulatory support.

In December 2014, we licensed all of our non-U.S. intellectual property rights to a non-U.S. wholly-owned subsidiary.

Financial Operations Overview

Revenue

Our revenue to date has been generated primarily through research funding, license fees, option exercise fees and preclinical development payments under our research collaboration and license agreement with KHK and a government grant. We have not generated any commercial product revenue. For each product candidate under our research collaboration and license agreement with KHK, we are also entitled to receive clinical, regulatory and commercialization milestone payments of up to $110.0 million and royalties on net sales of such product candidate. We did not receive any royalty payments during 2014 or 2013.

We did not have revenue for the years ended December 31, 2014 and 2013.

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

Research and development expenses

Research and development expenses consist of costs associated with our research activities, including discovery and development of our DsiRNA and DsiRNA-EX molecules and drug delivery technologies and our research activities under our research collaboration and license agreement with KHK. Our research and development expenses include:

- direct research and development expenses incurred under arrangements with third parties, such as contract research organizations, contract manufacturing organizations, and consultants;
- platform-related lab expenses, including lab supplies, license fees consultants and our scientific advisory board;
- employee-related expenses, including salaries, benefits and stock-based compensation expense; and

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

We expense research and development costs as they are incurred. We account for nonrefundable advance payments for goods and services that will be used in future research and development activities as expenses when the service has been performed or when the goods have been received. A significant portion of our research and development costs are not tracked by project as they benefit multiple projects or our technology platform.

In the second quarter of 2014, we initiated a multi-center, dose-escalating Phase 1 clinical study of DCR-MYC to assess the safety and tolerability of DCR-MYC in patients with solid tumors, multiple myeloma, or lymphoma who are refractory or unresponsive to standard therapies, and in the first quarter of 2015 we have initiated a global Phase 1b/2 clinical trial of DCR-MYC in patients with advanced HCC. The process of conducting preclinical studies and clinical trials necessary to obtain regulatory approval is costly and time-consuming. We, KHK or any future collaborator may never succeed in obtaining marketing approval for any of our product candidates. The probability of success for each product candidate may be affected by numerous factors, including preclinical data, clinical data, competition, manufacturing capability and commercial viability.

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

General and administrative expenses

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

Interest income

Interest income consists of interest income earned on our cash and cash equivalents, held-to-maturity investments and assets held in restriction.

Interest expense

Interest expense consists of interest expense on our borrowings under bridge financing loans that converted into shares of our preferred stock (convertible notes), including our 2013 bridge notes financing and the Hercules loan, which was repaid in full in April 2014.

Preferred stock warrant remeasurement

Preferred stock warrant remeasurement is associated with warrants to purchase preferred stock issued to lenders under our convertible notes and the Hercules loan. The remeasurement consists of the change in value

calculated using the Black-Scholes option pricing model to estimate the fair value of the warrants. We base the estimates in the Black-Scholes option pricing model, in part, on subjective assumptions, including stock price volatility, risk-free interest rate, dividend yield and the fair value of the preferred stock underlying the warrants. The remeasurement gain or loss associated with the change in the fair value of the preferred stock warrant liability each reporting period is recognized as a component of other income (expense). Upon the completion of our initial public offering on February 4, 2014, the preferred stock warrant liability was reclassified as a component of equity and is no longer subject to remeasurement. The fair value of the preferred stock warrants as of the initial public offering closing date of the initial public offering was $3.1 million.

Critical Accounting Policies and Significant Judgments and Estimates

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

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

Revenue recognition

Collaborative research and development and multiple-deliverable arrangements

We have generated our revenue primarily through our research collaboration and license agreement with KHK and a government grant. The terms of the research collaboration and license agreement with KHK include multiple deliverables by us (e.g., license rights and research and development services) in exchange for consideration to us of some combination of research funding, license fees, option exercise fees, payments based upon the achievement of specified milestones and royalty payments based on product sales derived from the collaboration.

We recognize revenue when all of the following four criteria are met: (1) persuasive evidence that an arrangement exists; (2) delivery of the products or services has occurred; (3) the selling price is fixed or determinable; and (4) collectability is reasonably assured. Multiple-deliverable arrangements, such as license and development agreements, are analyzed to determine whether the deliverables can be separated or whether they must be accounted for as a single unit of accounting. When deliverables are separable, consideration received is allocated to the separate units of accounting based on the relative selling price method and the appropriate revenue recognition principles are applied to each unit. When we determine that an arrangement should be accounted for as a single unit of accounting, we must determine the period over which the performance obligations will be performed and revenue will be recognized.

At the inception of each arrangement that includes payments for optional research or milestones, we evaluate whether each option or milestone is substantive and at risk to both parties on the basis of the contingent nature of the option or milestone. This evaluation includes an assessment of whether: (1) the consideration is commensurate with either the entity's performance to achieve the milestone or the enhancement of the value of

the delivered items; (2) as a result of a specific outcome resulting from the entity's performance to achieve the milestone; (3) the consideration relates solely to past performance; and (4) the consideration is reasonable relative to all of the deliverables and payment terms within the arrangement. Substantive options and milestones are recognized as revenue upon the achievement of the milestone, assuming all other revenue recognition criteria are met.

License fees are initially recorded as deferred revenue upon receipt and then recognized as revenue over our performance period. Research and development service revenue is recognized over the research term as the research and development services are provided. The cost of such services is reflected in research and development costs in the period in which it is incurred. Assuming all other revenue recognition criteria are met, milestone payments are recognized as revenue when the milestone is achieved or is probable of achievement. Royalty payments are recognized as revenue based on contract terms and reported sales of licensed products, when reported sales are reliably measurable and collectability is reasonably assured.

Preferred stock warrants liability

As of December 31, 2013, we had outstanding warrants for the purchase of shares of Series A and Series B preferred stock as well as warrants issued in the Series C bridge loan that became exercisable for shares of Series C preferred stock, (Series C warrants), upon the closing of our sale of Series C preferred stock in July 2013. We account for freestanding warrants related to shares that are redeemable or contingently redeemable, or for purchases of preferred stock that are not indexed to our stock, as liabilities. The warrants are recorded at fair value, estimated using the Black-Scholes option-pricing model, at each balance sheet date with changes in the fair value of the liability recorded in the statement of operations.

Pursuant to the terms of these warrants, upon the conversion of the class of preferred stock underlying the warrant, the warrants automatically become exercisable for shares of our common stock based upon the conversion ratio of the underlying class of preferred stock. The consummation of our initial public offering resulted in the conversion of all classes of our preferred stock into common stock. Upon the conversion of the underlying classes of preferred stock, our outstanding warrants to purchase Series A, Series B and Series C preferred stock were reclassified as a component of equity and are no longer subject to remeasurement.

Net operating loss and research and development tax credit carryforwards

We file U.S. federal income tax returns, Massachusetts state tax returns. The deferred tax assets were primarily comprised of federal and state tax net operating losses and tax credit carryforwards and were recorded using enacted tax rates expected to be in effect in the years in which these temporary differences are expected to be utilized. As of December 31, 2014, the Company has approximately $57.8 million of federal and $53.4 million of state net operating loss carryforwards, and $1.5 million of federal and $0.9 million of Massachusetts research and development credits that expire starting in 2028. As of December 31, 2014, we had $1.2 million of unrecognized tax benefits, of which $1.2 million would affect income tax expense if recognized, before consideration of our valuation allowance.

Utilization of the net operating loss and tax credit carryforwards may be subject to an annual limitation due to historical or future ownership percentage change rules provided by the Internal Revenue Code of 1986, as amended, and similar state provisions. The annual limitation may result in the expiration of certain net operating loss and tax credit carryforwards before their utilization. However, due to uncertainties surrounding our ability to generate future taxable income to realize these tax assets, a full valuation allowance has been established to offset our deferred tax assets.

Redeemable convertible preferred stock

We have issued preferred stock in the past to raise capital. We initially record preferred stock redeemable outside of our control outside of stockholders' equity (deficit) at the value of the proceeds received or fair value,

if lower, net of issuance costs. Subsequently, if it is probable that the preferred stock will become redeemable, we adjust the carrying value to the redemption value over the period from the issuance date to the earliest possible redemption date.

Stock-based compensation and common stock valuation

Stock-based compensation

We estimate the fair value of our stock-based awards to employees and non-employees using the Black-Scholes option-pricing model, which requires the input of highly subjective assumptions, including: (1) the expected volatility of our stock, (2) the expected term of the award, (3) the risk-free interest rate and (4) expected dividends. Due to the lack of a public market history for the trading of our common stock before and after the completion of our initial public offering and a lack of company specific historical and implied volatility data, we have based our estimate of expected volatility on the historical volatility of a group of similar companies that are publicly traded. For these analyses, we have selected companies with comparable characteristics to ours, including factors such as enterprise value, risk profiles, position within the industry and historical share price information, sufficient to meet the expected life of the stock-based awards. We compute the historical volatility data using the daily closing prices for the selected companies' shares during the equivalent period of the calculated expected term of our stock-based awards. We have estimated the expected life of our employee stock options using the "simplified" method, whereby the expected life equals the average of the vesting term and the original contractual term of the option. The risk-free interest rates for periods within the expected life of the option are based on the U.S. Treasury yield curve in effect during the period the options were granted.

We are also required to estimate forfeitures at the time of grant and revise those estimates in subsequent periods if actual forfeitures differ from estimates. We use historical data to estimate pre-vesting option forfeitures and record stock-based compensation expense only for those awards that are expected to vest. Stock-based compensation expense recognized in the financial statements is based on awards that are ultimately expected to vest.

Common stock valuations before the initial public offering

We have historically granted stock options at exercise prices not less than the fair value of our common stock. As there was no public market for our common stock before our initial public offering, the estimated fair value of our common stock was previously determined by our board of directors. Stock options granted after the completion of initial public offering are valued using our common stock price as stated on The NASDAQ Global Select Market on the grant date. We have periodically determined, for financial reporting purposes, the estimated per share fair value of our common stock at various dates using contemporaneous valuations performed in accordance with the guidance outlined in the American Institute of Certified Public Accountants Practice Aid, *Valuation of Privately-Held Company Equity Securities Issued as Compensation* (Practice Aid). We performed these contemporaneous valuations as of January 31, 2012 and August 31, 2013. In conducting the contemporaneous valuations, we considered all objective and subjective factors that we believed to be relevant for each valuation conducted, including our best estimate of our business condition, prospects and operating performance at each valuation date. Within the contemporaneous valuations performed, a range of factors, assumptions and methodologies were used. The significant factors included:

- the prices of our preferred stock sold to or exchanged between outside investors in arm's length transactions, and the rights, preferences and privileges of our preferred stock as compared to those of our common stock, including the liquidation preferences of our preferred stock;
- our results of operations, financial position and the status of research and development efforts;
- the composition of, and changes to, our management team and board of directors;
- the lack of liquidity of our common stock as a private company;

- our stage of development and business strategy and the material risks related to our business and industry;
- the achievement of enterprise milestones, including entering into collaboration and license agreements;
- the valuation of publicly traded companies in the life sciences and biotechnology sectors, as well as recently completed mergers and acquisitions of peer companies;
- any external market conditions affecting the life sciences and biotechnology industry sectors;
- the likelihood of achieving a liquidity event for the holders of our common stock and stock options, such as an initial public offering or a sale of our company, given prevailing market conditions;
- the state of the initial public offering market for similarly situated privately held biotechnology companies; and
- any recent contemporaneous valuations prepared by our board of directors and management in accordance with methodologies outlined in the Practice Aid.

Stock option grants on December 4, 2013 and December 30, 2013

For the stock options granted by us on December 4, 2013 and December 30, 2013, our board of directors determined that the fair value of common stock of $3.42 per share calculated in the contemporaneous valuation as of August 31, 2013 reasonably reflected the per share fair value of our common stock on each of the grant dates. However, in the context and given the anticipated proximity of our initial public offering, for financial reporting purposes, in early January 2014 we conducted a retrospective valuation as of December 31, 2013, which reasonably assumed that examination of contemporaneous information would have concluded a price range consistent with the then estimated price range for our initial public offering of $11.00 to $13.00 per share. The retrospective valuation as of December 31, 2013 indicated that the fair value of our common stock on December 31, 2013 was $7.42 per share. The valuation concluded that, with such contemporaneous information, the fair value of our common stock as of December 31, 2013 was $7.42 per share primarily due to feedback from investment bankers that we had an increased probability of executing a successful initial public offering in the first quarter of 2014 and feedback from investment bankers that public investors could potentially price our common stock in the range of $11.00 to $13.00 per share in such an initial public offering. Accordingly, we recognized a stock-based compensation charge of less than $0.1 million in relation to the December 4, 2013 and December 30, 2013 option grants for the quarter ended December 31, 2013 based on the grant date fair value of our common stock as determined by the retrospective valuation.

Held-to-Maturity Investments

We account for our investment in marketable securities in accordance with FASB ASC 320, Investments — Debt and Equity Securities. We determine the appropriate classification of investments at the time of purchase and re-evaluate such designation as of each balance sheet date. Debt securities carried at amortized cost are classified as held-to-maturity when we have the positive intent and ability to hold the securities to maturity. At December 31, 2014, all of our investments were classified as held-to-maturity.

Emerging growth company status

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

Recent Accounting Pronouncements

In June 2014, the FASB issued Accounting Standards Update No. 2014-12, Compensation—Stock Compensation (ASU 2014-12). The guidance provides clarification regarding the accounting for equity awards where a performance target that affects vesting and that could be achieved after the requisite service period should be accounted for as a performance condition. Compensation cost would be recognized over the required service period, if it is probable that the performance condition will be achieved. We do not expect the standard will have an impact on our consolidated financial statements and related disclosures since we are currently accounting for these awards in a manner consistent with the new guidance.

Comparison of the years ended December 31, 2014 and 2013

The following table summarizes the results of our operations for the years ended December 31, 2014 and 2013 (in thousands, except percentages):

	FOR THE YEARS ENDED DECEMBER 31,		INCREASE (DECREASE)	
	2014	2013		
Total revenue	$ —	$ —	$ —	—
Expenses:				
Research and development	29,453	11,558	17,895	155%
General and administrative	15,648	5,820	9,828	169%
Total expenses	45,101	17,378	27,723	160%
Loss from operations	(45,101)	(17,378)	(27,723)	(160)%
Other expense	(2,838)	(1,140)	(1,698)	(149)%
Net loss	$ (47,939)	$ (18,518)	$(29,421)	(159)%

Revenue

We did not recognize any revenue for the years ended December 31, 2014 and 2013. We do not expect to generate any product revenue for the foreseeable future.

Research and development expenses

The following table summarizes our research and development expenses incurred during the years ended December 31, 2014 and 2013 (in thousands):

	FOR THE YEARS ENDED DECEMBER 31,		INCREASE (DECREASE)
	2014	2013	
Direct research and development expenses	$ 11,068	$ 4,164	$ 6,904
Platform-related expenses	9,984	3,492	6,492
Employee-related expenses	7,694	2,871	4,823
Facilities, depreciation and other expenses	707	1,031	(324)
Total	$ 29,453	$ 11,558	$ 17,895

Research and development expenses were $29.5 million and $11.6 million for the years ended December 31, 2014 and 2013, respectively. For the year ended December 31, 2014, direct research and development expenses increased by $6.9 million compared to the prior year as a result of the initiation of the clinical trials related to DCR-MYC and an increase in research activities related to DCR-PH1, of which $3.0 million related to license fees paid to Tekmira for the LNP delivery of DCR-PH1. For the year ended December 31, 2014, platform-related expenses increased by $6.5 million compared to the prior year primarily

due to increased expenses related to discovery and early development of future programs, along with an increase in non-employee stock-based compensation of $1.7 million. Employee-related expenses increased by $4.8 million for the year ended December 31, 2014 compared to the prior year primarily due to additional hiring during the period, along with an increase in stock-based compensation of $2.4 million. Facilities, depreciation and other expenses have decreased by $0.3 million for the year ended December 31, 2014 due to a reduction in occupancy costs. We expect our research and development expenses to continue to increase in 2015 as we continue spending on our development programs and clinical trials.

General and administrative expenses

General and administrative expenses were $15.6 million and $5.8 million for the years ended December 31, 2014 and 2013, respectively. The increase of $9.8 million, or 169 percent, was primarily due to an increase in payroll-related expenses of $3.6 million, which includes an increase in stock-based compensation of $2.6 million, an increase in professional fees of $2.9 million and an increase in non-employee stock based compensation of $1.1 million. The remaining increase in general and administrative expenses during 2014 was primarily due to the transition and increased costs associated with operating as a public company. We expect that general and administrative expenses will continue to increase in 2015 as we expand our operating activities and incur additional costs associated with being a publicly-traded company. These increases will likely include legal, accounting and filing fees, directors' and officers' liability insurance premiums and fees associated with investor relations.

Other expense

Other expense was $2.8 million and $1.1 million for the years ended December 31, 2014 and 2013, respectively. The increase of $1.7 million, or 149%, was primarily due to the re-measurement of the preferred stock warrant liability of $2.7 million, which was partially offset by a decrease in interest and other expense of $1.0 million. The decrease in interest expense was due to the Hercules loan being repaid in full in April 2014.

Comparison of the years ended December 31, 2013 and 2012

The following table summarizes the results of our operations for the years ended December 31, 2013 and 2012 (in thousands, except percentages):

	FOR THE YEARS ENDED DECEMBER 31,		INCREASE (DECREASE)	
	2013	2012		
Revenue:				
License fee and research funding	$ —	$ —	$ —	0%
Option exercise fees and preclinical payments	—	6,461	(6,461)	(100)%
Mutually agreed upon research	—	554	(554)	(100)%
Total revenue	—	7,015	(7,015)	(100)%
Expenses:				
Research and development	11,558	11,565	(7)	0%
General and administrative	5,820	4,700	1,120	24%
Total expenses	17,378	16,265	1,113	7%
Loss from operations	(17,378)	(9,250)	(8,128)	(88)%
Other expense	1,140	871	269	31%
Net loss	$ (18,518)	$ (10,121)	$(8,397)	(83)%

Revenue

We recognized no revenue for the year ended December 31, 2013 and $7.0 million for the year ended December 31, 2012. The revenue recognized during the year ended December 31, 2012 related to portions of an option exercise fee and mutually agreed upon research received as part of the research collaboration and license agreement with KHK. No revenue producing events occurred during the year ended December 31, 2013. We do not expect to generate any product revenue for the foreseeable future.

Research and development expenses

The following table summarizes our research and development expenses incurred during the years ended December 31, 2013 and 2012 (in thousands):

	FOR THE YEARS ENDED DECEMBER 31,		INCREASE (DECREASE)
	2013	2012	
Direct research and development expenses	$ 4,164	$ 1,315	$ 2,849
Platform-related expenses	3,492	5,931	(2,439)
Employee-related expenses	2,871	3,264	(393)
Facilities, depreciation and other expenses	1,031	1,055	(24)
Total	$ 11,558	$ 11,565	$ (7)

Research and development expenses were $11.6 million and $11.6 million for the years ended December 31, 2013 and 2012. For the years ended December 31, 2013, direct research and development expenses increased by $2.8 million compared to the prior year due to a natural shift of resources from our EnCore platform towards increased development activities in preparation for a clinical trial for DCR-MYC that was initiated in the first half of 2014. For the year ended December 31, 2013, platform-related expenses decreased by $2.4 million compared to the prior year due to the reduction in the level of spending on research and development of DsiRNA molecules and delivery technologies. For the year ended December 31, 2013, employment-related expenses decreased by $0.4 million compared to the prior year due to a realignment and reduction of staff during the year ended December 31, 2013.

General and administrative expenses

General and administrative expenses were $5.8 million and $4.7 million for the years ended December 31, 2013 and 2012. The increase of $1.1 million, or 24 percent compared to the year ended December 31, 2013, was primarily due to a $0.6 million increase in employee-related expenses and a $0.5 million increase in professional fees indirectly related to the initial public offering of our common stock. We expect general and administrative expenses to increase in the future as we expand our operating activities and incur additional costs associated with being a publicly-traded company.

Other expense

Other expense was $1.1 million and $0.9 million for the years ended December 31, 2013 and 2012. The increase of $0.2 million, or 31 percent compared to the year ended December 31, 2013, was primarily due to the loss on extinguishment of debt in 2013 of $0.3 million and a decrease in expense related to the remeasurement of the warrants exercisable for Series A, Series B and Series C preferred stock of $0.3 million, which were partially offset by a decrease of interest expense by $0.4 million. The loss on extinguishment related to the 2013 bridge note financing that closed in June 2013. The decrease in interest expense was due to a decrease in the Hercules loan balance outstanding at December 31, 2013 as compared to December 31, 2012.

Liquidity and Capital Resources

Since our inception and through December 31, 2014, we have raised an aggregate of $233.2 million to fund our operations, of which $92.7 million was from the initial public offering of our common stock, which closed on February 4, 2014, $110.5 million was from the sale of preferred stock and convertible debt securities (including $3.0 million from the 2013 bridge note financing), $17.5 million was through our collaboration and license agreement with KHK, $0.5 million was from a federal government grant for our Qualifying Therapeutic Discovery Project in November 2010 and $12.0 million was from borrowings under the Hercules loan. As of December 31, 2014, we had cash and cash equivalents and held-to-maturity investments of $98.6 million and $1.4 million in assets held in restriction.

On February 4, 2014, we closed our initial public offering, in which we issued and sold a total of 6,900,000 shares of our common stock, including 900,000 shares sold pursuant to the exercise in full by the underwriters of their option to purchase additional shares, at a public offering price of $15.00 per share, and received net proceeds of approximately $92.7 million after deducting underwriting commissions and discounts and offering expenses payable by us.

Contemporaneously with the filing of this Form 10-K, we are filing with the SEC a universal shelf registration statement on Form S-3 permitting the sale of 10,000,000 shares of our common stock and $50,000,000 of other securities.

In June 2011, we entered into an amendment to our original loan and security agreement with Hercules Technology II, L.P. (Hercules), pursuant to which we were entitled to borrow a term loan in the principal amount of up to $12.0 million with a floating interest rate equal to the greater of (1) 10.15 percent or (2) the sum of 10.15 percent plus the prime rate published on The Wall Street Journal minus 5.75 percent, not to exceed 12.75 percent per annum, which interest is computed daily based on the actual number of days elapsed. On April 7, 2014, we repaid the remaining amount of the Hercules loan in full for a total payment of $3.6 million. We granted Hercules a security interest in certain of our assets. In connection with the loan and security agreement, as amended, we issued to Hercules warrants to purchase 21,000 shares of Series A preferred stock and 26,400 shares of Series B preferred stock, respectively, each at an exercise price of $25.00 per share. The warrants became exercisable to purchase our common stock immediately prior to the closing of our initial public offering. On February 11, 2014, Hercules net exercised these warrants in exchange for a total of 12,702 shares of our common stock. On April 7, 2014, we repaid the remaining amount of the Hercules loan.

In addition to our existing cash and cash equivalents, for each product candidate under our research collaboration and license agreement with KHK, we are entitled to receive clinical, regulatory and commercialization milestone payments of up to $110.0 million and royalties on net sales of such product candidate. Our ability to earn these milestone payments and the timing of achieving these milestones is dependent upon the outcome of our research and development and regulatory activities and is uncertain at this time. Our right to receive the payment of certain milestones under our agreement with KHK is our only committed external source of funds.

Cash flows

As of December 31, 2014, we had $98.6 million in cash and cash equivalents and held-to-maturity investments and $1.4 million in assets held in restriction.

The following table shows a summary of our cash flows for the years ended December 31, 2014, 2013 and 2012 (in thousands).

	FOR THE YEARS ENDED DECEMBER 31,		
	2014	2013	2012
Net cash used in operating activities	$(34,764)	$(10,944)	$(15,737)
Net cash used in investing activities	(75,761)	(413)	(120)
Net cash provided by (used in) financing activities	89,997	54,282	(2,963)
Increase (decrease) in cash and cash equivalents	$(20,528)	$ 42,925	$(18,820)

Operating activities

Net cash used in operating activities for years ended December, 2014 and 2013 was $34.8 million and $10.9 million, respectively. The increase in cash used in operating activities of $23.8 million was due primarily to an increase in our net loss of $29.4 million, partially offset by non-cash items and changes in working capital totaling $5.6 million, including a payment of $5.0 million received in 2013 under a license agreement related to an option exercise fee and preclinical payments earned in December 2012.

Net cash used in operating activities was $10.9 million and $15.7 million for the years ended December 31, 2013 and 2012. The decrease in cash used in operating activities of $4.8 million was primarily due to a decrease in our research collaboration and license agreement receivable of $5.0 million for the twelve months ended December 31, 2013 related to an option exercise fee and preclinical payments earned in December 2012 but not collected until 2013, which was partially offset by an increase in working capital and other non-cash items of $0.2 million for the twelve months ended December 31, 2013.

Investing activities

Net cash used in investing activities for the years ended December 31, 2014 and 2013 was $75.8 million and $0.4 million, respectively. Net cash used in investing activities for the periods presented relates to net purchases of held-to-maturity investments, purchases of property and equipment, primarily laboratory equipment, and an increase in assets held in restriction.

Net cash used in investing activities for the years ended December 31, 2013 and 2012 was $0.4 million and $0.1 million, respectively. Net cash used in investing activities for the periods presented relates entirely to purchases of property and equipment, mostly laboratory equipment.

Financing activities

Net cash provided by financing activities for the years ended December 31, 2014 and 2013 was $90.0 million and $54.3 million, respectively. In 2014, net proceeds from our initial public offering was $94.1 million and proceeds from other issuance of common stock was $0.9 million, partially offset by the repayment of and principal payments related to the Hercules loan for $5.0 million. In 2013, we had net proceeds of $56.8 million from the issuance of redeemable convertible preferred stock and net proceeds of $3.0 million from a bridge loan financing, which were offset by $4.1 million of repayments on long-term debt, and $1.4 million of deferred issuance payments.

Net cash provided by financing activities of $54.3 million for the twelve months ended December 31, 2013 is due to $60.0 million of proceeds from the issuance of Series C preferred stock (including $3.0 million of proceeds received in our 2013 bridge note financing for the purchase of convertible promissory notes and Series C warrants), which is partially offset by $4.1 million of repayments on the Hercules loan and $1.6 million of issuance costs. Net cash used in financing activities of $3.0 million for the twelve months ended December 31, 2012 relates entirely to repayments on the Hercules loan.

Funding requirements

We expect that our primary uses of capital will continue to be third-party clinical research and development services, compensation and related expenses, laboratory and related supplies, legal and other regulatory expenses and general overhead costs. We believe that our cash and cash equivalents as of December 31, 2014 excluding any potential option exercise fees or milestone payments, will be sufficient to meet our anticipated cash requirements through 2016. However, we may require additional capital for the further development of our existing product candidates and may also need to raise additional funds sooner to pursue other development activities related to additional product candidates.

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

- the receipt of milestone payments under our research collaboration and license agreement with KHK;
- the terms and timing of any other collaboration, licensing and other arrangements that we may establish;
- the initiation, progress, timing and completion of preclinical studies and clinical trials for our potential product candidates;
- the number and characteristics of product candidates that we pursue;
- the progress, costs and results of our preclinical studies and clinical trials;
- the outcome, timing and cost of regulatory approvals;
- delays that may be caused by changing regulatory requirements;
- the cost and timing of hiring new employees to support our continued growth;
- the costs involved in filing and prosecuting patent applications and enforcing and defending patent claims;
- the costs of filing and prosecuting intellectual property rights and enforcing and defending any intellectual property-related claims;
- the costs and timing of procuring clinical and commercial supplies of our product candidates;
- the extent to which we acquire or in-license other product candidates and technologies; and
- the extent to which we acquire or invest in other businesses, product candidates or technologies.

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

Contractual Obligations and Commitments

The following is a summary of our significant contractual obligations as of December 31, 2014 (in thousands).

	PAYMENTS DUE BY PERIOD				
CONTRACTUAL OBLIGATIONS	TOTAL	LESS THAN 1 YEAR	MORE THAN 1 YEAR AND LESS THAN 3	MORE THAN 3 YEARS AND LESS THAN 5	MORE THAN 5 YEARS
Existing operating lease obligations(1)	$10,691	$ 2,101	$ 3,702	$ 3,307	$ 1,581

(1) Total commitments includes future minimum lease payments under our existing non-cancelable operating lease for our former office and laboratory space in Watertown, Massachusetts, as amended on July 3, 2013, that expires on November 30, 2016 with an average rent of approximately $51 per month, and lease payments under a non-cancelable operating lease for our current office and laboratory space in Cambridge, Massachusetts, as executed on July 11, 2014 with an average rent of approximately $134 per month.

We also have obligations to make future payments to COH, PBL and Carnegie Institution of Washington that become due and payable on the achievement of certain development, regulatory and commercial milestones. We have not included these commitments on our balance sheet or in the table above because the achievement and timing of these milestones is not probable and estimable.

Off-balance Sheet Arrangements

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

Segment Reporting

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

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

The primary objectives of our investment activities are to ensure liquidity and to preserve principal while at the same time maximizing the income we receive from our marketable securities without significantly increasing risk. Some of the securities that we invest in may have market risk related to changes in interest rates. As of December 31, 2014, we had cash and cash equivalents and held-to-maturity investments of $98.6 million and as of December 31, 2013, we had cash and cash equivalents of $46.6 million consisting of an interest-bearing money market account. Our primary exposure to market risk is interest rate sensitivity, which is affected by changes in the general level of U.S. interest rates. Due to the short-term maturities of our cash and cash equivalents and held-to-maturity investments and the low risk profile of our investments an immediate 100 basis point change in interest rates would not have a material effect on the fair market value of our cash and cash equivalents and held-to-maturity investments. To minimize the risk in the future, we intend to maintain our portfolio of cash and cash equivalents and held-to-maturity investments in a variety of securities, including U.S. treasury securities and government agency bonds.

Table of Contents

Item 8. ***Financial Statements and Supplementary Data***

DICERNA PHARMACEUTICALS, INC.
INDEX TO FINANCIAL STATEMENTS

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Board of Directors and Stockholders of
Dicerna Pharmaceuticals, Inc.
Cambridge, Massachusetts

We have audited the accompanying consolidated balance sheets of Dicerna Pharmaceuticals, Inc. and its subsidiaries (the "Company") as of December 31, 2014 and 2013, and the related consolidated statements of operations, redeemable convertible preferred stock and stockholders' equity (deficit), and cash flows for each of the three years in the period ended December 31, 2014. These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on the 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, such consolidated financial statements present fairly, in all material respects, the financial position of Dicerna Pharmaceuticals, Inc. and its subsidiaries as of December 31, 2014 and 2013, and the results of their operations and their cash flows for each of the three years in the period ended December 31, 2014, in conformity with accounting principles generally accepted in the United States of America.

/s/ Deloitte & Touche LLP

Boston, Massachusetts
March 12, 2015

DICERNA PHARMACEUTICALS, INC.

Consolidated Balance Sheets
As of December 31, 2014 and 2013
(In thousands, except share data and par value)

	DECEMBER 31, 2014	DECEMBER 31, 2013
ASSETS		
CURRENT ASSETS:		
Cash and cash equivalents	$ 26,067	$ 46,595
Held-to-maturity investments	70,055	—
Prepaid expenses and other current assets	1,194	2,058
Total current assets	97,316	48,653
NONCURRENT ASSETS:		
Property and equipment—net	2,165	877
Held-to-maturity investments	2,501	—
Assets held in restriction	1,380	264
Other assets	243	—
Total noncurrent assets	6,289	1,141
TOTAL ASSETS	$ 103,605	$ 49,794
LIABILITIES AND STOCKHOLDERS' EQUITY / (DEFICIT)		
CURRENT LIABILITIES:		
Accounts payable	$ 1,237	$ 1,700
Accrued expenses and other current liabilities	3,845	1,286
Deferred rent	77	105
Current portion of long-term debt	—	4,587
Total current liabilities	5,159	7,678
NONCURRENT LIABILITIES:		
Security deposit	106	—
Long-term debt—net of current portion	—	260
Preferred stock warrant liability	—	529
Total noncurrent liabilities	106	789
TOTAL LIABILITIES	5,265	8,467
COMMITMENTS AND CONTINGENCIES (Note 14)		
REDEEMABLE CONVERTIBLE PREFERRED STOCK, $0.0001 PAR VALUE—AUTHORIZED 11,070,000 SHARES:		
Series A—No shares designated, issued and outstanding at December 31, 2014 and 880,000 shares designated; 855,996 shares issued and outstanding at December 31, 2013, (aggregate liquidation preference of $21,400 at December 31, 2013)	—	21,400
Series B—No shares designated, issued and outstanding at December 31, 2014 and 1,190,000 shares designated, 1,162,021 shares issued and outstanding at December 31, 2013, (aggregate liquidation preference of $29,050 at December 31, 2013)	—	29,050
Series C—No shares designated, issued and outstanding at December 31, 2014 and 9,000,000 shares designated; 8,571,417 shares issued and outstanding at December 31, 2013, (aggregate liquidation preference of $60,000 at December 31, 2013)	—	59,796
STOCKHOLDERS' EQUITY / (DEFICIT):		
Preferred stock, $0.0001 par value—5,000,000 shares and no shares authorized at December 31, 2014 and December 31, 2013, respectively; no shares issued and outstanding at December 31, 2014 and December 31, 2013, respectively	—	—
Common stock, $0.0001 par value—150,000,000 and 15,000,000 shares authorized; 17,786,867 and 38,226 shares issued and outstanding at December 31, 2014 and 2013, respectively	3	1
Additional paid-in capital	231,741	16,545
Accumulated deficit	(133,404)	(85,465)
Total stockholders' equity / (deficit)	98,340	(68,919)
TOTAL LIABILITIES AND STOCKHOLDERS' EQUITY / (DEFICIT)	$ 103,605	$ 49,794

The accompanying notes are an integral part of these consolidated financial statements.

DICERNA PHARMACEUTICALS, INC.

Consolidated Statements of Operations
For the years ended December 31, 2014, 2013 and 2012
(In thousands, except share data and per share data)

	YEARS ENDED DECEMBER 31,		
	2014	2013	2012
Revenue	$ —	$ —	$ 7,015
Operating expenses:			
Research and development	29,453	11,558	11,565
General and administrative	15,648	5,820	4,700
Total operating expenses	45,101	17,378	16,265
Loss from operations	(45,101)	(17,378)	(9,250)
Other income (expense):			
Preferred stock warrant liability remeasurement	(2,559)	126	469
Loss on extinguishment of debt	(143)	(318)	—
Interest income	63	4	2
Interest expense	(199)	(952)	(1,342)
Total other income (expense)	(2,838)	(1,140)	(871)
Net loss	$ (47,939)	$ (18,518)	$ (10,121)
Less: Accretion and dividends on redeemable convertible preferred stock	204	2,388	4,097
Net loss attributable to common stockholders	(48,143)	(20,906)	(14,218)
Net loss per share attributable to common stockholders—basic and diluted	$ (3.00)	$ (709.57)	$ (516.00)
Weighted average shares outstanding—basic and diluted	16,070,054	29,463	27,554

The accompanying notes are an integral part of these consolidated financial statements.

DICERNA PHARMACEUTICALS, INC.

Consolidated Statements of Redeemable Convertible Preferred Stock and Stockholders' Equity / (Deficit)

For the years ended December 31, 2014, 2013 and 2012
(In thousands, except share data and par value)

	SERIES A REDEEMABLE CONVERTIBLE PREFERRED STOCK $0.0001 PAR VALUE		SERIES B REDEEMABLE CONVERTIBLE PREFERRED STOCK $0.0001 PAR VALUE		SERIES C REDEEMABLE CONVERTIBLE PREFERRED STOCK $0.0001 PAR VALUE		COMMON STOCK $0.0001 PAR VALUE		ADDITIONAL PAID-IN CAPITAL	ACCUMULATED DEFICIT	TOTAL STOCKHOLDERS' EQUITY / (DEFICIT)
	SHARES	AMOUNT	SHARES	AMOUNT	SHARES	AMOUNT	SHARES	AMOUNT			
BALANCE—January 1, 2012	855,996	$ 27,990	1,162,021	$ 32,161	—	—	27,522	$ 1	—	$ (50,634)	$ (50,633)
Accretion of preferred stock issuance costs	—	26	—	35	—	—	—	—	(61)	—	(61)
Accrued dividends	—	1,712	—	2,324	—	—	—	—	(71)	(3,965)	(4,036)
Vesting of restricted common stock	—	—	—	—	—	—	50	—	2	—	2
Stock-based compensation	—	—	—	—	—	—	—	—	123	—	123
Exercise of common stock options	—	—	—	—	—	—	281	—	7	—	7
Net loss	—	—	—	—	—	—	—	—	—	(10,121)	(10,121)
BALANCE—December 31, 2012	855,996	29,728	1,162,021	34,520	—	—	27,853	1	—	(64,720)	(64,719)
Issuance of Series C preferred stock, net of issuance costs of $220	—	—	—	—	8,142,891	56,780	—	—	—	—	—
Issuance of Series C preferred stock, in satisfaction of bridge loan	—	—	—	—	428,526	3,000	—	—	—	—	—
Accretion of preferred stock issuance costs	—	47	—	58	—	16	—	—	(121)	—	(121)
Accrued dividends	—	962	—	1,305	—	—	—	—	(40)	(2,227)	(2,267)
Deemed contribution of preferred stockholders	—	(9,337)	—	(6,833)	—	—	—	—	16,170	—	16,170
Vesting of restricted common stock	—	—	—	—	—	—	15	—	—	—	—
Repurchase of unvested restricted common stock	—	—	—	—	—	—	—	—	(5)	—	(5)
Stock-based compensation	—	—	—	—	—	—	—	—	495	—	495
Exercise of common stock options	—	—	—	—	—	—	10,358	—	46	—	46
Net loss	—	—	—	—	—	—	—	—	—	(18,518)	(18,518)
BALANCE—December 31, 2013	855,996	21,400	1,162,021	29,050	8,571,417	59,796	38,226	1	16,545	(85,465)	(68,919)
Issuance of Common Stock from initial public offering, net of underwriting fees and issuance costs of $10,751	—	—	—	—	—	—	6,900,000	1	92,749	—	92,750
Net exercise of common stock warrant	—	—	—	—	—	—	12,702	—	—	—	—
Reclassification of warrants to purchase shares of redeemable convertible preferred stock into a warrant to purchase common stock	—	—	—	—	—	—	—	—	3,088	—	3,088
Accretion of preferred stock issuance costs	—	—	—	—	—	204	—	—	(204)	—	(204)
Conversion of preferred stock to common stock	(855,996)	(21,400)	(1,162,021)	(29,050)	(8,571,417)	(60,000)	10,589,434	1	110,451	—	110,452
Vesting of restricted common stock	—	—	—	—	—	—	4,000	—	—	—	—
Stock-based compensation	—	—	—	—	—	—	—	—	8,237	—	8,237
Exercise of common stock options	—	—	—	—	—	—	239,853	—	824	—	824
Sale of common stock related to employee stock purchase plan	—	—	—	—	—	—	2,652	—	51	—	51
Net loss	—	—	—	—	—	—	—	—	—	(47,939)	(47,939)
BALANCE—December 31, 2014	—	$ —	—	$ —	—	$ —	17,786,867	$ 3	$ 231,741	$ (133,404)	$ 98,340

The accompanying notes are an integral part of these consolidated financial statements.

DICERNA PHARMACEUTICALS, INC.

Consolidated Statements of Cash Flows
For the years ended December 31, 2014, 2013 and 2012
(In thousands)

	YEARS ENDED DECEMBER 31,		
	2014	2013	2012
CASH FLOWS FROM OPERATING ACTIVITIES:			
Net loss	$ (47,939)	$ (18,518)	$ (10,121)
Adjustments to reconcile net loss to net cash used in operating activities:			
Deferred revenue	—	—	(1,014)
Depreciation and amortization	848	740	776
Stock-based compensation	8,237	495	125
Loss on extinguishment of debt	143	318	—
Increase (Decrease) in fair value of preferred stock warrant	2,559	(126)	(469)
Changes in operating assets and liabilities:			
Research and license receivable	—	5,018	(4,857)
Prepaid expenses and other assets	(1,171)	57	28
Accounts payable	(97)	116	(216)
Accrued expenses and other liabilities	2,684	1,016	49
Deferred rent	(28)	(60)	(38)
Net cash used in operating activities	(34,764)	(10,944)	(15,737)
CASH FLOWS FROM INVESTING ACTIVITIES—			
Changes in assets held in restriction	(1,116)	—	—
Purchases of property and equipment	(2,013)	(413)	(120)
Maturities of held-to-maturity investments	9,995	—	—
Purchases of held-to-maturity investments	(82,627)	—	—
Net cash used in investing activities	(75,761)	(413)	(120)
CASH FLOWS FROM FINANCING ACTIVITIES:			
Proceeds from issuance of common stock	875	46	7
Net proceeds from initial public offering	94,148	—	—
Repurchase of restricted common stock	—	(5)	—
Payments of deferred issuance costs	—	(1,399)	—
Proceeds from issuance of redeemable convertible preferred stock	—	57,000	—
Redeemable preferred stock issuance costs	—	(220)	—
Proceeds from bridge loan financing	—	3,000	—
Payments of long-term debt fees	—	—	(136)
Repayments of long-term debt principal	(5,026)	(4,140)	(2,834)
Net cash provided by (used in) financing activities	89,997	54,282	(2,963)
(DECREASE) INCREASE IN CASH AND CASH EQUIVALENTS	(20,528)	42,925	(18,820)
CASH AND CASH EQUIVALENTS—Beginning of year	46,595	3,670	22,490
CASH AND CASH EQUIVALENTS—End of year	$ 26,067	$ 46,595	$ 3,670
NONCASH FINANCING ACTIVITIES:			
Accretion of redeemable convertible preferred stock	$ 204	$ 2,388	$ 4,097
Deemed contribution of preferred stockholders	$ —	$ 16,170	$ —
Conversion of bridge loan financing	$ —	$ 3,000	$ —
Tenant allowances	$ —	$ 104	$ —
SUPPLEMENTAL CASH FLOW INFORMATION—			
Warrant conversion to common stock	$ 3,088	$ —	$ —
Cash paid for interest	$ 194	$ 771	$ 1,123

The accompanying notes are an integral part of these consolidated financial statements.

DICERNA PHARMACEUTICALS, INC.

Notes to Consolidated Financial Statements
(In thousands, except share and per share data)

1. Nature of Business and Basis of Presentation

Nature of business

Dicerna Pharmaceuticals, Inc., and its subsidiaries, (the Company) is a biopharmaceutical company focused on the discovery and development of innovative treatments for rare inherited diseases involving the liver and for cancers that are genetically defined. The Company is using its proprietary RNA interference, (RNAi), technology platform, which the Company believes improves on existing RNAi technologies, to build a broad pipeline in these therapeutic areas. The Company intends to discover, develop and commercialize novel therapeutics either on its own or in collaboration with pharmaceutical partners.

The Company continues to be subject to a number of risks common to companies in similar stages of development. Principal among these risks are the uncertainties of technological innovations, which are particularly high in the field of drug discovery and development, dependence on key individuals, development of the same or similar technological innovations by the Company's competitors and protection of proprietary technology. The Company's ability to fund its planned preclinical and clinical operations, including completion of its planned trials, is expected to depend on the amount and timing of cash receipts under its existing collaboration agreement, as well as any future collaboration or product sales and financing transactions.

In February 2014, the Company completed the sale of 6,900,000 shares of common stock in its initial public offering (IPO) at a price to the public of $15.00 per share, resulting in net proceeds to the Company of $92,750 after deducting underwriting discounts and commissions of $7,245 and offering expenses of $3,506. The Company's common stock began trading on the NASDAQ Global Market under the symbol "DRNA" on January 31, 2014. In connection with the close of the IPO, all of the outstanding shares of Series A mandatorily redeemable, convertible preferred stock (Series A preferred stock), Series B mandatorily redeemable, convertible preferred stock (Series B preferred stock) and Series C mandatorily redeemable, convertible preferred stock (Series C preferred stock) were converted into shares of common stock on a one-for-one basis immediately prior to the closing of the IPO. Following these transactions, the Company had a total of 17,786,867 shares of common stock issued and outstanding as of December 31, 2014. The significant increase in the shares outstanding in 2014 has impacted the year over year comparability of the Company's net loss per share calculations.

2. Summary of Significant Accounting Policies

Basis of presentation and consolidation

The accompanying consolidated financial statements have been prepared under accounting principles generally accepted in the United States of America, or GAAP, and include the accounts of the Company and its wholly-owned subsidiary. All intercompany balances and transactions have been eliminated in consolidation.

Significant judgments and estimates

The preparation of these financial statements is in conformity with GAAP which requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, and the disclosure of contingent assets and liabilities at the date of the consolidated financial statements, as well as the revenues and expenses incurred during the reporting periods. On an ongoing basis, the Company evaluate judgments and estimates, including those related to accrued expenses, revenue recognition, deferred revenue and stock-based compensation. The Company base estimates on historical experience and on various other factors that the Company believes are reasonable under the circumstances, the results of which form the basis for making judgments about the carrying value of assets and liabilities that are not apparent from other sources. Changes in estimates are reflected in reported results for the period in which they become known. Actual results could differ materially from those estimates.

Cash equivalents

Cash equivalents include all highly liquid investments maturing within 90 days from the date of purchase. Cash equivalents consist of money market funds as of December 31, 2014 and 2013 and are valued at cost, plus accrued interest, which approximates fair value.

Held-to-Maturity Investments

The Company accounts for its investments in marketable securities in accordance with FASB ASC 320, *Investments—Debt and Equity Securities* . The Company determines the appropriate classification of investments at the time of purchase and re-evaluates such designation as of each balance sheet date. Debt securities carried at amortized cost are classified as held-to-maturity when the Company has the positive intent and ability to hold the securities to maturity. At December 31, 2014, all of the Company's investments are classified as held-to-maturity.

Assets held in restriction

As of December 31, 2014, assets held in restriction are comprised of two certificates of deposit that mature annually, and secure the Company's outstanding letters of credit of $1,116 and $264 for the operating leases for office and laboratory space. The letters of credit are required to be maintained throughout the term of the Company's leases which expire on December 1, 2020 and November 30, 2016, respectively. As of December 31, 2013, assets held in restriction is comprised of one certificate of deposit securing the Company's outstanding letter of credit of $264, as noted above.

Concentrations of credit risk

Financial instruments that subject the Company to significant concentrations of credit risk consist of cash and cash equivalents, assets held in restriction and held-to-maturity investments. All of the Company's cash and cash equivalents, assets held in restriction and held-to-maturity investments are invested in money market funds or U.S. Treasury or agency securities that management believes to be of high credit quality. During 2012, one counterparty accounted for all of the Company's revenue.

Deferred stock issuance costs

Deferred stock issuance costs, which consisted of direct incremental legal and professional accounting fees relating to the Company's IPO, totaling $1,784, were initially capitalized in 2013 and subsequently offset against IPO proceeds in 2014, when the offering became effective. No amounts were deferred as of December 31, 2014.

Property and equipment

Property and equipment are stated at cost. Major betterments are capitalized whereas expenditures for maintenance and repairs which do not improve or extend the life of the respective assets are charged to operations as incurred. Depreciation is provided using the straight-line method over the estimated useful lives:

ASSET CATEGORY	USEFUL LIVES
Office and computer equipment	3-5 years
Laboratory equipment	5 years
Furniture and fixtures	5 years
Leasehold improvements	5 years or the remaining term of lease, if shorter

Impairment of long-lived assets

Long-lived assets are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount of the asset may not be recoverable. When such events occur, the Company compares the

carrying amounts of the assets to their undiscounted expected future cash flows. If this comparison indicates that there is an impairment, the amount of the impairment is calculated as the difference between the carrying value and fair value of the related asset. For the years ended December 31, 2014, 2013 and 2012, no impairments have been recorded.

Fair value of financial instruments

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

Segment and geographic information

Operating segments are defined as components (business activity from which it earns revenue and incurs expenses) of an enterprise about which discrete financial information is available and regularly reviewed by the chief operating decision maker in deciding how to allocate resources and in assessing performance. The Company, through its Chief Executive Officer in his role as chief operating decision maker, views its operations and manages its business as one operating segment. All material long-lived assets of the Company are located in the United States.

Revenue recognition

The Company generates revenue from research collaboration and license agreements with third parties which contain multiple deliverables. The deliverables in the agreements include (a) the use of the Company's technology and (b) research and development of product candidates. Such agreements may provide for consideration to the Company in the form of up-front payments, research and development services, milestone payments and royalties. Revenue is recognized when the following criteria have been met: (1) pervasive evidence of an arrangement exists; (2) delivery has occurred or services have been rendered and risk of loss has passed; (3) the seller's price to the buyer is fixed or determinable; and (4) collectability is reasonably assured. Multiple-deliverable arrangements are analyzed to determine whether the deliverables can be separated or whether they must be accounted for as a single unit of accounting. When deliverables are separable, consideration received is allocated to the separate units of accounting based on the relative selling price method and the appropriate revenue recognition principles are applied to each unit.

At the inception of each arrangement that includes payments for optional research or milestones, the Company evaluates whether each option or milestone is substantive and at risk to both parties on the basis of the contingent nature of the option or milestone. This evaluation includes an assessment of whether (1) the consideration is commensurate with either the entity's performance to achieve the milestone or the enhancement of the value of the delivered item(s); (2) as a result of a specific outcome resulting from the entity's performance to achieve the milestone; (3) the consideration relates solely to past performance; and (4) the consideration is reasonable relative to all of the deliverables and payment terms within the arrangement. Substantive options and milestones are recognized as revenue upon the achievement of the milestone, assuming all other revenue recognition criteria are met.

When the Company determines that an arrangement should be accounted for as a single unit of accounting, it must determine the period over which the performance obligations will be performed and revenue will be recognized. The Company's only revenue to date results from a research collaboration and license agreement entered into in December 2009. Non-refundable up-front license fees under the agreement were initially recorded as deferred revenue upon receipt and are being recognized as revenue over the Company's performance period as defined in the agreement. Research and development service revenue is recognized over the research term as the research and development services are provided. The cost of such services is reflected in research and development costs in the period in which it is incurred.

Royalty payments are recognized as revenue based on contract terms and reported sales of licensed products, when reported sales are reliably measurable and collectability is reasonably assured.

Research and development costs

Research and development costs consist of expenses incurred in performing research and development activities, including compensation and benefits for full-time research and development employees, an allocation of facility expenses, overhead expenses and other outside expenses. Research and development costs are expensed as incurred. Research and development costs that are paid in advance of performance are deferred as a prepaid expense and amortized over the service period as the services are provided.

Preferred stock warrant liability

Freestanding warrants related to shares that are redeemable, contingently redeemable, or for purchases of preferred stock that are not indexed to the Company's own stock are classified as a liability on the Company's balance sheet. The preferred stock warrants were recorded at fair value, estimated using the Black-Scholes option-pricing model for the year ended December 31, 2013 and until the conversion date of February 4, 2014, and marked to market at each balance sheet date with changes in the fair value of the liability recorded in the statements of operations. After the closing of the IPO, the preferred stock warrants were no longer classified as a liability subject to remeasurement as the preferred stock warrants became warrants to purchase shares of common stock. The Company classified the liability as noncurrent at December 31, 2013. There were no preferred stock warrants outstanding as of December 31, 2014.

Deferred Rent

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

Redeemable convertible preferred stock

The Company initially records preferred stock that may be redeemed at the option of the holder or based on the occurrence of events not under the Company's control outside of stockholders' equity (deficit) at the value of the proceeds received or fair value, if lower, net of issuance costs. Subsequently, if it is probable that the preferred stock will become redeemable, the Company adjusts the carrying value to the redemption value over the period from the issuance date to the earliest possible redemption date using the effective interest method. If it is not probable that the preferred stock will become redeemable, the Company does not adjust the carrying value. In the absence of retained earnings these accretion charges are recorded against additional paid-in-capital, if any, and then to accumulated deficit.

Common stock valuation

Due to the absence of an active market for the Company's common stock prior to the IPO, the Company utilized methodologies in accordance with the framework of the American Institute of Certified Public Accountants Technical Practice Aid, *Valuation of Privately-Held Company Equity Securities Issued as Compensation* , to estimate the fair value of its common stock. In determining the exercise prices for options granted, the Company has considered the fair value of the common stock as of the measurement date. The fair value of the common stock has been determined at each award grant date based upon a variety of factors, including the illiquid nature of the common stock, arm's-length sales of the Company's capital stock (including redeemable convertible preferred stock), the effect of the rights and preferences of the preferred stockholders, and the prospects of a

liquidity event. Among other factors are the Company's financial position and historical financial performance, the status of technological developments within the Company's research, the composition and ability of the current research and management team, an evaluation or benchmark of the Company's competition, and the current business climate in the marketplace. Significant changes to the key assumptions underlying the factors used could result in different fair values of common stock at each valuation date.

Stock-based compensation

The Company accounts for stock options granted as share-based payments at fair value, which is measured using the Black-Scholes option pricing model. The fair value measurement date for employee awards is the date of grant. The fair value measurement date for nonemployee awards is generally the date the performance of services is completed. Share-based compensation costs are recognized as expense over the requisite service period, which is generally the vesting period, on a straight-line basis for all time-vested awards.

For performance-based stock awards, compensation costs are first recorded when the Company determines that the achievement of such performance conditions is deemed probable. This determination requires significant judgment by management. At the probable date, the Company records a cumulative expense catch-up, with the remaining compensation cost being amortized over the remaining vesting period.

The Company accounts for restricted stock awards granted to employees at fair value, which is measured based upon the quoted closing market price per share on the date of grant, adjusted for assumed forfeitures. The compensation costs are recognized over the vesting period, commencing when the Company determines that it is probable that the awards will vest.

Share-based payments to nonemployees are remeasured at each reporting date and recognized as services are rendered, generally on a straight-line basis. The Company believes that the fair value of these awards is more reliably measurable than the fair value of the services rendered.

Income taxes

The Company records deferred tax assets and liabilities for the expected future tax consequences of temporary differences between the Company's financial statement carrying amounts and the tax basis of assets and liabilities using enacted tax rates expected to be in effect in the years in which the differences are expected to reverse. A valuation allowance is provided to reduce the net deferred tax assets to the amount that will more likely than not be realized.

The Company also assesses the probability that the positions taken or expected to be taken in its income tax returns will be sustained by taxing authorities. A "more likely than not" (more than 50 percent) recognition threshold must be met before a tax benefit can be recognized. Tax positions that are more likely than not to be sustained are reflected in the Company's financial statements. Tax positions are measured as the largest amount of tax benefit that is greater than 50 percent likely of being realized upon settlement with a taxing authority that has full knowledge of all relevant information. The difference between the benefit recognized for a position and the tax benefit claimed on a tax return is referred to as an unrecognized tax benefit. Potential interest and penalties associated with such uncertain tax positions are recorded as a component of income tax expense.

Net loss per common share

The Company computes basic net loss per common share by dividing net loss attributable to common stockholders by the weighted average number of common shares outstanding. During periods where the Company earns net income, the Company allocates participating securities a proportional share of net income determined by dividing total weighted average participating securities by the sum of the total weighted average common shares and participating securities (the "two-class method"). The Company's preferred stock and vested

restricted stock participate in any dividends declared by the Company and are therefore considered to be participating securities. Participating securities have the effect of diluting both basic and diluted earnings per share during periods of income. During periods where the Company incurred net loss, the Company allocates no loss to participating securities because they have no contractual obligation to share in the losses of the Company. The Company computes diluted net loss per common share after giving consideration to the dilutive effect of stock options, warrants and unvested restricted stock that are outstanding during the period, except where such non-participating securities would be anti-dilutive.

Comprehensive loss

The Company has no comprehensive loss items other than net loss.

Guarantees and indemnifications

The Company is not a guarantor under any agreements.

The Company leases office space under an operating lease. The Company has standard indemnification arrangements under these leases that require the Company to indemnify the landlord against losses, liabilities, and claims incurred in connection with the premises covered by the Company's lease, the Company's use of the premises, property damage or personal injury, and breach of the agreement.

Through December 31, 2014, the Company had not experienced any losses related to this indemnification obligation and no claims with respect thereto were outstanding. The Company does not expect material claims related to this indemnification obligation, and consequently, concluded that the fair value of this obligation is negligible and no related liabilities were established.

The Company has indemnified, under pre-determined conditions and limitations, a counterparty for infringement of third-party intellectual property rights by the Company. The Company does not believe, based on information available, that it is probable that any material amounts will be paid under these indemnification provisions.

As permitted under Delaware law, the Company indemnifies its officers, directors, and employees for certain events or occurrences while the officer or director is, or was, serving at the Company's request in such capacity. The term of the indemnification is for the officer's or director's lifetime.

Recent Accounting Pronouncements

In June 2014, the FASB issued Accounting Standards Update No. 2014-12, Compensation—Stock Compensation (ASU 2014-12). The guidance provides clarification regarding the accounting for equity awards where a performance target that affects vesting and that could be achieved after the requisite service period should be accounted for as a performance condition. Compensation cost would be recognized over the required service period, if it is probable that the performance condition will be achieved. The Company does not expect the standard will have an impact on the Company's consolidated financial statements and related disclosures since the Company currently accounting for these awards in a manner consistent with the new guidance.

3. Net Loss Per Share Attributable to Common Stockholders

The following table summarizes the computation of basic and diluted net loss per share attributable to common stockholders of the Company (in thousands, except share and per share data):

	YEARS ENDED DECEMBER 31,		
	2014	2013	2012
Net loss	$ (47,939)	$ (18,518)	$ (10,121)
Accretion of preferred stock issuance costs to redemption value	(204)	(121)	(61)
Accrued dividends on preferred stock	—	(2,267)	(4,036)
Net loss attributable to common stockholders—basic and diluted	$ (48,143)	$ (20,906)	$ (14,218)
Weighted-average number of common shares—basic and diluted	16,070,054	29,463	27,554
Net loss per share attributable to common stockholders—basic and diluted	$ (3.00)	$ (709.57)	$ (516.00)

The following potentially dilutive securities outstanding, prior to the application of the treasury stock method or if-converted method, have been excluded from the computation of diluted weighted-average common shares outstanding, because such securities had an anti-dilutive impact due to the losses reported:

	FOR THE YEARS ENDING DECEMBER 31,		
	2014	2013	2012
Options to purchase common stock	2,764,144	403,959	25,512
Warrants to purchase common stock	80,722	2,198	2,198
Warrants to purchase redeemable convertible preferred stock	12,763	91,543	47,400
Redeemable convertible preferred stock	1,015,426	5,634,458	2,018,017
Unvested restricted stock	92,932	7	152

4. Held-to-maturity Investments

The Company invests its excess cash balances in short-term and long-term fixed-income investments. The Company determines the appropriate classification of investments at the time of purchase and re-evaluates such designation as of each balance sheet date. Debt securities carried at amortized cost are classified as held-to-maturity when the Company has the positive intent and ability to hold the securities to maturity.

The following tables provide information relating to held-to-maturity investments at December 31, 2014:

	Amortized Cost	Gross Unrealized Gains	Gross Unrealized Losses	Fair Value
Held-to-maturity investments				
U.S. Government treasury and agency securities	$ 72,556	$ 2	$ (26)	$72,532
Total held-to-maturity investments	$ 72,556	$ 2	$ (26)	$72,532

The amortized cost and fair value of held-to-maturity investments by contractual maturities at December 31, 2014, are as follows:

	Held-to-Maturity	
	Amortized Cost	Fair Value
Maturing in one year or less	$ 70,055	$70,030
Maturing after one year through two years	2,501	2,502
Total	$ 72,556	$72,532

5. Prepaid Expenses and Other Current Assets

Prepaid expenses and other current assets consists of the following:

	AS OF DECEMBER 31,	
	2014	2013
Prepaid expenses	$ 1,115	$ 261
Interest receivable	55	—
Debt issuance costs	—	12
Deferred stock issuance costs	—	1,784
Other current assets	24	1
Prepaid expenses and other current assets	$ 1,194	$ 2,058

6. Property and Equipment, Net

Property and equipment, net consists of the following:

	AS OF DECEMBER 31,	
	2014	2013
Office and computer equipment	$ 503	$ 253
Laboratory equipment	3,209	1,988
Leasehold improvements	887	670
Furniture and fixtures	624	299
Property and equipment—at cost	5,223	3,210
Less accumulated depreciation	(3,058)	(2,333)
Property and equipment—net	$ 2,165	$ 877

Depreciation expense for the years ended December 31, 2014, 2013 and 2012 was $725, $523 and, $551, respectively.

7. Long-term Debt

On March 26, 2009, the Company entered into a loan and security agreement with an independent finance company, Hercules Technology II, LP (Hercules), for up to $7,000 (Hercules loan). The Hercules loan, which has since been repaid, was collateralized by a security interest in all tangible assets. On May 28, 2010, the Company and Hercules executed an amendment to the loan and security agreement to defer $653 in principal payments originally due in June 2010 through August 2010, and amortized such deferred principal amounts equally over the remaining payment term beginning in September 2010. On June 28, 2011, the Company and Hercules executed a second amendment to the loan and security agreement, which increased the maximum loan amount to $12,000. Upon execution of the second amendment, the Company drew a $7,000 advance, a portion of which the

Company used to repay the outstanding balance of principal and interest under the original loan and security agreement. On December 15, 2011, the Company drew down the remaining $5,000. Interest was payable monthly and principal was to be repaid in equal monthly installments beginning April 1, 2012 through January 2, 2015. The applicable annual interest rate was 10.15% at December 31, 2013. On April 7, 2014, the Company repaid the remaining amount of the Hercules loan in full in a total amount of $3,590.

The unamortized discount related to the Hercules loan of $143 was reflected as a loss on extinguishment of the Hercules loan in the accompanying statement of operations, when the loan was repaid.

In connection with the Hercules loan, the Company issued warrants to Hercules for the purchase of an aggregate of 21,000 shares of the Series A preferred stock and 26,400 shares of the Series B preferred stock each at an exercise price of $25.00 per share. Immediately prior to the closing of the IPO on February 4, 2014, all of the outstanding shares of the Series A, Series B and Series C preferred stock were automatically converted into shares of common stock on an one-for-one basis. On February 11, 2014, Hercules net exercised the warrants in exchange for a total of 12,702 shares of the Company's common stock. The fair value of the warrants was classified as a liability in the accompanying consolidated balance sheet as of December 31, 2013. After the conversion of Series A and Series B preferred stock, the fair value of the warrants was reclassified as a part of stockholders' equity / (deficit). The remeasurement of the liability continued until the date of the closing of the IPO. The estimated fair value of the outstanding Hercules warrants as of the IPO closing date was $765 and $94 as of December 31, 2013. The estimated fair values were determined using the Black-Scholes option-pricing model with the following assumptions:

	FEBRUARY 4, 2014	DECEMBER 31, 2013
Stock price	$ 32.66	$9.09
Expected option term (in years)	3.0	3.6 – 4.1
Expected volatility	62%	59 – 64%
Risk-free interest rate	0.7%	1.0 – 1.2%
Expected dividend yield	0.0%	0.0%

There were no Series A and Series B warrants outstanding at December 31, 2014.

The adjustment to this preferred stock warrant liability related to the Hercules warrants was recorded in other income (expense) and amounted to $(671) and $237 for the years ended December 31, 2014 and 2013, respectively.

8. Bridge Loan Financing

On June 26, 2013, the Company issued convertible notes and warrants for the purchase of preferred stock in the next qualified financing to then existing preferred and common stockholders for approximately $3,000 (bridge loan financing). The notes were due to mature on June 26, 2018, unless previously converted or repaid. In the event the Company were to obtain financing through the issuance of equity securities, including an IPO, prior to the maturity date, the notes would automatically convert into shares of the equity issued in such a qualified financing and at the lowest price per share of the equity securities issued and sold in that financing. If a liquidation event were to occur prior to June 26, 2018, the notes could be converted at the option of the holder for an amount equal to two times the outstanding principal balance of the notes in cash or the issuance of Series B preferred stock equal to the outstanding principal balance of the notes divided by 0.9. The notes had an interest rate of 7% per year, payable at the earlier of the notes' conversion or maturity.

The purpose of this bridge loan financing was to provide operating cash to the Company until it completed the issuance of the Series C in July 2013, at which time the notes were converted into 428,526 shares of Series C preferred shares at $7.00 per share and the related accrued interest of $20 became payable.

In connection with the issuance of the bridge loan financing, the Company issued warrants for the purchase of an aggregate of 85,703 shares of the Company's preferred stock in the next qualified financing at an exercise price of $7.00 per share. The warrants are immediately exercisable and expire 5 years from the date of issuance. The Company estimated the fair value of the warrants at the date of issuance to be $324. The fair value of the warrants was recorded as a discount to the convertible notes upon issuance, and was initially classified as a liability in the accompanying consolidated balance sheets. The issuance date fair value was determined using the Black-Scholes option-pricing model with the following assumptions: risk-free interest rate of approximately 1.2%, expected life of 5 years, volatility of 64%, and no expected dividends. After the conversion of Series C preferred stock, the fair value of the warrants related to Series C preferred stock outstanding immediately prior to the closing of the IPO was reclassified as a part of stockholders' equity (deficit). The remeasurement of the Series C preferred stock warrant liability continued until the closing date of the IPO.

The estimated fair value of the outstanding Series C warrants at of the IPO closing date and December 31, 2013 was $2,323 and $435, respectively. The estimated fair values were determined using the Black-Scholes option-pricing model with the following assumptions:

	FEBRUARY 4, 2014	DECEMBER 31, 2013
Stock price	$ 32.66	$ 8.84
Expected option term (in years)	4.4	4.5
Expected volatility	65%	64%
Risk-free interest rate	1.5%	1.3%
Expected dividend yield	0.0%	0.0%

There were no Series C warrants outstanding at December 31, 2014. As of the closing of the IPO on February 4, 2014, the conversion of Series C preferred stock into common stock triggered the conversion all Series C warrants into common share warrants. As of December 31, 2014 there were 85,703 common share warrants outstanding.

The adjustment to this preferred stock warrant liability was recorded in other income (expense) and for the years ended December 31, 2014, and 2013 amounted to $(1,888) and $(111), respectively.

The bridge loan discount was amortized to interest expense using the effective interest method over the loan repayment term, and the unamortized discount of $318 was reflected as a loss on extinguishment of the bridge loan in the accompanying statement of operations, when the notes were converted to Series C in July 2013.

9. Revenue

In December 2009, the Company entered into a research collaboration and license agreement with Kyowa Hakko Kirin Co., Ltd. (KHK) for the research, development and commercialization of drug delivery systems and DsiRNA pharmaceuticals for therapeutic targets primarily in oncology. The Company granted KHK an exclusive, worldwide, royalty-bearing and sub-licensable license to the DsiRNA and drug delivery technologies and intellectual property for certain selected DsiRNA-based compounds. Under the agreement, KHK is responsible for activities to develop, manufacture and commercialize the selected DsiRNA-based compounds and pharmaceutical products containing such compounds.

Since the initiation of the research collaboration and license agreement two target programs, including the initial target KRAS, have been nominated by KHK for formal development studies. Both target programs utilize the Company's specific RNAi-inducing double-stranded DsiRNA molecules and a lipid nanoparticle drug delivery system proprietary to KHK.

The Company is entitled to receive up to $110,000 in regulatory, clinical and commercialization milestone payments, and royalties on net sales of each product candidate under the KHK agreement.

The deliverables at the effective date of the agreement include delivery of intellectual property, conducting the KRAS research and development program, and providing KHK the exclusive option right to reserve additional targets. The Company concluded the performance of additional research for each additional target, if exercised by KHK, is not a deliverable of the agreement at inception because it is a substantive option and is not priced at a significant and incremental discount.

The performance period is the expected period over which the services of the combined unit are performed which spans from the contract inception through the end of 2011. The Company received cash payments of $5,000 and $1,000 in 2013 and 2012, respectively, under the research collaboration and license agreement with KHK, which amounts included license fees, option exercise fees and research funding.

The Company has no further obligations under the research collaboration and license agreement related to the KRAS target or the additional target.

The Company recognized option and milestone payments of $0 and $7,015 in 2013 and 2012, respectively, related to the exercise of substantive options and milestones when the milestone and options were achieved and performance related to such milestones was completed.

The Company has not recognized or received cash payments from partners during the year ended December 31, 2014.

10. Redeemable Convertible Preferred Stock

The consummation of the IPO on February 4, 2014 resulted in the conversion of all of the shares of the Company's Series A, Series B and Series C preferred stock into shares of common stock. Each share of Series A, Series B and Series C preferred stock was automatically converted into common stock on a one-for-one basis.

Prior to conversion, the Company had classified the preferred stock outside of stockholders' equity / (deficit) because the preferred stock contained redemption features that were not solely within the Company's control.

There was no preferred stock issued or outstanding as of December 31, 2014.

Preferred stock consisted of the following as of December 31, 2013:

	PREFERRED SHARES AUTHORIZED	ISSUANCE DATES	PREFERRED SHARES ISSUED AND OUTSTANDING	REDEMPTION VALUE/ LIQUIDATION PREFERENCE	CARRYING VALUE	COMMON STOCK ISSUABLE UPON CONVERSION
Series A	880,000	April 2007	9,999			
		July 2007	19,999			
		November 2007	489,999			
		July 2008	335,999			
			855,996	$ 21,400	$ 21,400	855,996
Series B	1,190,000	August 2010	992,021			
		September 2010	10,000			
		October 2010	160,000			
			1,162,021	29,050	29,050	1,162,021
Series C	9,000,000	July 2013	8,571,417	60,000	59,796	8,571,417
Total	11,070,000		10,589,434	$ 110,450	$ 110,246	10,589,434

The Series A, Series B and Series C preferred stock had the following rights and preferences:

Voting

The holders of Series A, Series B and Series C were entitled to one vote per common share equivalent on all matters voted on by holders of common stock.

Dividends

The holders of Series A and Series B were entitled to receive cumulative dividends at the rate of $2.00 per share per annum in preference to any dividends on common stock, payable only when and if declared by the Board of Directors. Dividends accrued daily in arrears and are not compounded, whether or not declared by the Board of Directors. As of December 31, 2013, no dividends had been declared.

Concurrent with the July 2013 Series C financing, the provisions relating to the Series A and Series B dividends were modified such that Series A and Series B dividends would accrue only if declared by the Board of Directors. On July 25, 2013, the carrying amount of the Series A and Series B preferred stock immediately preceding the modification included $16,170 of accrued dividends, which were cancelled and recorded as additional paid-in capital. If dividends were declared, the holders of Series C preferred stock were entitled to accrue dividends at the rate of $0.56 per share per annum in preference to any dividends on Series A, Series B or common stock. As of December 31, 2013, the Company had accrued no cumulative dividends and no dividends had been declared.

Liquidation rights

Prior to the IPO, and in the event of any liquidation, dissolution or winding-up of the Company, the Series C ranked senior to the Series A and Series B and the holders of Series C would have been entitled to receive their original purchase price together with all accumulated but unpaid dividends prior to any distributions being made to Series A and Series B. In the event of any liquidation, dissolution or winding-up of the Company, the Series A and Series B ranked senior to the Company's common stock and the holders of Series A and Series B preferred stocks would have been entitled to receive their original purchase price together with all accumulated but unpaid dividends prior to any distributions being made to common stock. Upon completion of the payment of principal and declared but unpaid dividends to the holders of Series A and Series B preferred stocks, all of the remaining assets would have been distributed among the holders of Series A and Series B and common stock pro rata based on the number of shares of common stock held by each, assuming full conversion of all outstanding shares of Series A and Series B preferred stocks.

Conversion

Prior to the IPO, each Series A and Series B preferred stock was convertible at the option of the holder at any time after issuance into the number of fully paid and nonassessable shares of common stock as determined by dividing the original issuance price of $25.00 per share, plus any declared and unpaid dividends thereon by the conversion price in effect on the date the certificate is surrendered for conversion. The initial conversion price was $25.00 per share and was subject to adjustment for certain dilutive events, as defined. Each Series A and Series B preferred stock would be automatically be converted into one share of common stock in the event of an initial public offering that results in minimum net proceeds to the Company of $30,000 or at the election of the holders of at least 60% of the then outstanding Series A and Series B preferred stock. Each share of Series C was convertible at the option of the holder at any time after issuance into the number of fully paid and nonassessable shares of common stock as determined by dividing the original issuance price of $7.00 per share, plus any declared and unpaid dividends thereon by the conversion price in effect on the date the certificate is surrendered for conversion. The initial conversion price was $7.00 per share and was subject to adjustment for certain dilutive events, as defined. In July 2013, the terms of the Series A, Series B and Series C were amended such that each share of Series A, Series B and Series C would automatically be converted into one share of common stock in the

event of an IPO that results in minimum net proceeds to the Company of $60,000 or at the election of the holders of at least a majority of the then outstanding shares of preferred stock, the majority of which includes at least 74% of the holders of the then outstanding shares of Series C. As of the closing of the IPO on February 4, 2014, the conversion of Series A, Series B and Series C preferred stock into common stock was triggered. All Series A, B and C preferred stock were converted into common stock.

Redemption

Prior to the IPO, and at any time on or after April 1, 2015, and at the request of the holders of not less than 60% of the then outstanding Series A and Series B preferred stock, the Company would have redeemed all of the then outstanding Series A and Series B preferred stock at an amount equal to the original issue price, plus all accumulated but unpaid dividends on such Series A and Series B preferred stock in three equal annual installments beginning on the redemption date.

Prior to the IPO, the Company was accreting the carrying value of Series A and Series B preferred stock to redemption value over the period from issuance to the earliest redemption date of April 1, 2015. The accretion amounts were recorded as an increase to the carrying value of the Series A and Series B preferred stock with a corresponding charge to additional paid-in capital, if any, and then to accumulated deficit.

Concurrent with the July 2013 issuance of Series C preferred stock, the Series A and Series B redemption date was extended to March 1, 2019. At any time on or after March 1, 2019 and at the request of the holders of at least a majority of the then outstanding shares of preferred stock, the majority of which includes at least 74% of the holders of the then outstanding shares of Series C, the Company would have redeemed all of the then outstanding shares of preferred stock at an amount equal to the original issue price, plus all dividends declared but unpaid on such shares of preferred stock in three equal annual installments beginning on the redemption date.

Modification of Series A and Series B rights and preferences

The aforementioned modification of the Series A and Series B rights and preferences was reflected as a deemed contribution by the Series A and Series B preferred stockholders of their forfeited rights to the accrued dividends on the modification date. On July 25, 2013, the carrying amount of the Series A and Series B preferred stock immediately preceding the modification included $16,170 of accrued dividends. The resulting deemed contribution was recorded as a $16,170 increase to additional paid-in capital.

11. Common Stock and Stock Option Plan

Common stock

Prior to the IPO, voting, dividend and liquidation rights of the holders of the common stock were subject to and qualified by the rights, powers and preferences of the holders of the preferred stock.

Voting

The holders of the common stock are entitled to one vote for each share of common stock held at all meetings of stockholders. The number of authorized shares of common stock may be increased or decreased (but not below the number of shares thereof) by the affirmative vote of the holders of shares of capital stock of the Company representing a majority of the votes represented by all outstanding shares of capital stock of the Company entitled to vote.

Stock option plan

On July 1, 2007, the Board of Directors approved the 2007 Employee, Director, and Consultant Stock Plan, which provides for the grant of qualified incentive stock options, nonqualified stock options, and restricted stock to employees, directors, and nonemployees. On May 5, 2010, the Board of Directors approved the Fourth

Amended and Restated 2007 Employee, Director, and Consultant Stock Plan, which authorizes further issuances of up to 30,254 shares of the Company's common stock. On October 14, 2010, the Board of Directors approved the retirement of the 2007 Employee, Director and Consultant Stock Plan and adopted the 2010 Employee Director and Consultant Equity Incentive Plan (the "2010 Plan"). The 2010 Plan, as adopted, authorizes further issuances of up to 45,214 shares of the Company's common stock. On February 9, 2012, the Board of Directors approved an amendment to the 2010 Plan to increase the number of shares authorized for purchase by 4,800 shares, thereby providing for the purchase of up to 49,014 shares of the Company's common stock. On July 30, 2013, the Board of Directors approved an amendment to the 2010 Plan to increase the number of shares authorized for purchase by 1,715,851 shares, thereby providing for the purchase of up to 1,764,865 shares of the Company's common stock. The stock options generally vest 25% after 12 months, followed by ratable vesting over 36 months and expire 10 years from the grant date. On January 14, 2014, the Board of Directors approved the retirement of the 2010 Employee, Director and Consultant Stock Plan and adopted the 2014 Performance Incentive Plan (the "2014 Plan"). The 2014 Plan, as adopted, authorizes the issuances of up to 1,900,000 shares of the Company's common stock, with an additional 4% of the total outstanding common shares becoming available at each year ending December 31. The stock options generally vest 25% after 12 months, followed by ratable vesting over 36 months and expire 10 years from the grant date.

The fair value of each stock option award is estimated on the date of grant using the Black-Scholes option-pricing model that uses the assumptions noted in the table below. Expected volatility for the Company's common stock was determined based on an average of the historical volatility of a peer group of similar companies. The Company has limited stock option exercise information, as such; the expected term of stock options granted was calculated using the simplified method, which represents the average of the contractual term of the stock option and the weighted-average vesting period of the stock option. The assumed dividend yield is based upon the Company's expectation of not paying dividends in the foreseeable future. The risk-free rate for periods within the expected life of the stock option is based upon the U.S. Treasury yield curve in effect at the time of grant.

The assumptions used in the Black-Scholes option-pricing model for stock options granted during the years ended December 31, 2014, 2013 and 2012 are as follows:

	DECEMBER 31,		
	2014	2013	2012
Expected option term (in years)	5.5 – 6.3	6.0	6.0
Expected volatility	64% – 65%	64% – 69%	64%
Risk-free interest rate	1.7% – 2.0%	1.2% – 1.9%	0.7%
Expected dividend yield	0.0%	0.0%	0.0%

The weighted-average grant date fair value of stock options granted during the years ended December 31, 2014, 2013 and 2012 was $9.62, $2.52, and $30.00 per share, respectively. As of December 31, 2014, there was $18,284 of unrecognized compensation cost related to unvested employee stock options which are expected to be recognized over a weighted-average period of approximately 3 years. The intrinsic value of stock options exercised was $3,241, $0 and $7 for the years ended December 31, 2014, 2013 and 2012, respectively. Cash received from stock option exercises for the year ended December 31, 2014 was $824.

On September 24, 2013, the Board of Directors approved the repricing of all of the then outstanding 24,811 stock options, with an original per-share weighted average exercise price of $45.16, to a new per-share exercise price of $3.42, which represented the current per-share fair market value. The repricing was treated by the Company as an exchange of the original awards for new awards. The incremental fair value of the modification, which was $30, was recognized in the statement of operations in 2013, representing the value of vested awards.

A summary of stock option activity for employee and nonemployee awards under the Plan are presented below:

	NUMBER OF OPTIONS	WEIGHTED-AVERAGE PRICE PER SHARE	WEIGHTED-AVERAGE REMAINING CONTRACTUAL TERM (YEARS)
OUTSTANDING—January 1, 2014	1,610,139	$ 3.42	9.7
Granted	2,311,306	15.96	
Exercised	(239,853)	3.44	
Forfeited	(76,879)	11.72	
OUTSTANDING—December 31, 2014	3,604,713	11.28	9.1
EXERCISABLE—December 31, 2014	787,661	7.52	8.8
Vested and expected to vest as of December 31, 2014	3,603,566	$ 11.28	9.1

Under the Company's 2014 stock option plans, the Company has reserved 61,694 shares of common stock for future issuance at December 31, 2014.

Stock options granted to nonemployees

Stock-based compensation expense related to stock options granted to nonemployees is recognized as the consulting services are rendered, generally on a straight-line basis. The Company believes that the fair value of the stock options is more reliably measurable than the fair value of the services received. Compensation expense is subject to remeasurement until the options vest.

There were no such grants in 2014 and 2012. In 2013, the Company granted stock options to purchase 132,500 shares of common stock to nonemployees with an initial fair value of $337. The Company has recorded a stock-based compensation expense of $1,887, $23 and a stock-based compensation credit of $19 during the years ended December 31, 2014, 2013 and 2012, respectively. Compensation expense is subject to remeasurement until the stock options vest. The assumptions used to estimate fair value were as follows:

	DECEMBER 31,		
	2014	2013	2012
Stock price	$9.37 – 41.12	$7.42	$0.06
Expected option term (in years)	0.25 – 6.86	7.0	7.0
Expected volatility	56% – 68%	66%	66%
Risk-free interest rate	0.1% – 2.3%	2.8%	1.7%
Expected dividend yield	0.0%	0.0%	0.0%

As of December 31, 2014, there were 26,250 unvested stock options. The remaining unrecognized compensation cost related to unvested nonemployee stock options is dependent on the valuation inputs used on each remeasurement date and will be recognized over a weighted-average period of thirty months.

Restricted common stock

During 2007, the Company issued a total of 320 shares of the Company's common stock to a scientific advisor of the Company as consideration for services. The fair value of these shares was $8 at the grant date. Restricted common stock, prior to vesting, are subject to repurchase and transfer restrictions that lapsed in November 2011. As of December 31, 2014 and 2013, there was no remaining restricted common stock subject to repurchase. The Company has recorded stock-based compensation expense of $211, $0 and $3 in 2014, 2013 and 2012, respectively, associated with the vesting of restricted stock awards. In June 2011, the Company issued 200 shares of common stock of the Company's common stock to a scientific advisor of the Company at a purchase price of

$50.00 per share. The fair value of the common stock was $10 at the vesting date. The restricted common stock, prior to vesting, is subject to repurchase and transfer restrictions that lapse ratably over 48 months beginning in July 2011. As of December 31, 2012, there were 125 common stock subject to repurchase at $50.00 per share. In July 2013, the Company repurchased 100 unvested restricted common stock from the scientific advisor at a price of $50.00 per share. During 2014, the Company issued a total of 44,000 shares of the Company's restricted common stock. The fair value of these shares were $709 at the grant date.

As of December 31, 2014 the unrecognized compensation cost related to restricted common stock was $498. As of December 31, 2013, there was no unrecognized compensation cost related to restricted common stock. The total fair value of restricted stock awards that vested during the years ended December 31, 2014, 2013 and 2012 (measured on the date of vesting) was $57, $1 and $3

A summary of the Company's restricted common stock is presented below:

	SHARES	WEIGHTED-AVERAGE GRANT DATE FAIR VALUE PER SHARE
Nonvested—January 1, 2014	—	$ —
Issued	44,000	16.30
Vested	(4,000)	14.34
Nonvested—December 31, 2014	40,000	$ 16.30

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

	YEAR ENDED DECEMBER 31,		
	2014	2013	2012
Research and development	$ 4,183	$ 124	$ 14
General and administrative	4,054	371	111
Total	$ 8,237	$ 495	$ 125

12. Fair Value Measurements

Fair value is an exit price, representing the amount that would be received from the sale of an asset or paid to transfer a liability in an orderly transaction between market participants. As such, fair value is a market-based measurement that should be determined based on assumptions that market participants would use in pricing an asset or liability. As a basis for considering such assumption the accounting literature establishes a three-tier value hierarchy which prioritizes the inputs used in measuring fair value as follows: (Level 1) observable inputs, such as unadjusted quoted prices in active markets; (Level 2) inputs other than the quoted prices in active markets that are observable either directly or indirectly; and (Level 3) unobservable inputs for which there is little or no market data, which requires the Company to develop its own assumptions. This hierarchy requires the Company to use observable market data, when available, and to minimize the use of unobservable inputs when determining fair value.

A summary of the Company's assets that are measured or disclosed at fair value on a recurring basis as at December 31, 2014 and 2013 are presented below:

	At December 31,			
Description	2014	(Level 1)	(Level 2)	(Level 3)
Cash equivalents	$ 20,425	$20,425	$ —	$ —
Held-to-maturity investments				
U.S. treasury securities and government agency bonds	72,532	—	72,532	—
Assets held in restriction				
Certificates of deposit	1,380	—	1,380	—
Total	$ 94,361	$20,425	$73,936	$ —

	At December 31,			
Description	2013	(Level 1)	(Level 2)	(Level 3)
Cash equivalents	$ 46,041	$46,041	$ —	$ —
Assets held in restriction				
Certificates of deposit	264	—	264	—
Long-term debt	4,847	—	4,847	—
Preferred stock warrant liability	529	—	—	529
Total	$ 51,681	$46,041	$ 5,111	$ 529

The Company's cash equivalents, primarily money market accounts are classified within Level 1 of the fair value hierarchy because they are valued using quoted prices as of December 31, 2014 and 2013, respectively.

The Company's assets held in restriction bore interest at the prevailing market rates for instruments with similar characteristics and, accordingly, the carrying value of these instruments also approximated their fair value and the financial instruments were classified within Level 2 of the fair value hierarchy because the inputs to the fair value measurement are valued using observable inputs as of December 31, 2014 and 2013, respectively.

The Company's held-to-maturity investments bore interest at the prevailing market rates for instruments with similar characteristics. The financial instruments were classified within Level 2 of the fair value hierarchy because the inputs to the fair value measurement are valued using observable inputs as of December 31, 2014.

The Company's long-term debt bore an interest at the prevailing market rates for instruments with similar characteristics and, accordingly, the carrying value for these instruments also approximated their fair value. There was no debt outstanding as of December 31, 2014.

For the years ended December 31, 2014 and 2013, there were no transfers between Level 1 and Level 2.

The fair value of the preferred stock warrant liability was determined using the Black-Scholes option-pricing model for the years ended December 31, 2013 and 2012 and until the IPO conversion date of February 4, 2014. The fair value of the preferred stock warrant was based significantly on the fair value of the preferred stock, which was developed using unobservable inputs, and was classified within Level 3.

After the closing of the IPO, the remaining preferred stock warrant liability was no longer subject to re-measurement as the warrants to purchase the Company's preferred stock became warrants to purchase shares of the Company's common stock. As of the IPO closing date, the fair value of the preferred stock warrants was based significantly on the fair value of the Company's publicly traded common stock and other observable inputs and was reclassified to Level 2. There were no preferred stock warrants outstanding as of December 31, 2014.

The following table provides a roll-forward of the Company's liabilities measured at fair value on a recurring basis using unobservable inputs (Level 3):

BALANCE—January 1, 2012	$ 800
Change in fair value of warrant liability	(469)
BALANCE—December 31, 2012	331
Issuance of preferred stock warrants	324
Change in fair value of warrant liability	(126)
BALANCE—December 31, 2013	529
Change in fair value of warrant liability	2,559
Transfers to Level 2	(3,088)
BALANCE—December 31, 2014	$ —

The preferred stock warrant liability will increase or decrease each period based on the fluctuations of the fair value of the underlying preferred stock. A significant fluctuation in the preferred stock fair value would not result in a material increase or decrease in the fair value of the preferred stock warrant liability.

13. Income Taxes

The Company has a current alternative minimum tax of $125 and deferred income tax expense for the year ended December 31, 2014, and no current or deferred income tax expense for 2013. The Company did not recorded a federal income tax provision or benefit for the year ended December 31, 2014 and 2013.

The reconciliation between income taxes computed at the federal statutory income tax rate and the provision for (benefit from) income taxes is as follows:

	YEARS ENDED DECEMBER 31,		
	2014	2013	2012
Federal statutory rate	34.0%	34.0%	34.0%
Effect of:			
Change in valuation allowance	(32.0)	(35.4)	(33.2)
Research and development tax credit	0.8	2.5	(1.9)
Stock-based compensation	(2.6)	(1.3)	(0.4)
Other	(0.2)	0.2	1.5
Total	0.0%	0.0%	0.0%

The components of the deferred tax assets are as follows:

	As of December 31,	
	2014	2013
Deferred tax assets:		
Net operating loss carryforwards	$ 41,846	$ 27,314
Capitalized research and development costs	2,646	1,465
Research and development credit carryforwards	2,360	1,806
Stock Compensation	2,479	—
Depreciation and other costs	372	386
Net deferred tax assets	49,703	30,971
Valuation allowance	(49,703)	(30,971)
Net deferred tax assets	$ —	$ —

Management of the Company has evaluated the positive and negative evidence bearing upon the realizability of its net deferred tax assets and determined that it is more likely than not that the Company will not recognize the benefits of the net deferred tax assets. As a result, the Company has a valuation allowance at December 31, 2014 and 2013. The valuation allowance increased in 2014 and 2013 by $18,732 and $8,116, primarily due to the increase in the Company's net operating loss carryforwards, capitalized costs and stock compensation. As of December 31, 2014, the Company has approximately $57,800 of federal and $53,358 of state net operating loss carryforwards, and $1,457 of federal and $902 of Massachusetts research and development credits that expire starting in 2028.

Realization of the future tax benefits is dependent on many factors, including the Company's ability to generate taxable income within the net operating loss carryforward period. Under the provisions of the Internal Revenue Code, certain substantial changes in the Company's ownership, including a sale of the Company or significant changes in ownership due to sales of equity, may have limited, or may limit in the future, the amount of net operating loss carryforwards, which could be used annually to offset future taxable income.

As of December 31, 2014, the Company had $1,216 of unrecognized tax benefits, of which $1,216 would affect income tax expense if recognized, before consideration of the Company's valuation allowance. The Company does not expect the unrecognized tax benefits to change significantly over the next 12 months. The Company recognizes both interest and penalties associated with uncertain tax positions as a component of income tax expense. As of December 31, 2014 and 2013, the Company has not accrued any penalties or made provisions for interest.

A reconciliation of the gross unrecognized tax benefit is as follows (in thousands):

	Year Ended December 31,	
	2014	2013
Unrecognized tax benefits at the beginning of the period	$ 865	$ 563
Additions for current tax positions	220	113
Changes for previous tax positions	131	189
Unrecognized tax benefits at the end of the period	$ 1,216	$ 865

The Company files income tax returns in the United States and Commonwealth of Massachusetts. The tax years 2007 through 2014 remain open to examination by these jurisdictions, as carryforward attributes generated in past years may be adjusted in a future period. The Company is not currently under examination by the Internal Revenue Service or any other jurisdiction for these years. The Company has not recorded any interest or penalties for unrecognized tax benefits since its inception.

In December 2014, we licensed all of our non-U.S. intellectual property rights to a non-U.S. wholly-owned subsidiary.

14. Commitments and Contingencies

Facility lease

The Company began leasing office and lab space in 2008 under a noncancelable operating lease agreement that, as amended on July 3, 2013, expires on November 30, 2016. The lease agreement provides for an increasing monthly payment over the lease term. Rent expense is recorded on the straight-line basis and, therefore, the Company had a deferred rent obligation in the amount of $67 and $105 as of December 31, 2014 and 2013, respectively. The Company is also required to maintain a letter of credit of $264 related to the operating lease, which the letter of credit is secured by a certificate of deposit. The certificate of deposit is shown as assets held in restriction on the accompanying balance sheets.

On July 11, 2014, the Company executed a non-cancelable operating lease for office and laboratory space in Cambridge, Massachusetts. The lease agreement obligates the Company to future minimum payments totaling $9,498 over a six-year lease term. Rent expense is recorded on the straight-line basis and, therefore, the Company had a deferred rent obligation in the amount of $10 as of December 31, 2014. The lease commenced on December 1, 2014. As part of the lease agreement, the Company established a $1,116 letter of credit, secured by a certificate of deposit which is included in assets held in restriction at December 31, 2014.

Rent expense was $741, $875 and $899 and the years ended December 31, 2014, 2013 and 2012, respectively.

Under the current lease agreements, future minimum payments payable are approximately as follows:

PERIOD ENDING DECEMBER 30	OPERATING LEASES
2015	$ 2,101
2016	2,120
2017	1,582
2018	1,629
2019 and beyond	3,259
Total (1)	$ 10,691

(1) Of the $10,691 future minimum payments payable noted above, $1,194 is associated with an offsetting sublease. The yearly total for 2015 and 2016 are as follows; $610, and $584 respectively.

City of Hope license agreement

In September 2007, the Company entered into a license agreement with City of Hope, an independent academic research and medical center (the "Medical Center"). In consideration for the right to develop, manufacture, and commercialize products based on certain of the Medical Center's intellectual property, the Company paid a one-time, non-refundable license fee and issued shares of common stock as consideration for the license.

The Company is required to pay an annual license maintenance fee, reimburse the Medical Center for patent costs incurred, and an amount within the range of $5,000 to $10,000 upon the achievement of certain milestones, and royalties on future sales, if any. There were no sublicense and other fees accrued as at December 31, 2014, and 2013. The license agreement will remain in effect until the expiration of the last patents or copyrights licensed under the agreement or until all obligations under the agreement with respect to payment of milestones have terminated or expired. The Company may terminate the license agreement at any time upon 90 days written notice to the Medical Center. The Company recorded research and development expense, related to the agreement with the Medical Center, of $50, $500 and $1,500 in 2014, 2013 and 2012, respectively.

Plant Bioscience Limited license agreement

In September 2013, the Company entered into a commercial license agreement with Plant Bioscience Limited (PBL), pursuant to which PBL has granted to the Company a license to certain of its U.S. patents and patent applications to research, discover, develop, manufacture, sell, import and export, products incorporating one or more short RNA molecules (SRMs).

The Company has paid PBL a one-time, non-refundable signature fee and will pay PBL a nomination fee for any additional SRMs nominated by the Company under the agreement. The Company is further obligated to pay PBL milestone payments upon achievement of certain clinical and regulatory milestones. During 2014, the Company paid $100 to PBL based on meeting a clinical milestone. In addition, PBL is entitled to receive royalties of any net sale revenue of any licensed product candidates sold by the Company.

Tekmira Pharmaceuticals Corporation license agreement

In November 2014, the Company signed a licensing and collaboration agreement with Tekmira Pharmaceuticals Corporation (Tekmira) to license Tekmira's LNP delivery technology for exclusive use in the Company's primary hyperoxaluria type 1 (PH1) development program. The Company will use Tekmira's LNP technology to deliver DCR-PH1, for the treatment of PH1. As of December 31, 2014, the Company paid $3,000 in license fees. Tekmira is entitled to receive additional payments of $22 million in aggregate development milestones, plus a mid-single-digit royalty on future PH1 sales. This new partnership also includes a supply agreement with Tekmira providing clinical drug supply and regulatory support.

15. Employee Benefit Plan

The Company has a 401(k) retirement plan in which substantially all employees are eligible to participate. Eligible employees may elect to contribute up to the maximum limits, as set by the Internal Revenue Service, of their eligible compensation. The Company made discretionary plan contributions of $175, $105 and $127 in 2014, 2013 and 2012, respectively.

16. Quarterly Financial Data (Unaudited)

	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER	TOTAL YEAR
2014					
Revenue	$ —	$ —	$ —	$ —	$ —
Net loss	(10,804)	(11,355)	(11,193)	(14,587)	(47,939)
Net loss attributable to common stockholders	(11,008)	(11,355)	(11,193)	(14,587)	(48,143)
Net loss per share attributable to common stockholders—basic and diluted	$ (1.02)	$ (0.64)	$ (0.63)	$ (0.82)	$ (3.00)

	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER	TOTAL YEAR
2013					
Revenue	$ —	$ —	$ —	$ —	$ —
Net loss	(3,819)	(3,786)	(4,194)	(6,719)	(18,518)
Net loss attributable to common stockholders	(4,830)	(4,808)	(4,540)	(6,728)	(20,906)
Net loss per share attributable to common stockholders—basic and diluted	$ (172.80)	$ (171.13)	$ (161.55)	$ (199.91)	$(709.57)

Full year amounts may not sum due to rounding.

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

None.

Item 9A. ***Controls and Procedures***

Disclosure Controls and Procedures

We maintain disclosure controls and procedures that are designed to ensure that information required to be disclosed in our periodic and current reports that we file under the Securities Exchange Act of 1934, as amended (Exchange Act), with the Securities and Exchange Commission (SEC) is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms, and that such information is accumulated and communicated to our management, including our chief executive officer and principal financial officer, as appropriate, to allow timely decisions regarding required disclosure.

As of the end of the period covered by this Annual Report on Form 10-K, we carried out an evaluation, under the supervision and with the participation of our management, including the chief executive officer and the chief financial officer, of the effectiveness of the design and operation of our disclosure controls and procedures pursuant to Exchange Act Rule 13a-15. Based upon, and as of the date of, this evaluation, the chief executive officer and the chief financial officer concluded that our disclosure controls and procedures were effective. Accordingly, management believes that the financial statements included in this report fairly present in all material respects our financial condition, results of operations and cash flows for the periods presented.

Management's Annual Report on Internal Control over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting (as defined in Rules 13a-15(f) and 15d-15(f) of 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 as of December 31, 2014 based on the guidelines established in Internal Control—Integrated Framework 2013 issued by the Committee of Sponsoring Organizations of the Treadway Commission. Our internal control over financial reporting includes policies and procedures that provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external reporting purposes in accordance with U.S. generally accepted accounting principles.

Based on that evaluation, management concluded that our internal control over financial reporting was effective as of December 31, 2014.

Attestation Report of the Registered Public Accounting Firm

This Annual Report on Form 10-K does not include an attestation report of our independent registered public accounting firm as we are an "emerging growth company" as of December 31, 2014, as defined in the recently enacted Jumpstart Our Business Startups Act of 2012.

Changes in Internal Control Over Financial Reporting

We continuously seek to improve the efficiency and effectiveness of our internal controls. This results in refinements to processes throughout the Company. There was no change in our internal control over financial reporting during the quarter ended December 31, 2014, which was identified in connection with our management's evaluation required by Exchange Act Rules 13a-15(f) and 15d-15(f) that has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

Inherent Limitations on the Effectiveness of Controls

Our management, including the chief executive officer and chief financial officer, does not expect that our disclosure controls and procedures or our internal control over financial reporting will prevent all error and all fraud. A control system, no matter how well conceived and operated, can provide only reasonable, not absolute, assurance that the objectives of the control system are met. Because of the inherent limitations in all control systems, no evaluation of controls can provide absolute assurance that all control issues and instances of fraud, if any, within the company have been detected. These inherent limitations include the realities that judgments in decision making can be faulty and that breakdowns can occur because of simple error or mistake. Additionally, controls can be circumvented by the individual acts of some persons, by collusion of two or more people or by management override of the control. The design of any system of controls also is based in part upon certain assumptions about the likelihood of future events, and there can be no assurance that any design will succeed in achieving its stated goals under all potential future conditions. Over time, controls may become inadequate because of changes in conditions, or the degree of compliance with the policies or procedures may deteriorate. Because of the inherent limitations in a cost-effective control system, misstatements due to error or fraud may occur and not be detected.

Item 9B. ***Other Information***

None.

PART III

Item 10. *Directors, Executive Officers and Corporate Governance*

The following sets forth information about our executive officers as of March 11, 2015.

Name	Position	Age
Douglas M. Fambrough, III, Ph.D.	President, Chief Executive Officer and Director	46
Theodore T. Ashburn, M.D., Ph.D.	Senior Vice President, Product Strategy and Operations	47
Pankaj Bhargava, M.D.	Chief Medical Officer	46
Bob D. Brown, Ph.D.	Chief Scientific Officer, Senior Vice President	50
James E. Dentzer	Chief Financial Officer	48
James B. Weissman	Chief Business Officer	53
Non-Employee Directors		
Brian K. Halak, Ph.D.	Director	43
Stephen J. Hoffman, M.D., Ph.D.	Director	60
Peter Kolchinsky, Ph.D.	Director	38
Dennis H. Langer, M.D., J.D.	Director	63
David M. Madden	Chairman	52
Bruce Peacock	Director	63

The following is biographical information as of March 11, 2015 for our executive officers and directors.

Executive Officers

Douglas M. Fambrough, III, Ph.D. has served as a member of our board of directors since April 2007 and as our president and chief executive officer since May 2010. From 2000 to May 2010, Dr. Fambrough held various positions at Oxford Bioscience Partners, a life science venture capital firm, most recently as a general partner. During his years at Oxford Bioscience Partners, he specialized in financing innovative life science technology companies, including the Company, Sirna Therapeutics, Inc. (acquired by Merck & Co., Inc.), Solexa, Inc. (acquired by Illumina, Inc.), and Xencor, Inc. (NASDAQ: XNCR), and served as a director of each of these companies. Dr. Fambrough has also served as a Trustee of Boston Biomedical Research Institute, a not-for-profit organization. Before joining Oxford Bioscience Partners, he was a genomic scientist at the Whitehead/MIT Center for Genome Research (now known as the Broad Institute). Dr. Fambrough graduated from Cornell University and obtained his Ph.D. in genetics at the University of California, Berkeley. The nominating and corporate governance committee believes that Dr. Fambrough's experience serving as our president and chief executive officer and a member of our board of directors, combined with his experience in the venture capital industry and biotechnology research and development, provide him with the qualifications and skills to serve as a member of our board of directors.

Theodore T. Ashburn, M.D., Ph.D. joined us as Senior Vice President, Product Strategy and Operations in December 2014. Prior to that, from December 2006 to December 2014, Dr. Ashburn held various positions at Genzyme/Sanofi Oncology, most recently as global product leader, Leukine ® leading all aspects of the marketed product Leukine ® (yeast-derived, rhu GM-CSF), including commercial, manufacturing and development across multiple therapeutic areas and divisions. Prior to joining Genzyme, Dr. Ashburn worked at the venture capital firm Oxford BioScience Partners and superDimension, Ltd. (acquired by Covidien Ltd. in March 2012), and also co-founded and later worked for the Oxford-led start up Dynogen Pharmaceuticals, Inc. Dr. Ashburn started his business career in a business development and strategic planning group at Pfizer, Inc. Dr. Ashburn has a Ph.D. in organic chemistry from the Massachusetts Institute of Technology (MIT), where he worked on the structure and properties of ß-amyloid protein associated with Alzheimer's disease and a M.D. from Harvard Medical School.

Pankaj Bhargava, M.D. joined us as chief medical officer in March 2014. Prior to that, he was Associate Vice President at Sanofi Oncology from February 2011 to March 2014, where he led the global development of

aflibercept (ZALTRAP™) culminating in successful approvals by the U.S. Food and Drug Administration, European Medicines Agency and several other regulatory authorities worldwide. Dr. Bhargava also served as the Gastrointestinal Oncology Therapeutic Leader, Chairman of Protocol Review Committee, and a member of the Development Leadership Team at Sanofi Oncology Division. Prior to joining Sanofi, Dr. Bhargava was Vice President Clinical Research and Interim Chief Medical Officer at AVEO Pharmaceuticals, Inc. (NASDAQ: AVEO) from November 2006 to February 2011, where he led its clinical programs across all indications spanning from Phase 1 to Phase 3 development and was responsible for clinical and regulatory strategy, clinical development, operations, pharmaco-vigilance and joint development with alliance partners, among other things. Dr. Bhargava currently serves as an Attending Physician at Dana-Farber Cancer Institute and part-time faculty member at Harvard Medical School. Dr. Bhargava holds an M.B., B.S. degree from the University of Delhi, India, and is an alumnus of Harvard Business School Executive Education Program. Dr. Bhargava is U.S. Board Certified in Internal Medicine, Medical Oncology and Clinical Pharmacology, and did an advanced fellowship in Developmental Therapeutics at the Lombardi Cancer Center, Georgetown University.

Bob D. Brown, Ph.D. initially served as our senior vice president of research beginning in May 2008 and has served as our chief scientific officer since January 2012. From March 2003 to March 2008, Dr. Brown held various positions at Genta Incorporated, most recently as its vice president of research and technology. Previously, he was a co-founder and vice president of research and development of Oasis Biosciences Inc., which was acquired by Gen-Probe Incorporated. Dr. Brown is an inventor or co-inventor on 16 issued patents and dozens of patent applications covering oligonucleotide and conventional small molecule therapeutic agents, diagnostic tool and oligonucleotide and small molecule drug delivery technologies. Dr. Brown holds a Ph.D. in molecular biology from the University of California, Berkeley, and a B.S. in chemistry and biology from the University of Washington, Seattle.

James E. Dentzer joined us as chief financial officer in December 2013. Prior to that, he was the chief financial officer of Valeritas, Inc. from March 2010 to December 2013, where he led the finance team in raising a $150 million Series C equity round and a $100 million debt financing and helped guide the company through approval by the U.S. Food and Drug Administration, manufacturing scale-up and commercial launch of the V-Go insulin delivery device. Prior to joining Valeritas, Inc., he was the chief financial officer of Amicus Therapeutics, Inc. (NASDAQ: FOLD) from October 2006 to October 2009, where he led the company through a Series D preferred stock financing and subsequent initial public share offering. In prior positions, he spent six years as corporate controller of Biogen Idec and six years in various senior financial roles at E.I. du Pont de Nemours and Company in the U.S. and Asia. Mr. Dentzer holds a B.A. in philosophy from Boston College and an M.B.A. from the University of Chicago.

James B. Weissman has served as our chief business officer since January 2012. From January 2006 to January 2012, Mr. Weissman was senior director and then vice president, business development of MannKind Corporation (NASDAQ: MNKD), where he was responsible for leading the company's activities related to licensing, new products and strategic planning. Prior to MannKind, Mr. Weissman held leadership positions in both business development and marketing at Pfizer Pharmaceuticals, Inc. in Tokyo, most recently as senior director of marketing, responsible for the sales, profit and strategic targets for the company's specialty products, in a variety of therapeutic areas. Mr. Weissman holds a B.S. from Bates College in Maine.

Non-Employee Directors

Brian K. Halak, Ph.D. has served as a member of our board of directors since August 2010. Dr. Halak is currently a partner of Domain Associates, LLC, which he joined in 2001. Prior to joining Domain Associates, LLC, Dr. Halak was an associate with Advanced Technology Ventures. Prior to that, Dr. Halak was a consultant at the Wilkerson Group. Dr. Halak currently serves as a member of the boards of directors of Alimera Sciences, Inc. (NASDAQ: ALIM), BioNano Genomics, Inc., Carticept Medical, Inc., Kona Medical, Inc., Oraya Therapeutics, Inc., and Smart Medical Systems Ltd., and serves as a board observer to Eddingpharm, Inc. and Medico (Hong Kong) Limited. Dr. Halak also serves as an advisory board member to the University of

Pennsylvania, Department of BioEngineering and serves on the advisory committee for Elm Street Ventures. Dr. Halak previously served on the boards of directors of Corridor Pharmaceuticals, Inc. (formerly Immune Control, Inc.), Cartiva, Inc., Cortria Corporation, Domain Elite Holdings, Ltd., Eddingpharm, Inc., Esprit Pharma, Inc. (acquired by Allergan, Inc.), Fenway Pharmaceuticals, Inc., GI Dynamics, Inc. (ASX: GID), Immune Control, Inc., Oceana Therapeutics, Inc., Optherion, Inc., Tboira Therapeutics, Inc., and Vanda Pharmaceuticals, Inc. (NASDAQ: VNDA), and served as a board observer to Zyga Technology, Inc. Dr. Halak received his BSE in bioengineering from the University of Pennsylvania and his Ph.D. in immunology from the Thomas Jefferson University. The nominating and corporate governance committee believes that Dr. Halak's experience in the venture capital industry, particularly with biopharmaceutical companies, and his experience serving on the boards of directors of a number of biopharmaceutical companies provide him with the qualifications and skills to serve as a member of our board of directors.

Stephen J. Hoffman, M.D., Ph.D. has been a senior advisor to PDL BioPharma, Inc. since February 2014. Prior to that, he served as a managing director at Skyline Ventures, a venture capital firm, from May 2007 until February 2014. From January 2003 to March 2007, Dr. Hoffman was a general partner at TVM Capital, a venture capital firm. From 1994 to 2002, he served as president, chief executive officer and a member of the board of directors of Allos Therapeutics, Inc., a biopharmaceutical company, where he remained as chairman of the board until it was acquired by Spectrum Pharmaceuticals, Inc. in September 2012. From 1990 to 1994, Dr. Hoffman completed a fellowship in clinical oncology and a residency/fellowship in dermatology, both at the University of Colorado. Dr. Hoffman was the scientific founder of Somatogen Inc., a biotechnology company that was acquired by Baxter International, Inc. in 1998, where he held the position of vice president of science and technology from 1987 until 1990. Dr. Hoffman currently serves on the boards of directors of AcelRx Pharmaceuticals, Inc. (NASDAQ: ACRX) and Genocea Biosciences, Inc. (NASDAQ: GNCA). Previously, Dr. Hoffman also served on the board of directors of Sirtris Pharmaceuticals, Inc., a pharmaceutical company that was acquired by GlaxoSmithKline (NYSE: GSK) in 2008. Dr. Hoffman holds a Ph.D. in bio-organic chemistry from Northwestern University and an M.D. from the University of Colorado School of Medicine. The nominating and corporate governance committee believes that Dr. Hoffman's scientific and business experience, including his diversified background as an executive officer, director and venture capital investor in biopharmaceutical companies, provide him with the qualifications and skills to serve as a member of our board of directors.

Peter Kolchinsky, Ph.D. has served as a member of our board of directors since July 2013. Dr. Kolchinsky is a founding partner and portfolio manager at RA Capital, where he has been since September 2004. He is active in both public and private investments across the pharmaceutical, medical devices, diagnostics and life-science tools industries. Dr. Kolchinsky authored the e-book "The Entrepreneur's Guide to a Biotech Startup" and serves on the board of directors of the American Fertility Association. Dr. Kolchinsky currently also serves as a member of the boards of directors of CellScape Corporation, Zipline Medical, Inc., Lantos Technologies, Inc., Periphagen, Inc., Calimmune, Inc. and PiloFocus, Inc. In the past, Dr. Kolchinsky served on the Board of Global Science and Technology for the National Academies of Sciences. He received a Ph.D. in virology from Harvard University and a bachelor's degree from Cornell University. The nominating and corporate governance committee believes that Dr. Kolchinsky's experience as a venture capital investor in and director of a number of healthcare and life sciences companies provides him with the qualifications and skills to serve as a member of our board of directors.

Dennis H. Langer, M.D., J.D. has served as a member of our board of directors since November 2007. Dr. Langer previously served as the chairman of the board of directors and chief executive officer of AdvanDx, Inc., from January 2013 to August 2014. Dr. Langer has been a clinical professor in the department of psychiatry at Georgetown University School of Medicine since September 2003. From August 2005 to May 2010, Dr. Langer served as managing partner of Phoenix IP Ventures, LLC. From January 2004 to July 2005, he served as president, North America of Dr. Reddy's Laboratories, Inc. (NYSE: RDY). From September 1994 until January 2004, Dr. Langer held several positions at GlaxoSmithKline plc (NYSE: GSK) and its predecessor, SmithKline Beecham, culminating with senior vice president of research and development. Dr. Langer currently

serves on the boards of directors of Delcath Systems, Inc. (NASDAQ: DCTH) and Myriad Genetics, Inc. (NASDAQ: MYGN). Dr. Langer previously served on the boards of directors of Auxilium Pharmaceuticals, Inc. (NASDAQ: AUXL), Cytogen Corporation (acquired by EUSA Pharma, Inc.), Innocoll, Inc., Myrexis, Inc., Pharmacopeia, Inc. (acquired by Ligand Pharmaceuticals Incorporated) and Sirna Therapeutics, Inc. (acquired by Merck & Co., Inc.). Dr. Langer received a J.D. (*cum laude*) from Harvard Law School, an M.D. from Georgetown University School of Medicine and a B.A. in biology from Columbia University. The nominating and corporate governance committee believes that Dr. Langer's business and management experience, including senior positions at global pharmaceutical companies and innovative research and development experience at companies such as Eli Lilly & Co. (NYSE: LLY), Abbott Laboratories (NYSE: ABT) and G.D. Searle &Company, as well as his diversified background serving as a director of several pharmaceutical companies provide him with the qualifications and skills to serve as a member of our board of directors.

David M. Madden has served as a member and the chairman of our board of directors since June 2009. Mr. Madden is a founder and principal of Narrow River Management, LP, an investment management company with a focus on equity investments in the emerging pharmaceutical industry, where he has been since 2004. Mr. Madden has served as chief executive officer and a member of the board of directors of River Vision Development Corporation since 2011. Mr. Madden also serves as a member of the board of directors of the Hospital for Special Surgery. Mr. Madden previously served as interim president and chief executive officer of Adolor Corporation (NASDAQ: ADLR) from August 2005 to December 2006 and the chairman of its board of directors until it was acquired by Cubist Pharmaceuticals, Inc. (NASDAQ: CBST) in December 2011. Mr. Madden was co-chief executive officer of Royalty Pharma AG, a private investment management firm specializing in the acquisition of royalty interests in pharmaceutical products, from October 2000 to 2003, and a member of its board of directors until March 2004. From 1997 to October 2000, he served as a managing member of Pharmaceutical Partners, LLC. From 1992 to 1995, Mr. Madden was president and chief executive officer and a member of the board of directors of Selectide Corporation. Mr. Madden has a B.S. in Electrical Engineering from Union College and an M.B.A. from Columbia University. The nominating and corporate governance committee believes that Mr. Madden's diversified experience in the pharmaceutical, healthcare and financial services industries, particularly his experience of serving as an executive officer and director of several pharmaceutical companies, provide him with the qualifications and skills to serve as a member of our board of directors.

Bruce Peacock has served as a member of our board of directors since September 2014. Mr. Peacock served as the chief financial and business officer of Ophthotech Corporation from August 2013 to September 2014 and served as its chief business officer from September 2010 to August 2013. Previously, Mr. Peacock served as the chief executive officer of Alba Therapeutics, The Little Clinic, Adolor Corp., and Orthovita Inc. Mr. Peacock also served as chief operating officer of Cephalon Inc., chief business officer of Ophthotech, and as chief financial officer of Centocor Inc. Additionally, Mr. Peacock is co-chair of Alba Therapeutics, and is a member of the board of directors of Discovery Laboratories Inc., Ocular Therapeutix, and Invisible Sentinel Inc. Mr. Peacock holds a B.A. from Villanova University and is a certified public accountant.

Audit Committee

The board of directors has established an audit committee that oversees our corporate accounting and financial reporting process. The members of the audit committee are Mr. Peacock, Dr. Hoffman and Mr. Madden. Mr. Peacock serves as the chairman of the committee. Our board of directors has determined that each member of the audit committee is "independent" for audit committee purposes as that term is defined in the applicable rules of the SEC and NASDAQ. Our board of directors has designated each of Mr. Peacock and Dr. Hoffman as an "audit committee financial expert" as defined under the applicable rules of the SEC. The audit

committee has adopted a written audit committee charter, which is available on our corporate website at www.dicerna.com . The responsibilities and duties of the audit committee include, among other things:

- evaluating the performance and assessing the qualifications of our independent registered public accounting firm;
- determining whether to retain or terminate our independent registered public accounting firm or to appoint and engage a new independent registered public accounting firm;
- reviewing and determining the engagement of the independent registered public accounting firm, including the overall scope and plans for their respective audits, the adequacy of staffing and compensation, and negotiating and executing, on behalf of the Company, engagement letters with the independent auditors;
- establishing guidelines and procedures with respect to the rotation of the lead or coordinating audit partners having primary responsibility for the audit and the audit partner responsible for reviewing the audit;
- reviewing and approving the retention of our independent registered public accounting firm for any permissible non-audit services and the fees or other compensation for such services;
- obtaining and reviewing, at least annually, a formal written statement prepared by the independent registered public accounting firm delineating all relationships between our independent registered public accounting firm and the Company, discussing with our independent registered public accounting firm, and reviewing its independence from management and the Company;
- reviewing with our independent registered public accounting firm any management or internal control letter issued or proposed to be issued by our independent registered public accounting firm and management's response;
- reviewing with management and our independent registered public accounting firm the scope, adequacy and effectiveness of our financial reporting controls;
- reviewing and discussing with management, any internal auditor and our independent registered public accounting firm, as appropriate, the Company's major financial risks, the Company's policies for assessment and management of such risks and the steps to be taken to control such risks;
- establishing and maintaining procedures for the receipt, retention and treatment of complaints with respect to accounting, internal accounting controls or auditing matters, including procedures for the confidential and anonymous submission by employees of concerns regarding accounting or auditing matters;
- investigating and resolving any disagreements between the Company's management and our independent registered public accounting firm regarding the Company's financial reporting, accounting practices or accounting policies, and reviewing with our independent registered public accounting firm any other problems or difficulties it may have encountered during the course of the audit work;
- meeting with senior management and our independent registered public accounting firm in separate executive sessions;
- reviewing the financial statements to be included in our quarterly reports on Form 10-Q and our annual reports on Form 10-K;
- discussing with management and our independent registered public accounting firm the results of the independent registered public accounting firm's review of our quarterly financial statements and the results of our annual audit and the disclosures contained under the caption "Management's Discussion and Analysis of Financial Condition and Results of Operations" in our periodic reports;
- reviewing and discussing with management and our independent registered public accounting firm any material financial arrangements of the Company which do not appear on the financial statements of the Company and any significant transactions or courses of dealing with parties related to the Company;
- reviewing with management and our independent registered public accounting firm significant issues that arise regarding accounting principles and financial statement presentation;

- discussing with management and our independent registered public accounting firm any correspondence from or with regulators or governmental agencies, any employee complaints or any published reports that raise material issues regarding the Company's financial statements, financial reporting process or accounting policies;
- overseeing the preparation of the audit committee report to be included in the Company's annual reports or proxy statements;
- reviewing the Company's investment policy for its cash reserves and fraud monitoring practices and procedures;
- investigating any matter brought to the committee's attention that is within the scope of the committee's charter;
- preparing a report for inclusion in the Company's annual reports or proxy statements that describes the committee's composition and responsibilities and how those responsibilities were discharged;
- reviewing with management, our independent registered public accounting firm and the Company's counsel any legal or regulatory matters that may have a material impact on the financial statements, related compliance policies;
- establishing policies governing, or otherwise determines the appropriateness of, the hiring by the Company of any current or former employee of the independent registered public accounting firm; and
- reviewing and approving in advance any proposed related party transactions consistent with the Company related party transactions policy and reports to the board of directors.

The audit committee has the authority to retain special legal, accounting or other consultants to advise the committee as it deems necessary, at the Company's expense, to carry out its duties and to determine the compensation of any such advisors.

Code of Business Conduct and Ethics

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

Section 16(A) Beneficial Ownership Reporting Compliance

Section 16(a) of the Exchange Act requires our directors and executive officers, and persons who beneficially own more than ten percent of a registered class of our equity securities, to file with the SEC initial reports of ownership and reports of changes in ownership of our common stock and other equity securities. Officers, directors and greater than ten percent beneficial owners are required by SEC regulations to furnish us with copies of all Section 16(a) forms they file.

To our knowledge, based solely on our review of Forms 3, 4 and 5, and any amendments thereto, furnished to us or written representations that no Form 5 was required, we believe that during the fiscal year ended December 31, 2013, all filing requirements applicable to our executive officers and directors under the Exchange Act were met in a timely manner, except that (i) Douglas Fambrough filed a late Form 4 on February 20, 2014 reporting the purchase by him of shares of our common stock in our initial public offering, which closed on February 4, 2014 (our IPO) and the exercise vested options to purchase shares of our common stock which

occurred on November 11, 2013, (ii) each of David M. Madden and James B. Weissman filed a late Form 4 on February 20, 2014 reporting the purchase by each of them of shares of our common stock in the IPO, (iii) the Form 3 and Form 4 filed by Dennis H. Langer, M.D., J.D. with the SEC on January 29, 2014 and February 4, 2014, respectively, inadvertently reported 5,000 fewer shares of Series A preferred stock previously held by Langer Family Holdings, LLLP and converted into shares of common stock on a one-for-one basis immediately prior to the IPO, which has been corrected in a Form 4/A filed with the SEC on February 20, 2014, and further corrected in a Form 4/A filed with the SEC on April 21, 2014, (iv) RA Capital Management, LLC, Peter Kolchinsky, Ph.D., and RA Capital Healthcare Fund L.P. filed a late Form 4 on April 21, 2014 reporting the grant of stock options by the Company on April 16, 2014, and filed an amendment on Form 4/A on May 8, 2014 to reflect that such stock options are for the benefit of Dr. Kolchinsky and not the two reporting entities, and Dr. Kolchinsky filed a late form 4 on June 23, 2014 reporting the grant of stock options by the Company on June 18, 2014, (v) Brookside Capital Management LLC, Brookside Capital Investors L.P., Brookside Capital Partners Fund L.P., Brookside Capital Investors II, L.P. and Brookside Capital Trading Fund, L.P. filed a late Form 4 on April reported sales of common stock March 2014, (vi) the Form 4 filed by Brian Halak with the SEC on April 18, 2014 inadvertently reported an incorrect vesting schedule and expiration date of a grant of stock options by the Company, which has been corrected in a Form 4/A filed with the SEC on April 30, 2014, (vii) each of Vincent Miles and Stephen Hoffman filed a late Form 4 on June 23, 2014 and June 24, 2014, respectively, to report the grant of stock options by the Company on June 18, 2014, and (viii) Bruce Peacock filed a late Form 3 on December 11, 2014 following his appointment to our Board of Directors on September 9, 2014.

Item 11. *Executive Compensation*

Overview

Our executive compensation program is based on a pay-for-performance philosophy. We designed our executive compensation program to achieve the following primary objectives:

- provide compensation and benefit levels that will attract, retain, motivate and reward a highly talented executive team;
- create an environment that fosters high performance and strong sense of urgency to bring our novel therapeutic approach to patients;
- establish a direct link between the Company, individual and team performance and results and our executives' compensation; and
- align the interests and objectives of our executives with those of our stockholders by linking executive equity awards to long-term stockholder value creation.

Compensation for our named executive officers is comprised primarily of the following three main components.

- *Base Salary* . Base salaries are determined on a case-by-case basis for each executive, including consideration of each officer's experience, expertise and performance, as well as market compensation levels for similar positions.
- *Annual Cash Incentive Bonuses* . Annual cash incentive bonuses are contingent upon our achievement of certain operational and financial objectives, which for 2014 primarily related to pre-clinical and clinical development and technology platform goals. Each executive's target bonus amount is expressed as a percentage of the executive's base salary and intended to be commensurate with the executive's position and responsibilities. Target bonuses for our named executive officers ranged from 35 to 50 percent of base salary for the year ended December 31, 2014.
- *Long-term Equity Incentives* . We believe equity awards in the form of options to purchase shares of our common stock provide an incentive for our executives to focus on driving growth in our stock price

and long-term value creation and help us to attract and retain key talent. In addition, the granting of options helps ensure that the interests of our executive officers are aligned with those of our stockholders as the options only have value if the value of the Company's stock increases after the date the option is granted. In 2014, we granted options to our named executive officers that would vest based on the executive's continued service to the Company and provide an additional retention incentive.

Our named executive officers are entitled to certain benefits if the executive's employment terminates in certain circumstances or if a change of control occurs. We also may provide our named executive officers with relocation, housing or other benefits in certain circumstances. However, we do not provide any of our named executive officers with a tax gross-up payment on any severance or change-of-control benefits although we may provide tax reimbursement payments on relocation and other benefits.

Our compensation committee reviews our named executive officers' overall compensation packages on an annual basis or more frequently as it deems appropriate. From time to time, we may retain independent compensation consultants as we consider appropriate to help identify appropriate peer group companies and to obtain and evaluate current executive compensation data. We did not retain compensation consultants in designing our executive compensation programs for 2012 and 2013. The compensation committee retained an independent compensation consultant in designing our executive compensation programs for 2014.

Summary Compensation Table

The following table provides a summary of compensation paid to our principal executive officer and each of our other executive officers for the year ended December 31, 2014 (collectively, the named executive officers).

Name and principal position	Fiscal year	Base salary ($)	Bonus ($)	Stock awards ($)	Option awards ($) [1]	Non-equity incentive plan compensation ($) [2]	All other compensation ($) [3]	Total ($)
Douglas M. Fambrough, III, Ph.D.	2014	430,000	—	—	4,654,689	193,264	10,490	5,288,443
President and Chief Executive Officer	2013	375,000	—	—	1,151,485	164,063	8,875	1,699,423
Bob D. Brown, Ph.D.	2014	335,000	—	—	1,628,007	110,274	85,350	2,158,631
Chief Scientific Officer, Senior Vice President	2013	315,000	—	—	445,778	118,125	78,654	957,557
Pankaj Bhargava, M.D. [4]	2014	269,123	—	—	2,611,992	80,124	7,435	2,968,674
Chief Medical Officer								

(1) Pursuant to applicable SEC rules, the amounts reported in the "Option Awards" column of the table above reflect the fair value on the grant date of the option awards granted to our named executive officers during 2014 and 2013, and do not reflect the actual amounts earned. These amounts also include an incremental charge for the re-pricing of certain stock options held by Dr. Fambrough, and Dr. Brown during 2013. These values have been determined under the principles used to calculate the value of equity awards for purposes of our financial statements. For a discussion of the assumptions and methodologies used to calculate the amounts referred to above, please see the discussion of option awards contained in Note 11, Common Stock and Stock Option Plan, to our consolidated financial statements for the fiscal year ended December 31, 2014 included in this Annual Report on Form 10-K. The amounts reported in this column for each executive for 2013 include certain grants of stock options that are subject to performance-based vesting requirements as described in the footnotes to the "Outstanding Equity Awards at December 31, 2014" table below. These amounts are reported based on the probable outcome (as of the grant date) of the performance-based conditions applicable to the awards, as determined under generally accepted accounting principles. In each case, the amount was determined assuming that the maximum level of performance applicable to the award would be achieved.

(2) These amounts include payments under our annual incentive bonus plan, which is based on our performance against certain operational and financial goals established by our compensation committee. Based on what the compensation committee determined was remarkable progress with respect to our technology, product candidates and financial position, our named executive officers were awarded bonuses of 125 percent of their target bonus levels for 2013 and 86% to 94% of target bonus levels for 2014 (with Dr. Bhargava's bonus prorated to reflect his period of service with the Company during 2014).
(3) The amounts reported in this column consist of matching contributions we made to each executive's account under our 401(k) plan, as well as, in the case of Dr. Brown payment by us of certain temporary housing and relocation expenses and reimbursement for taxes incurred in connection with such payments.
(4) Dr. Bhargava commenced employment with us in March 2014.

Employment Agreements

Douglas M. Fambrough, III, Ph.D.

In May 2010, we entered into an employment agreement with Dr. Fambrough to serve as our president and chief executive officer. Dr. Fambrough's employment with us is "at-will," and the agreement does not include a specified term. The board of directors will determine his actual bonus amount based on its assessment of the Company and individual performance during the year. The agreement also provides for Dr. Fambrough to participate in our benefit programs made available to our senior executives generally.

Under Dr. Fambrough's agreement, if his employment is terminated by us without cause or by him for good reason (as such terms are defined in the agreement), he will be entitled to receive cash severance equal to twelve months of his base salary, reimbursement of his COBRA premiums for up to twelve months and a prorated payment of his target bonus for the year in which his termination occurs. If such a termination of Dr. Fambrough's employment occurs within one year after a change in control of the Company (as defined in the agreement), he would also be entitled to full acceleration of his stock options granted pursuant to the agreement. Dr. Fambrough's right to receive these severance benefits is subject to his providing a release of claims in favor of us.

Pankaj Bhargava, M.D.

In March 2014, we entered into an employment agreement with Dr. Bhargava to serve as our chief medical officer. Dr. Bhargava's employment with us is "at-will," and the agreement does not include a specified term. The board of directors of the Company will determine his actual bonus amount based on an assessment of the performance of the Company and Dr. Bhargava during the year. The agreement also provides for Dr. Bhargava to participate in the Company's benefit programs made available to its senior executives generally.

Under the employment agreement, if Dr. Bhargava's employment is terminated by the Company without cause or by him for good reason (as such terms are defined in the agreement), he will be entitled to receive cash severance equal to six months of his base salary and reimbursement of his COBRA premiums for up to six months. If such a termination occurs within one year after a change in control of the Company, Dr. Bhargava will be entitled to receive cash severance equal to twelve months of his base salary and reimbursement of his COBRA premiums for up to twelve months. Dr. Bhargava's right to receive these severance benefits is subject to his providing a release of claims in favor of the Company.

Bob D. Brown, Ph.D.

In May 2008, we entered into an employment agreement with Dr. Brown to serve as our senior vice president of research. Dr. Brown's employment with us is "at-will," and the agreement does not include a specified term. The board of directors will determine his actual bonus amount based on its assessment of the Company and individual performance during the year. The agreement also provides for Dr. Brown to participate in our benefit programs made available to our senior executives generally.

Under Dr. Brown's agreement, if his employment is terminated by us without cause or by him for good reason (as such terms are defined in the agreement), he will be entitled to receive cash severance equal to six months of his base salary and reimbursement of his COBRA premiums for up to six months. If such a termination of Dr. Brown's employment occurs within one year after a change in control of the Company (as defined in the agreement), his cash severance would be equal to twelve months of his base salary and would be paid to him in a lump sum, and he would be eligible for reimbursement of his COBRA premiums for up to twelve months. Dr. Brown's right to receive these severance benefits is subject to his providing a release of claims in favor of us.

Defined Contribution Plan

As part of our overall compensation program, we provide all full-time employees, including our named executive officers, with the opportunity to participate in a defined contribution 401(k) plan. Our 401(k) plan is intended to qualify under Section 401 of the Internal Revenue Code so that employee contributions and income earned on such contributions are not taxable to employees until withdrawn. Employees may elect to defer up to 96 percent of their eligible compensation (not to exceed the statutorily prescribed annual limit) in the form of elective deferral contributions to our 401(k) plan. Our 401(k) plan also has a "catch-up contribution" feature for employees aged 50 or older (including those who qualify as "highly compensated" employees) who can defer amounts over the statutory limit that applies to all other employees. We currently provide matching contributions under the plan of up to four percent of an employee's eligible compensation.

Outstanding Equity Awards at December 31, 2014

The following table presents information regarding the outstanding stock options held by each of the named executive officers as of December 31, 2014, including the vesting dates for the portions of these awards that had not vested as of that date. None of the named executive officers held any outstanding restricted stock or other equity awards as of that date.

Name	Grant date	Number of securities underlying unexercised options (#) exercisable	Number of securities underlying unexercised options (#) unexercisable	Equity incentive plan awards: number of securities underlying unexercised unearned Options (#)	Option exercise price ($)	Option expiration date
Douglas M. Fambrough, III, Ph.D.	9/24/2013	105,468	175,782(1)		3.42	9/23/2023
	9/24/2013	168,750	—	112,500(2)	3.42	9/23/2023
	4/16/2014	117,974	353,926(3)	—	16.30	4/15/2024
Pankaj Bhargava, M.D.	4/16/2014	—	264,808(5)	—	16.30	4/15/2024
Bob D. Brown, Ph.D.	10/14/2010	267	—	—	3.42	10/14/2020
	9/24/2013	32,812	82,032(1)	—	3.42	9/23/2023
	9/24/2013	43,750	—	43,750(4)	3.42	9/23/2023
	4/16/2014	41,262	123,788(3)	—	16.30	4/15/2024

(1) These options vest in monthly installments, with the first such installment vesting July 30, 2013 and an additional installment vesting on the last day of each of the 47 months thereafter.
(2) This option vests based on the achievement of certain regulatory approvals, certain operational and business development goals and the listing of our common stock on The NASDAQ Stock Market, with 20 percent of the option vesting on the achievement of each such goal. The listing of our common stock on The NASDAQ Stock Market has been achieved as of February 4, 2014.
(3) These options vest in monthly installments, with the first such installment vesting January 30, 2014 and an additional installment vesting on the last day of each of the 47 months thereafter.
(4) This option vests based on the achievement of certain regulatory approvals.
(5) This option vests as to 25 percent of the option on March 31, 2015, and as to the remaining 75 percent of the option in 36 monthly installments thereafter.

Director Compensation

The following table presents information regarding the compensation paid for 2014 to members of our board of directors who are not also employed by us or any of our subsidiaries (our non-employee directors). The compensation paid to Douglas M. Fambrough, III, Ph.D., who is also our chief executive officer, is set forth above in the section titled "Executive Compensation" and the related explanatory tables. Dr. Fambrough was not entitled to receive additional compensation for his service as a director.

Name	Fees earned or paid in cash ($)	Option awards [1] ($)	All other compensation ($)	Total ($)
Brian K. Halak, Ph.D.	41,147	402,062	—	443,209
Stephen J. Hoffman, M.D., Ph.D.	49,883	402,062	—	451,945
Peter Kolchinsky, Ph.D.	38,404	402,062	—	440,466
Dennis H. Langer, M.D., J.D.	36,758	402,062	—	438,820
David M. Madden	64,373	503,808	—	568,181
Vincent J. Miles, Ph.D. [2]	16,201	402,062	—	418,263
Bruce Peacock [3]	12,954	156,812	—	169,766

(1) Pursuant to applicable SEC rules, the amounts reported in the "Option Awards" column of the table above reflect the fair value on the grant date of the option awards granted to our non-employee directors during 2014. These values have been determined under the principles used to calculate the value of equity awards for purposes of our financial statements. For a discussion of the assumptions and methodologies used to calculate the amounts referred to above, please see the discussion of option awards contained in Note 11, Common Stock and Stock Option Plan, to our consolidated financial statements for the fiscal year ended December 31, 2014 included in this Annual Report on Form 10-K.

(2) Dr. Miles resigned as a member of our board of directors in September 2014.

(3) Mr. Peacock joined our board of directors in September 2014.

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

The following table sets forth certain information regarding the ownership of our common stock as of March 11, 2015, by: (i) each nominee for director; (ii) each of our named executive officers; (iii) all of our executive officers and directors as a group; and (iv) all those known by us to be beneficial owners of more than five percent of our common stock.

	Beneficial Ownership**	
Beneficial Owner	Number of Shares	Percent of Total
Fidelity Management & Research Company (1)	2,665,993	14.96%
RA Capital Management, LLC (2)	2,438,980	13.68%
Wellington Group Holdings LLP (3)	1,819,961	10.21%
Domain Associates, L.L.C. (4)	1,797,317	10.07%
Skyline Ventures Partners V, L.P. (5)	1,719,671	9.64%
Abingworth Management Limited (6)	1,198,027	6.72%
RTW Investments, LLC (7)	1,115,981	6.26%
Douglas Fambrough (8)	493,504	2.70%
Brian K. Halak (9)	1,797,317	10.08%
Stephen J. Hoffman, M.D., Ph.D. (10)	10,409	*
Peter Kolchinsky, Ph.D. (11)	2,438,980	13.68%
Dennis H. Langer, M.D., J.D. (12)	137,058	*
David M. Madden (13)	132,502	*
Bruce Peacock (14)	—	*
Pankaj Bhargava (15)	76,405	*
Bob D. Brown, Ph. D (16)	168,371	*
All executive officers and directors as a group (11 persons)	5,469,865	29.10%

* Denotes ownership percentage less than one percent.

** This table is based upon information supplied by officers, directors and principal stockholders and Forms 3, Forms 4 and Schedules 13D and 13G filed with the SEC. Unless otherwise indicated in the footnotes to this table, we believe that each of the stockholders named in the table has sole voting and dispositive power with respect to the shares indicated as beneficially owned. Applicable percentages are based on 17,820,985 shares outstanding on March 11, 2015, adjusted as required by rules promulgated by the SEC.

(1) Based solely on the Schedule 13G filed with the SEC on February 13, 2015 by FMR LLC, a Delaware limited liability company, Edward C. Johnson, III, Abigail P. Johnson, and Fidelity Growth Company Fund. Fidelity Management & Research Company (Fidelity), 245 Summer Street, Boston, Massachusetts 02210, a wholly-owned subsidiary of FMR LLC and an investment adviser registered under Section 203 of the Investment Advisers Act of 1940, is the beneficial owner of 2,665,993 shares of our common as a result of acting as investment adviser to various investment companies registered under Section 8 of the Investment Company Act of 1940 (collectively, Fidelity Funds). Edward C. Johnson, III, FMR LLC, and Abigail P. Johnson, through his or its control of Fidelity, each has sole power to dispose of the 2,665,993 shares of our common stock owned by the Fidelity Funds. Fidelity SelectCo, LLC (SelectCo), 1225 17th Street, Suite 1100, Denver, Colorado 80202, a wholly-owned subsidiary of FMR LLC, is the beneficial owner of 313,850 shares of our common stock as a result of acting as investment adviser to various investment companies (collectively, SelectCo Funds). Edward C. Johnson, III and FMR LLC, through his or its control of SelectCo, each has sole power to dispose of the 313,850 shares of our common stock owned by the SelectCo Funds. Members of the family of Edward C. Johnson, III, Chairman of FMR LLC, are the predominant owners, directly or through trusts, of Series B voting common shares of FMR LLC, representing 49% of the

voting power of FMR LLC. The Johnson family group and all other Series B shareholders have entered into a shareholders' voting agreement under which all Series B voting common shares will be voted in accordance with the majority vote of Series B voting common shares. Accordingly, through their ownership of voting common shares and the execution of the shareholders' voting agreement, members of the Johnson family may be deemed, under the Investment Company Act of 1940, to form a controlling group with respect to FMR LLC. Neither FMR LLC nor Edward C. Johnson, III, Chairman of FMR LLC, has the sole power to vote or direct the voting of the shares owned directly by the Fidelity Funds, which power resides with the Fidelity Funds' Boards of Trustees. Fidelity carries out the voting of the shares under written guidelines established by the Fidelity Funds' Boards of Trustees. Fidelity Management Trust Company, 245 Summer Street, Boston, Massachusetts 02210, a wholly-owned subsidiary of FMR LLC and a bank as defined in Section 3(a)(6) of the Exchange Act, is the beneficial owner of 103,022 shares of our common stock as a result of its serving as investment manager of the institutional account(s). Edward C. Johnson, III and FMR LLC, through his or its control of Fidelity Management Trust Company, each has sole dispositive power over 103,022 shares and sole power to vote or to direct the voting of 103,022 shares of our common stock owned by these certain institutional accounts as described above. Pyramis Global Advisors Trust Company (PGATC), 900 Salem Street, Smithfield, Rhode Island 02917, an indirect wholly-owned subsidiary of FMR LLC and a bank as defined in Section 3(a)(6) of the Exchange Act, is the beneficial owner of 10,800 shares of our common stock as a result of its serving as investment manager of institutional accounts owning such shares. Edward C. Johnson, III and FMR LLC, through his or its control of PGATC, each has sole dispositive power over 10,800 shares of our common stock and sole power to vote or to direct the voting of 10,800 shares of our common stock owned by these institutional accounts managed by PGATC as described above.

(2) Based solely on the Schedule 13D filed with the SEC on February 5, 2014 and the Form 4 filed with the SEC on April 21, 2014 by RA Capital Healthcare Fund, L.P. (RA Fund), RA Capital Management, LLC (RA Capital) and Peter Kolchinsky, Ph.D. Includes 2,428,571 shares of our common stock and 10,409 shares of our common stock issuable upon exercise of options exercisable within 60 days of March 11, 2015. RA Fund has the shared voting power and shared dispositive power with respect to 2,256,071 shares of our common stock and 8,639 shares of our common stock issuable upon exercise of options exercisable within 60 days of March 11, 2015. RA Capital has the shared voting power and shared dispositive power with respect to 2,428,571 shares of our common stock, including (a) 2,256,071 shares of our common stock held by RA Fund, for which RA Capital serves as the sole general partner, and (b) 172,500 shares of our common stock held in a separately managed account, for which RA Capital serves as investment adviser. RA Capital further has the shared voting power and shared dispositive power with respect to (a) 8,639 shares of our common stock issuable to RA Fund upon exercise of options exercisable within 60 days of March 11 and (b) 1,770 shares of our common stock issuable upon exercise of options exercisable within 60 days of March 11, held in the separately managed account. Dr. Kolchinsky has the shared voting power and shared dispositive power with respect to 2,428,571 shares of our common stock and 10,409 shares of our common stock issuable upon exercise of options exercisable within 60 days of March 11, 2015, reported for RA Capital, for which Dr. Kolchinsky serves as the manager. Each of RA Fund, RA Capital and Dr. Kolchinsky disclaims beneficial ownership for the shares and options, except to the extent of its or his pecuniary interest therein. The address of the principal place of business of RA Fund, RA Capital and Peter Kolchinsky, Ph.D. is 20 Park Plaza, Suite 1200, Boston, MA 02116.

(3) Based solely on the Schedule SC 13G/A filed with the SEC on February 10, 2015 by Wellington Management Group LLP, a Massachusetts limited liability partnership (WMG), Wellington Group Holdings LLP, a Delaware limited liability partnership (WGH), Wellington Investment Advisors Holdings LLP, a Delaware limited liability partnership (WIA), and Wellington Management Company LLP, a Delaware limited liability partnership (WMC). Consists of 1,819,961 shares of our common stock held of record by clients of WMC, an investment advisor, and other investment advisors affiliated with WMC (collectively, the Wellington Investment Advisors). WMC may be deemed to beneficially own 1,655,861 of such shares, share dispositive power over 1,655,861 of such shares, and share voting power over 1,524,651 of such shares. WIA controls directly, or indirectly through Wellington Management Global Holdings, Ltd., WNC and the other Wellington Investment Advisers and may be deemed to beneficially own 1,819,961 of such

shares, share dispositive power over 1,819,961 of such shares, and share voting power over 1,633,751 of such shares.WGH owns WIA and also may be deemed to beneficially own 1,819,961 of such shares, share dispositive power over 1,819,961 of such shares, and share voting power over 1,633,751 of such shares. WMG owns WGH and may be deemed to beneficially own 1,655,861 of such shares, share dispositive power over 1,655,861 of such shares, and share voting power over 1,524,651 of such shares. The address and principal place of business of WMG, WGH, WIA and WMC is c/o Wellington Management Company LLP, 280 Congress Street, Boston, MA 02210.

(4) Consists of (a) 1,752,707 shares of our common stock held by Domain Partners VIII, L.P. (Domain Partners), (b) 21,041 shares of our common stock issuable upon exercise of a common stock warrant held by Domain Partners, (c) 13,004 shares of our common stock held by DP VIII Associates, L.P. (DP Associates), and (d) 156 shares of our common stock issuable upon exercise of a common stock warrant held by DP Associates. James C. Blair, Brian H. Dovey, Jesse I. Treu, Kathleen K. Schoemaker, Brian K. Halak, a member of our board of directors, and Nicole Vitullo, the managing members of One Palmer Square Associates VIII, L.L.C., the general partner of Domain Partners and DP Associates, share the power to vote or dispose of the shares held by Domain Partners and DP Associates and therefore each of the foregoing managing members may be deemed to have voting and dispositive power with respect to such shares. Each of the foregoing managing members disclaims beneficial ownership of such shares except to the extent of his or her pecuniary interest therein, if any. The address of the principal place of business of Domain Partners and DP Associates is One Palmer Square, Suite 515, Princeton, NJ 08542.

(5) Based solely on the Form 4 filed with the SEC on February 24, 2015 and the Schedule 13D filed with the SEC on February 14, 2014 by Skyline Venture Partners V, L.P., a Delaware limited partnership (SVP), Skyline Venture Management V, LLC, a California limited liability company (SVM), John G. Freund, M.D. and Yasunori Kaneko, M.D. SVP holds 1,719,671 shares of our common stock and common stock warrants to purchase 22,452 shares of our common stock. John G. Freund, M.D. and Yasunori Kaneko, M.D. are Managing Directors of SVM, the general partner of SVP, and may be deemed to share voting and dispositive power over the shares held by SVP. Stephen Hoffman, M.D., Ph.D., a member of our board of directors, is a former member of SVM that has transitioned to an independent consultant of SVM, SVP or its affiliates with no voting or dispositive power over the shares and may be deemed to share voting and dispositive power over the shares held by SVP. Each of Drs. Freund and Kaneko disclaims beneficial ownership of such shares, except to the extent of his pecuniary interest therein. The address of the principal place of business of SVP, SVM and Drs. Freund, Kaneko and Hoffman is 525 University Avenue, Suite 520, Palo Alto, CA 94301.

(6) Based solely on the Schedule 13D filed with the SEC on February 14, 2014 by Abingworth LLP, a limited liability partnership organized under the laws of England, and Abingworth Bioventures V, L.P., a limited partnership organized under the laws of England (ABV). As of February 4, 2014, Abingworth LLP, as the investment manager of ABV, may be deemed to beneficially own an aggregate of 1,198,027 shares of our common stock, consisting of (a) 1,182,196 shares of our common stock held by ABV, (b) 532 shares of our common stock issuable upon exercise of a common stock warrant held by ABV and (c) 15,299 shares of our common stock issuable upon exercise of a common warrant stock held by ABV. ABV and Abingworth LLP have the shared voting power and dispositive power with respect to the 1,182,196 shares of our common stock held by ABV and the 15,831 shares of our common stock issuable upon exercise of the warrants held by ABV. The address of the principal place of business of Abingworth LLP and ABV is c/o Abingworth LLP, Princes House, 38 Jermyn Street, London, England SW1Y 6DN.

(7) Based solely on the Schedule 13G filed with the SEC on December 29, 2014 by RTW Investments, a Delaware limited liability company (RTWI), RTW Master Fund, Ltd., a company organized under the laws of the Cayman Islands (RTW Fund), and Roderick Wong. RTWI, RTW and Roderick Wong have shared voting power and share dispositive power with respect to 1,115,981 shares of our common stock. Each may be deemed to beneficially own such shares. The address of the principal place of business of RTWI and Roderick Wong is c/o RTW Investments, LLC, 250 West 55 th Street, 16 th Floor, Suite A, New York, New York 10019. The address and principal place of RTW Fund is c/o Walkers Corporate Services Limited, Walker House, 87 Mary Street, George Town, Grand Cayman KY1-9005, Cayman Islands.

(8) Consists of (a) 19,800 shares of our common stock and (b) 473,704 shares of our common stock issuable upon exercise of stock options exercisable within 60 days of March 11, 2015.
(9) Consists of shares of our common stock held and issuable upon exercise of warrants held by Domain Partners and DP Associates as described in footnote (4) above, and 10,409 shares of common stock issuable upon exercise of stock options within 60 days of March 11, 2015. Dr. Halak is a managing member of One Palmer Square Associates VII, L.L.C., the general partner of Domain Partners and DP Associates, and may be deemed to share voting and dispositive power over the shares held by Domain Partners and DP Associates. Dr. Halak disclaims beneficial ownership of such shares held by Domain Partners and DP Associates, except to the extent of his pecuniary interest therein.
(10) Consists of 10,409 shares of common stock issuable upon exercise of stock options within 60 days of March 11, 2015.
(11) Consists of 2,428,571 shares of our common stock and 10,409 shares of our common issuable upon exercise of options, each beneficially owned by RA Capital as described in footnote (2) above. Dr. Kolchinsky serves as the manager of RA Capital, the sole general partner of RA Fund, and may be deemed to beneficially own the shares beneficially owned by RA Capital. Dr. Kolchinsky disclaims beneficial ownership for the shares beneficially owned by RA Capital, except to the extent of his pecuniary interest therein.
(12) Consists of (a) 95,194 shares of common stock held by Langer Family Holdings, LLLP, (b) 360 shares of common stock issuable upon exercise of stock options exercisable within 60 days of March 11, 2015 held by Langer Family Holdings, LLLP, (c) 8,873 shares of common stock held by Dennis H. Langer, M.D., J.D., and (d) 32,631 shares of common stock issuable upon stock options exercisable within 60 days of March 11, 2015 held by Dennis H. Langer, M.D., J.D. Dennis H. Langer, M.D., J.D. is a manager of Langer Family Investments, LLC, which is the general partner of Langer Family Holdings, LLLP. Dr. Langer disclaims beneficial ownership of the shares and options owned by Langer Family Holdings, LLLP.
(13) Consists of (a) 63,518 shares of common stock outstanding as of March 11, 2015 held by David M. Madden, (b) 6,166 shares of common stock held by David M. Madden that will become vested within 60 days of March 11, 2015, (c) 42,827 shares of common stock held by David M. Madden that remain unvested and subject to the repurchase rights of the Company 60 days after March 11, 2015, 12,491 shares of common stock issuable upon exercise of stock options within 60 days of March 11, 2015 and (d) 7,500 shares of common stock owned by Madden 2002 Trust. David M. Madden disclaims beneficial ownership of the shares owned by Madden 2002 Trust.
(14) Mr. Peacock joined our board of directors in September 2015 and was granted options, none of which are exercisable within 60 days of March 11, 2015.
(15) Consists of 76,405 shares of common stock issuable upon exercise of options exercisable within 60 days of March 11, 2015.
(16) Consists of a) 19,339 shares of common stock and 149,032 shares of common stock issuable upon exercise of options exercisable within 60 days of March 11, 2015.

Securities Authorized for Issuance Under Equity Compensation Plans

The following table provides information about the securities authorized for issuance under our equity compensation plans as of December 31, 2014, which consisted of our 2007 Employee, Director and Consultant Stock Plan, as amended, 2010 Employee, Director and Consultant Equity Incentive Plan, as amended, 2014 Performance Incentive Plan and our 2014 Employee Stock Purchase Plan:

Plan category	Number of shares to be issued upon exercise of outstanding options, warrants and rights (a)	Weighted-average exercise price of outstanding options, warrants and rights (b)	Number of shares remaining available for future issuance under equity compensation plans (excluding securities reflected in column (a)) (c)	Total of shares reflected in columns (a) and (c) (d)
Equity compensation plans approved by stockholders	3,644,728	$ 11.16	61,694	3,706,422
Equity compensation plans not approved by stockholders	—	—	—	—
Total	3,644,728	$ 11.16	61,694	3,706,422

Item 13. Certain Relationships and Related Transactions and Director Independence

We describe below transactions and series of similar transactions since January 1, 2014, to which we were a party or will be a party, in which (i) the amounts involved exceeded or will exceed $120,000 and (ii) any of our directors, executive officers, holders of more than five percent of our capital stock or any member of their immediate family had or will have a direct or indirect material interest, other than compensation arrangements with directors and executive officers, which are described where required in the sections titled “Director Compensation” and “Executive Compensation,” respectively, in this proxy statement.

Participation in the initial public offering

Certain holders of more than five percent of our capital stock and their affiliated entities purchased shares of our common stock in the initial public offering from the underwriters as summarized in the following table. The underwriters received the same underwriting discount from the sale of the shares of our common stock to these holders as they did from other shares of our common stock sold to the public in the initial public offering.

Participants	Number of Shares of Common Stock Purchased	Aggregate Purchase Price ($)
RA Capital Management, LLC (1)	1,000,000	15,000,000
Affiliates of Deerfield Management, L.P. (2)	1,000,000	15,000,000
Brookside Capital Management, LLC	1,000,000	15,000,000
Skyline Venture Partners V, L.P. (3)	200,000	3,000,000
Abingworth Bioventures V, L.P. (4)	100,000	1,500,000

(1) Consists of (a) 827,500 shares of our common stock purchased by RA Fund, for which RA Capital Management, LLC serves as the sole general partner, and (ii) 172,500 shares of our common stock held in a separately managed account, for which RA Capital Management, LLC serves as investment adviser. Peter Kolchinsky, Ph.D., a member of our board of directors, serves as the manager of RA Capital Management, LLC.

(2) Consists of (a) 138,000 shares of our common stock purchased by Deerfield Special Situations Fund, L.P., (b) 112,000 shares of our common stock purchased by Deerfield Special Situations International Master Fund, L.P., (c) 349,500 shares of our common stock purchased by Deerfield Private Design Fund II, L.P. and (d) 400,500 shares of our common stock purchased by Deerfield Private Design International II, L.P.

(3) Skyline Venture Management V, LLC is the general partner of Skyline Venture Partners V, L.P. Stephen Hoffman, M.D., Ph.D., a member of our board of directors, was, at the time of the transaction, a member of Skyline Venture Management V, LLC.
(4) Abingworth LLP is the investment manager of Abingworth Bioventures V, L.P. Vincent J. Miles, Ph.D., who was at the time a member of our board of directors, is a partner of Abingworth Management Inc., a wholly-owned subsidiary of Abingworth LLP.

Director and Executive Officer Agreements and Compensation

We have entered employment-related agreements with our executive officers, and agreements with David M. Madden, Dennis H. Langer, M.D., J.D. and Bruce Peacock, three of our non-employee directors. See sections titled "Director Compensation" and "Executive Compensation," respectively, in this Annual Report on Form 10-K for more information regarding agreements with our named executive officers and our non-employee directors, and compensation of our directors and named executive officers.

Indemnification of Directors and Officers

We have entered into indemnification agreements with each of our directors and executive officers. These agreements, among other things, require us or will require us to indemnify each director (and in certain cases their affiliated venture capital funds) and executive officer to the fullest extent permitted by Delaware law, including indemnification of expenses such as attorneys' fees, judgments, fines and settlement amounts incurred by the director or executive officer in any action or proceeding, including any action or proceeding by or in right of us, arising out of the person's services as a director or executive officer.

Policies and Procedures for Related Party Transactions

We have adopted a written related party transactions policy that sets forth the policies and procedures for the review and approval or ratification of related party transactions. The policy covers, with certain exceptions set forth in Item 404 of Regulation S-K promulgated under the Exchange Act, any transaction, arrangement or relationship, or any series of similar transactions, arrangements or relationships, in which we were or are to be a participant, where the amount involved exceeds $120,000 and a related party had, has or will have a direct or indirect material interest, including indebtedness, guarantees of indebtedness and employment by us of a related party.

A related party transaction reviewed under the policy will be considered approved or ratified if it is authorized by the audit committee of our board of directors or the chairperson of the audit committee in accordance with the standards set forth in the policy after full disclosure of the related party's interests in the transaction. As appropriate for the circumstances, the audit committee or the chairperson of the audit committee, as applicable, shall review and consider:

- the related party's interest in the transaction;
- the approximate dollar value of the amount involved in the related party transaction;
- the approximate dollar value of the amount of the related party's interest in the transaction without regard to the amount of any profit or loss;
- whether the transaction was undertaken in our ordinary course of business;
- whether the transaction with the related party is proposed to be, or was, entered into on terms no less favorable to us than terms that could have been reached with an unrelated third party;
- the purpose and the potential benefits of the related party transaction to us;
- required public disclosure, if any; and
- any other information regarding the related party transaction in the context of the proposed transaction that would be material to investors in light of the circumstances of the particular transaction.

Independence of the Board of Directors

Under the rules of The NASDAQ Stock Market LLC (NASDAQ), independent directors must comprise a majority of a listed company's board of directors within twelve months from the date of listing. In addition, NASDAQ rules require that, subject to specified exceptions, each member of a listed company's audit, compensation and nominating and corporate governance committees be independent. Audit committee members must also satisfy additional independence criteria set forth in Rule 10A-3 under the Exchange Act, and in NASDAQ rule 5605(c)(2)(A). Under NASDAQ rules, a director will only qualify as an "independent director" if, in the opinion of that company's board of directors, that person does not have a relationship that would interfere with the exercise of independent judgment in carrying out the responsibilities of a director.

To be considered independent for purposes of Rule 10A-3, a member of an audit committee of a listed company may not, other than in his or her capacity as a member of the audit committee, the board of directors or any other board committee, accept, directly or indirectly, any consulting, advisory or other compensatory fee from the listed company or any of its subsidiaries or be an affiliated person of the listed company or any of its subsidiaries.

Our board of director has undertaken a review of its composition, the composition of its committees and the independence of each director. Based upon information requested from and provided by each director concerning his background, employment and affiliations, including family relationships, our board of directors has determined that none of Brian K. Halak, Ph.D., Stephen J. Hoffman, M.D., Ph.D., Peter Kolchinsky, Ph.D., Dennis H. Langer, M.D., J.D., David M. Madden or Bruce Peacock, representing six of our seven directors, has a relationship that would interfere with the exercise of independent judgment in carrying out the responsibilities of a director and that each of these directors is "independent" as that term is defined under NASDAQ rules. Our board of directors has also determined that Mr. Peacock, Dr. Hoffman and Mr. Madden, members of our audit committee, Dr. Halak, Dr. Hoffman and Dr. Langer, members of our compensation committee, and Dr. Kolchinsky and Mr. Madden, members of our nominating and corporate governance committee, satisfy the independence standards for those committees established by applicable SEC and NASDAQ rules. In making these determinations, our board of directors considered the relationships that each non-employee director has with us and all other facts and circumstances our board of directors deemed relevant in determining their independence, including the beneficial ownership of our capital stock by each non-employee director.

Item 14. ***Principal Accountant Fees and Services***

The following table represents aggregate fees billed to us for fiscal years ended December 31, 2014 and 2013, respectively, by Deloitte & Touche LLP, our independent registered public accounting firm.

	Fiscal Year Ended December 31,	
	2014	2013
Audit Fees(1)	$ 310,000	$ 974,850
Audit-Related Fees(2)	—	—
Tax Fees(3)	18,875	8,324
All Other Fees(4)	—	—
	$ 328,875	$ 983,400

(1) This category consists of fees for professional services rendered in connection with the audit of our annual financial statements, review of our quarterly financial statements, assistance with registration statements filed with the SEC and services that are normally provided by the independent registered public accounting firm in connection with statutory and regulatory filings or engagements. Fees of 2013 also include fees associated with the initial public offering of our common stock closed on February 4, 2014, which included review of our quarterly financial statements included in our registration statement on Form S-1 filed with the SEC and delivery of comfort letters, consents and review of documents filed with the SEC.

(2) This category consists of fees for professional services rendered that are reasonably related to the performance of the audit or review of our financial statements.
(3) This category consists of fees for tax consultation services provided.
(4) This category consists of fees for all other services that are not reported above.

We did not incur any Audit-Related Fees or Other Fees in 2014 or 2013. All fees described above were approved by our board of directors or the audit committee of the board of directors.

Pre-Approval Policies and Procedures

The audit committee has adopted policies and procedures for the pre-approval of audit and non-audit services provided by our independent registered public accounting firm, Deloitte & Touche LLP. The policy generally requires pre-approval for specified services in the defined categories of audit services, audit-related services and tax services up to specified amounts. Pre-approval may also be given as part of the audit committee's approval of the scope of the engagement of the independent registered public accounting firm or on an individual explicit case-by-case basis before the independent registered public accounting firm is engaged to provide each service. The pre-approval of services may be delegated to one or more of the audit committee's members, but the decision must be reported to the full audit committee at its next scheduled meeting.

The audit committee will review both audit and non-audit services performed by Deloitte & Touche LLP and the fees charged for such services on at least an annual basis. Among other things, the audit committee will review non-audit services proposed to be provided by Deloitte & Touche LLP and pre-approve such services only if they are compatible with maintaining Deloitte & Touche LLP's status as an independent registered public accounting firm. All services provided by Deloitte & Touche LLP in 2014 and 2013 were pre-approved by our board of directors or the audit committee after review of each of the services proposed for approval.

PART IV

Item 15. ***Exhibits and Financial Statement Schedules***

(1) *Consolidated Financial Statements:*

The following consolidated financial statements are filed as part of this Annual Report on Form 10-K under Item 8 "Financial Statements and Supplementary Data."

(2) *Financial Statement Schedules:* None

(3) *Exhibits.*

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

Exhibit Number	Description of Documents
3.1(1)	Amended and Restated Certificate of Incorporation of the Company.
3.2(1)	Amended and Restated Bylaws of the Company.
4.1(2)	Specimen Common Stock Certificate.
4.2(3)	Form of Warrant to Purchase Common Stock.
4.3(3)	Form of Warrant to Purchase Preferred Stock.
4.4(3)	Amended and Restated Registration Rights Agreement dated as of July 30, 2013, by and among the Company and the investors named therein.
10.1(3)	2007 Employee, Director and Consultant Stock Plan, as amended (the 2007 Plan).++
10.2(3)	Form of Restricted Stock Agreement under the 2007 Plan.++
10.3(3)	Form of Incentive Stock Option Agreement under the 2007 Plan.++
10.4(3)	Form of Non-Qualified Stock Option Agreement under the 2007 Plan.++
10.5(3)	2010 Employee, Director and Consultant Equity Incentive Plan, as amended (the 2010 Plan).++
10.6(3)	Form of Stock Option Grant Notice and Stock Option Agreement under the 2010 Plan.++
10.7(3)	Form of Restricted Stock Agreement under the 2010 Plan.++
10.8(2)	2014 Performance Incentive Plan.++
10.9(2)	2014 Employee Stock Purchase Plan.++
10.10(2)	Form of Indemnification Agreement by and between the Company and each of its directors.++
10.11(3)	Employment Agreement dated as of May 6, 2010, by and between the Company and Douglas M. Fambrough, III, Ph.D.++

10.12(3)	Employment Agreement dated as of May 1, 2008, by and between the Company and Bob D. Brown, Ph.D.++
10.13(3)	Employment Agreement dated as of December 5, 2011, by and between the Company and James B. Weissman.++
10.14(3)	Letter agreement dated as of June 2, 2009, by and between the Company and David M. Madden.++
10.15(3)	Letter agreement dated as of February 28, 2011, by and between the Company and Dennis H. Langer M.D., J.D.++
10.16(3)	Transition Agreement dated as of September 8, 2009, as amended by Amendment to Transition Agreement dated as of February 1, 2010 and Second Amendment to the Transition Agreement dated as of July 29, 2013, by and between the Company and James C. Jenson, Ph.D.++
10.17(4)	Employment agreement dated as of November 24, 2013, by and between the Company and James E. Dentzer.++
10.18(2)	Loan and Security Agreement dated as of March 25, 2009, as amended by Amendment No. 1 to Loan and Security Agreement dated as of May 28, 2010, and Second Amendment to Loan and Security Agreement dated as of June 28, 2011, by and between the Company and Hercules Technology II, L.P.
10.19(5)	Research Collaboration and License Agreement dated as of December 21, 2009, as amended by Amendment No. 1 to Research Collaboration and License Agreement dated as of December 2, 2010, by and between the Company and Kyowa Hakko Kirin Co., Ltd.†
10.20(2)	Exclusive License Agreement dated as of September 28, 2007, by and between the Company and City of Hope.†
10.21(2)	Commercial License Agreement dated as of September 2, 2013, by and between the Company and Plant Bioscience Limited.†
10.22(2)	Lease Agreement dated as of March 14, 2008, as amended by First Amendment to Lease dated as of September 12, 2008 and Second Amendment to Lease dated as of July 3, 2013, by and between the Company and ARE-480 Arsenal Street, LLC.†
10.23(2)	Letter agreement dated as of January 24, 2014, by and between the Company and James E. Dentzer.++
10.24(6)	Lease agreement dated as of July 11, 2014, by and between the Company and King 87 CPD LLC
10.25(7)	Employment Agreement dated as of March 7, 2014, by and between the Company and Pankaj Bhargava, M.D.++
10.26(7)	Letter Agreement dated as of September 12, 2014, by and between the Company and Bruce Peacock.++
10.27(7)	Employment Agreement dated as of November 22, 2014, by and between the Company and Theodore Ashburn, M.D., Ph.D.++
10.28(7)	License Agreement dated as of November 16, 2014 by and between the Company, on one hand, and Protiva Biotherapeutics Inc. and Tekmira Pharmaceuticals Corporation, on the other hand. †
10.29(7)	Development and Supply Agreement dated as of November 16, 2014 by and between Protiva Biotherapeutics Inc. and Tekmira Pharmaceuticals Corporation, on one hand, and the Company, on the other hand.†
21.1(7)	Subsidiaries of the Company.
23.1(7)	Consent of Independent Registered Accounting Firm.

24	Power of Attorney (reference is made to the signature page).
31.1(7)	Certification of the Company's principal executive officer required by Rule 13a-14(a) or Rule 15d-14(a).
31.2(7)	Certification of the Company's principal financial officer required by Rule 13a-14(a) or Rule 15d-14(a).
32.1*	Section 1350 Certifications.
101.INS(7)	XBRL Report Instance Document
101.SCH(7)	XBRL Taxonomy Extension Schema Document
101.CAL(7)	XBRL Taxonomy Calculation Linkbase Document
101.LAB(7)	XBRL Taxonomy Label Linkbase Document
101.PRE(7)	XBRL Taxonomy Presentation Linkbase Document
101.DEF(7)	XBRL Taxonomy Extension Definition Linkbase Document

† Confidential treatment with respect to specific portions of this Exhibit has been requested, and such portions are omitted and have been filed separately with the Securities and Exchange Commission.

++ Management contract or compensatory plan or arrangement.

* Exhibit 32.1 is being furnished and shall not be deemed to be "filed" for purposes of Section 18 of the Securities Exchange Act of 1934, as amended (Exchange Act), or otherwise subject to the liability of that section, nor shall such exhibit be deemed to be incorporated by reference in any registration statement or other document filed under the Securities Act of 1933, as amended, or the Exchange Act, except as otherwise stated in such filing.

(1) Incorporated by reference to the indicated exhibit in the Company's Current Report on Form 8-K filed on February 5, 2014.

(2) Incorporated by reference to the indicated exhibit in the Company's Amendment No. 3 to Registration Statement on Form S-1 (No. 333-193150) filed on January 28, 2014.

(3) Incorporated by reference to the indicated exhibit in the Company's Registration Statement on Form S-1 (No. 333-193150) filed on December 31, 2013.

(4) Incorporated by reference to the indicated exhibit in the Company's Amendment No. 1 to Registration Statement on Form S-1 (No. 333-193150) filed on January 17, 2014.

(5) Incorporated by reference to the indicated exhibit in the Company's Amendment No. 5 to Registration Statement on Form S-1 (No. 333-193150) filed on January 29, 2014.

(6) Incorporated by reference to the indicated exhibit in the Company's Registrant's Quarterly Report on Form 10-Q filed on November 6, 2014 (File No. 001-36281) for the quarterly period ended September 30, 2014.

(7) Filed herewith.

Table of Contents

SIGNATURES

Pursuant to the Securities Exchange Act of 1934, the Registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized, in Cambridge, Commonwealth of Massachusetts on March 12, 2015.

By: /s/ Douglas M. Fambrough, III

Douglas M. Fambrough, III, Ph.D.
Chief Executive Officer and Director (Principal Executive Officer)

By: /s/ James E. Dentzer

James E. Dentzer
Chief Financial Officer (Principal Financial Officer and Principal Accounting Officer)

Table of Contents

POWER OF ATTORNEY

KNOW ALL PERSON BY THESE PRESENTS, that each person whose signature appears below constitutes and appoints Douglas M. Fambrough, III, Ph.D. and James E. Dentzer and each of them, as his true and lawful attorneys-in-fact and agents, with full power of substitution and resubstitution, for him and in his name, place and stead, in any and all capacities, to sign any and all amendments to this Annual Report on Form 10-K and to file the same, with all exhibits thereto and other documents in connection therewith, with the Securities and Exchange Commission, granting unto said attorneys-in-fact and agents and each of them, full power and authority to do and perform each and every act and thing requisite and necessary to be done in connection therewith, as fully to all intents and purposes as he might or could do in person, hereby ratify and confirming all that said attorneys-in-fact and agents, or any of them, or their or his substitute or substitutes, may lawfully do or cause to be done by virtue hereof.

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

Signature	Title	Date
/s/ Douglas M. Fambrough, III **Douglas M. Fambrough, III, Ph.D.**	Chief Executive Officer and Director (Principal Executive Officer)	March 12, 2015
/s/ James E. Dentzer **James E. Dentzer**	Chief Financial Officer (Principal Financial Officer and Principal Accounting Officer)	March 12, 2015
/s/ David M. Madden **David M. Madden**	Chairman	March 12, 2015
/s/ Brian K. Halak **Brian K. Halak, Ph.D.**	Director	March 12, 2015
/s/ Stephen J. Hoffman **Stephen J. Hoffman, M.D., Ph.D.**	Director	March 12, 2015
/s/ Peter Kolchinsky **Peter Kolchinsky, Ph.D.**	Director	March 12, 2015
/s/ Dennis H. Langer **Dennis H. Langer, M.D., J.D.**	Director	March 12, 2015
/s/ Bruce Peacock **Bruce Peacock**	Director	March 12, 2015

Table of Contents

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3.2(1)	Amended and Restated Bylaws of the Company.
4.1(2)	Specimen Common Stock Certificate.
4.2(3)	Form of Warrant to Purchase Common Stock.
4.3(3)	Form of Warrant to Purchase Preferred Stock.
4.4(3)	Amended and Restated Registration Rights Agreement dated as of July 30, 2013, by and among the Company and the investors named therein.
10.1(3)	2007 Employee, Director and Consultant Stock Plan, as amended (the 2007 Plan).++
10.2(3)	Form of Restricted Stock Agreement under the 2007 Plan.++
10.3(3)	Form of Incentive Stock Option Agreement under the 2007 Plan.++
10.4(3)	Form of Non-Qualified Stock Option Agreement under the 2007 Plan.++
10.5(3)	2010 Employee, Director and Consultant Equity Incentive Plan, as amended (the 2010 Plan).++
10.6(3)	Form of Stock Option Grant Notice and Stock Option Agreement under the 2010 Plan.++
10.7(3)	Form of Restricted Stock Agreement under the 2010 Plan.++
10.8(2)	2014 Performance Incentive Plan.++
10.9(2)	2014 Employee Stock Purchase Plan.++
10.10(2)	Form of Indemnification Agreement by and between the Company and each of its directors.++
10.11(3)	Employment Agreement dated as of May 6, 2010, by and between the Company and Douglas M. Fambrough, III, Ph.D.++
10.12(3)	Employment Agreement dated as of May 1, 2008, by and between the Company and Bob D. Brown, Ph.D.++
10.13(3)	Employment Agreement dated as of December 5, 2011, by and between the Company and James B. Weissman.++
10.14(3)	Letter agreement dated as of June 2, 2009, by and between the Company and David M. Madden.++
10.15(3)	Letter agreement dated as of February 28, 2011, by and between the Company and Dennis H. Langer M.D., J.D.++
10.16(3)	Transition Agreement dated as of September 8, 2009, as amended by Amendment to Transition Agreement dated as of February 1, 2010 and Second Amendment to the Transition Agreement dated as of July 29, 2013, by and between the Company and James C. Jenson, Ph.D.++
10.17(4)	Employment agreement dated as of November 24, 2013, by and between the Company and James E. Dentzer.++
10.18(2)	Loan and Security Agreement dated as of March 25, 2009, as amended by Amendment No. 1 to Loan and Security Agreement dated as of May 28, 2010, and Second Amendment to Loan and Security Agreement dated as of June 28, 2011, by and between the Company and Hercules Technology II, L.P.

10.19(5)	Research Collaboration and License Agreement dated as of December 21, 2009, as amended by Amendment No. 1 to Research Collaboration and License Agreement dated as of December 2, 2010, by and between the Company and Kyowa Hakko Kirin Co., Ltd.†
10.20(2)	Exclusive License Agreement dated as of September 28, 2007, by and between the Company and City of Hope.†
10.21(2)	Commercial Licence Agreement dated as of September 2, 2013, by and between the Company and Plant Bioscience Limited.†
10.22(2)	Lease Agreement dated as of March 14, 2008, as amended by First Amendment to Lease dated as of September 12, 2008 and Second Amendment to Lease dated as of July 3, 2013, by and between the Company and ARE-480 Arsenal Street, LLC.†
10.23(2)	Letter agreement dated as of January 24, 2014, by and between the Company and James E. Dentzer.++
10.24(6)	Lease agreement dated as of July 11, 2014, by and between the Company and King 87 CPD LLC
10.25(7)	Employment Agreement dated as of March 7, 2014, by and between the Company and Pankaj Bhargava, M.D.++
10.26(7)	Letter Agreement dated as of September 12, 2014, by and between the Company and Bruce Peacock.++
10.27(7)	Employment Agreement dated as of November 22, 2014, by and between the Company and Theodore Ashburn, M.D., Ph.D.++
10.28(7)	License Agreement dated as of November 16, 2014 by and between the Company, on one hand, and Protiva Biotherapeutics Inc. and Tekmira Pharmaceuticals Corporation, on the other hand. †
10.29(7)	Development and Supply Agreement dated as of November 16, 2014 by and between Protiva Biotherapeutics Inc. and Tekmira Pharmaceuticals Corporation, on one hand, and the Company, on the other hand.†
21.1(7)	Subsidiaries of the Company.
23.1(7)	Consent of Independent Registered Accounting Firm.
24	Power of Attorney (reference is made to the signature page).
31.1(7)	Certification of the Company's principal executive officer required by Rule 13a-14(a) or Rule 15d-14(a).
31.2(7)	Certification of the Company's principal financial officer required by Rule 13a-14(a) or Rule 15d-14(a).
32.1*	Section 1350 Certifications.
101.INS(7)	XBRL Report Instance Document
101.SCH(7)	XBRL Taxonomy Extension Schema Document
101.CAL(7)	XBRL Taxonomy Calculation Linkbase Document
101.LAB(7)	XBRL Taxonomy Label Linkbase Document
101.PRE(7)	XBRL Taxonomy Presentation Linkbase Document
101.DEF(7)	XBRL Taxonomy Extension Definition Linkbase Document

† Confidential treatment with respect to specific portions of this Exhibit has been requested, and such portions are omitted and have been filed separately with the Securities and Exchange Commission.

++ Management contract or compensatory plan or arrangement.
* Exhibit 32.1 is being furnished and shall not be deemed to be "filed" for purposes of Section 18 of the Securities Exchange Act of 1934, as amended (Exchange Act), or otherwise subject to the liability of that section, nor shall such exhibit be deemed to be incorporated by reference in any registration statement or other document filed under the Securities Act of 1933, as amended, or the Exchange Act, except as otherwise stated in such filing.
(1) Incorporated by reference to the indicated exhibit in the Company's Current Report on Form 8-K filed on February 5, 2014.
(2) Incorporated by reference to the indicated exhibit in the Company's Amendment No. 3 to Registration Statement on Form S-1 (No. 333-193150) filed on January 28, 2014.
(3) Incorporated by reference to the indicated exhibit in the Company's Registration Statement on Form S-1 (No. 333-193150) filed on December 31, 2013.
(4) Incorporated by reference to the indicated exhibit in the Company's Amendment No. 1 to Registration Statement on Form S-1 (No. 333-193150) filed on January 17, 2014.
(5) Incorporated by reference to the indicated exhibit in the Company's Amendment No. 5 to Registration Statement on Form S-1 (No. 333-193150) filed on January 29, 2014.
(6) Incorporated by reference to the indicated exhibit in the Company's Registrant's Quarterly Report on Form 10-Q filed on November 6, 2014 (File No. 001-36281) for the quarterly period ended September 30, 2014.
(7) Filed herewith.

Exhibit 10.25

EMPLOYMENT AGREEMENT

This EMPLOYMENT AGREEMENT ("Agreement") is made this 7th day of March 2014 (the "Effective Date") between Dicerna Pharmaceuticals, Inc. ("Company") on the one hand and Pankaj Bhargava (the "Executive") on the other hand, the Company and the Executive together being the "Parties".

WHEREAS the Company desires to employ the Executive and the Executive desires to be employed by the Company, on terms set forth herein;

NOW, THEREFORE, in consideration of the mutual agreements set forth herein, the parties agree as follows:

1. Term of Employment . The Executive's employment under this Agreement shall commence on March 31, 2014 (the "Start Date") and shall end on such date as the Executive's employment terminates in accordance with Section 4 of this Agreement. Subject to the balance of this Agreement, the Executive shall be an at-will employee of the Company whose employment may be terminated (by the Company or by the Executive) at any time, with or without cause, for any or no reason, in which case the Executive will be entitled to the separation benefits set forth in Section 4, below.

2. Duties . The Executive shall initially have the title of **Chief Medical Officer** . The Executive shall devote his full business time and effort, except as otherwise provided in the Agreement, to the performance of his duties for the Company, which he shall perform faithfully, to the best of his ability. The Executive shall have all of the customary powers and duties associated with his position and shall be subject to the Company's policies, procedures, and approval practices, as generally in effect from time to time for all senior executives of the Company and the direction and oversight of the Company's Board of Directors (the "Board"). The Executive will report directly to the President and CEO of the Company.

The Parties agree that executive may continue all of his activities and duties at and on behalf of Dana-Farber Cancer Institute, Brigham and Womens Hospital and Harvard Medical School which Executive currently performs. Additionally, Executive may participate from time to time (a) as member of one or more advisory boards, (b) as a director on boards of directors of other entities and (c) in other capacities with entities other than the Company after the approval of the CEO of the Company.

3. Compensation and Related Matters .

a. Base Salary . The Company shall pay the Executive base salary at a rate of $14,166.67 paid twice monthly (which annualizes to $340,000) less withholdings and deductions required and/or permitted by law. The Executive's base salary shall be paid in conformity with the Company's payroll practices generally applicable to the Company's senior executives.

i. Annual bonus. The Executive shall be eligible to be considered for an Annual Bonus upon achieving certain pre-determined performance targets consistent with any Incentive Compensation Plan established by the Board. The Annual Bonus shall be based, in part, on the Executive's performance. The grant of such a bonus shall be in the sole discretion of the Board. The maximum bonus amount for which the Executive will be eligible is forty percent (40%) of base salary earned for the calendar year. The Annual Bonus will be earned only after it has been granted by the Board. The Annual Bonus shall be paid to the Executive following the close of the fiscal year to which it relates, in no event later than March 15 th of the calendar year immediately following the calendar year in which it was earned. The Executive must be actively employed by the Company at the time the Board considers granting of bonuses to be eligible to receive such bonus.

b. Stock/Stock Options . The Executive will receive, pursuant to the Company's 2010 Employee, Director and Consultant Equity Incentive Plan (the "Plan"), an incentive stock option grant (the "ISO Grant") to purchase up to 264,808 shares of Common Stock (equivalent to 1.25% of the Company on a fully-diluted basis as of the Effective Date) at an exercise price equal to the fair market value of each share on the date of grant as determined by the Board in its sole discretion. The ISO Grant shall vest in accordance with the following scheduling: 25% of the shares underlying the ISO Grant will vest on the twelve (12) month anniversary of Executive's Start Date with the Company and the remaining shares will vest and become exercisable on a pro rata, monthly basis, over the subsequent 36 months, beginning with the month after the twelve (12) month anniversary of the Start Date. Vesting of the ISO Grant will be subject to Executive's continued status as a service provider with the Company at each such vesting period. The ISO Grant will be subject to the terms of the Plan and a Stock Option Agreement that the Company and Executive will be required to execute (the "Option Agreement"). The ISO Grant will fully accelerate upon Change of Control of the Company as defined in herein.

c. Benefits . During his employment with the Company, the Executive shall be entitled to participate in all employee benefit plans and programs, including paid sick leave and holidays, life insurance, disability, medical, dental, and retirement savings plans, to the same extent generally available to senior executives of the Company, in accordance with the terms of those plans and programs. The Executive shall be permitted up to four weeks of paid vacation per year, which will accrue on a monthly basis. The Executive will not be allowed to accumulate more than three weeks of unused vacation days at any given time. The Executive may carry over a maximum of five unused vacation days from one calendar year to the next.

The Company shall pay, upon Executive's request and submission of supporting documentation, all fees and other costs associated with Executive's Massachusetts Medical License, hospital privileges, and membership in professional societies including but not limited to ASCO, AACR, ACP and ASCPT.

d. Expenses . The Company agrees to reimburse the Executive for reasonable out-of-pocket expenses incurred in connection with Company business and within standards to be established by the Board from time to time, including, without limitation, travel and accommodations for authorized business trips, provided vouchers therefor, or other supporting information as the Company may reasonably require, are presented to the Company. All reimbursements provided under this Agreement shall be made or provided in accordance with the requirements of Section 409A of the Internal Revenue Code and the rules and regulations thereunder ("Section 409A") including, where applicable, the requirement that (i) any reimbursement is for expenses incurred during the Executive's lifetime (or during a shorter period of time specified in this Agreement); (ii) the amount of expenses eligible for reimbursement during a calendar year may not affect the expenses eligible for reimbursement in any other calendar year; (iii) the reimbursement of an eligible expense shall be made no later than the last day of the calendar year following the year in which the expense is incurred; and (iv) the right to reimbursement or in kind benefits is not subject to liquidation or exchange for another benefit.

4. Termination

a. Rights and Duties. The Executive is an employee "at will." Accordingly, the Company or the Executive may terminate his employment, at any time with or without cause, for any lawful reason, or no reason. The Executive and the Company agree that, without modifying or altering the Executive's "at will" status, each will provide the other with at least thirty (30) days' prior written notice of termination of the Executive's employment with the Company. If the Executive gives notice of termination, except in the case of a termination by the Executive for "Good Reason" as set forth below, such notice will be deemed a voluntary resignation by the Executive and the Company, in its sole discretion, may elect to relieve the Executive of any obligation to perform duties during the notice period, waive the notice period and immediately accept termination of the Executive's employment, without changing the status of such termination as a voluntary resignation by the Executive. Should the Company in the event of a voluntary resignation decide to relieve the Executive of any obligation to perform duties during the notice period, waive the notice period and immediately accept termination of the Executive's employment, it shall nonetheless continue his compensation and benefits for the term of the notice period, except that no bonus shall be accrued during and after the notice period.

b. Termination for "Good Reason." The Executive may terminate his employment at any time for "Good Reason." "Good Reason" shall comport with the requirements of Regulation §1.409A-1(n)(ii) and shall mean:

i. A material diminution in the Executive's authority, duties or responsibilities;

ii. A material diminution by the Company of the Executive's annual base compensation then in effect, except a material diminution generally affecting the members of the Company's management;

iii. Any action or inaction by the Company that constitutes a material breach by the Company of the terms of this Agreement; or

iv. A requirement that the Executive be based more than 50 miles from the offices at which he was principally employed immediately prior to the date of termination.

The parties acknowledge and agree that "Good Reason" shall not be deemed to have occurred unless: (1) the Executive provides the Company with written notice that he intends to terminate his employment hereunder for one of the Good Reason grounds set forth in Section 4.b. within sixty (60) days of the initial occurrence of such ground, with such notice containing a description of such ground, (2) if such Good Reason ground is capable of being cured, the Company has failed to cure such ground within a period of thirty (30) days from the date of such written notice, and (3) the Executive terminates his employment within ninety-one (91) days from the date that such Good Reason ground first occurs. For purposes of clarification, the above-listed conditions shall apply separately to each occurrence of a Good Reason ground, and failure to adhere to such conditions in the event of the occurrence of grounds that would otherwise have constituted Good Reason had the conditions herein been satisfied shall not disqualify the Executive from asserting and satisfying the conditions for Good Reason for any subsequent occurrence that may constitute Good Reason.

c. Termination by the Company for Cause. The Company may terminate the Executive's employment at any time for "Cause." "Cause" shall mean:

i. The Executive's commission of an act of fraud, dishonesty, breach of fiduciary duty or misappropriation which may or does adversely affect the Company;

ii. The Executive's conviction or plea of guilty or *nolo contendere* to or engaging in any felony or crime involving moral turpitude, fraud, misrepresentation or other crime and/or indictment for a crime that, in the reasonable opinion of the Company, affects the Executive's ability to perform the duties set forth in this Agreement and/or reflects negatively upon the Company;

iii. Unauthorized disclosure by the Executive of the Company's Proprietary Information, as defined in the Nondisclosure Agreement (as defined in Section 5 below) which results or could have been reasonably foreseen to result, in a material financial loss to the Company; or

iv. The Executive's material breach of this Agreement or the Nondisclosure Agreement. If such breach is reasonably possible of being cured in the opinion of the Company, then the Executive will be given thirty (30) days after written notice from the Company of such breach to cure.

v. The Executive's failure (which shall not include any Disability as defined below) or refusal to perform the duties and responsibilities of his employment and/or to follow the policies and procedures of the Company, including without limitation the failure or refusal to carry out lawful instructions from the Board. If such failure or refusal is reasonably possible of being cured in the opinion of the Company, then the Executive will be given thirty (30) days after written notice from the Company of such failure or refusal to cure.

d. Termination in the Event of Death or Disability. The Agreement shall terminate upon the Executive's death or Disability, and the Executive's employment with the Company shall thereupon terminate. For purposes of the Agreement, "Disability" is defined as any illness, injury, accident or condition of either a physical or psychological nature as a result of which the Executive is unable to perform the essential functions of his duties and responsibilities hereunder for 90 days during any period of 365 consecutive calendar days or for any consecutive 90-day period.

e. Effect of Termination.

i. If the Executive is terminated by the Company for Cause, or by the Executive voluntarily other than for Good Reason, then the Executive will only be entitled to payment when due of any unpaid base salary, expense reimbursements, and vacation days accrued prior to termination of employment.

ii. If the Executive's employment is terminated by the Company other than for Cause, or by the Company due to the Executive's Disability, or by the Executive for Good

Reason (each of which will be deemed an involuntary termination), then the Executive will be entitled to payment when due of any unpaid base salary, expense reimbursements, and vacation days accrued prior to termination of employment and, in exchange for the Executive's execution of a separation agreement and general release provided by the Company and expressly subject to the conditions described in Section 4.e.v. below, the following:

a) Continuation of the Executive's base salary at the rate in effect as of the day immediately preceding his date of termination for a six (6) month period, payable in accordance with the Company's regular payroll practices, less applicable withholdings, commencing at the conclusion of the Review Period (as described below), *provided* that the first installment of such payments shall include all amounts which would have been paid during the period between the Executive's date of termination and the date of such first installment; and

b) The Executive shall be eligible to continue health benefits pursuant to COBRA or the appropriate state equivalent. If the Executive is eligible for and properly elects continuation of such coverage during the permissible time frame, the Company will pay the premiums for such group health insurance coverage for the shorter of (i) six (6) months or (ii) until the Executive becomes eligible for health benefits through another employer or otherwise. After the shorter period, the Executive will be responsible for premium payments for continuation of such group health insurance coverage.

iii. If the Agreement is terminated because of the Executive's death, the Company shall pay to the estate of the Executive the salary, accrued bonus, expense reimbursement, employer contribution to retirement savings plan, and benefits which would otherwise have been payable to the Executive up to the date of termination of his employment because of death.

iv. In the event a Change of Control (as defined below) occurs and, if within one (1) year thereafter, the Executive's employment is terminated by the Company other than for Cause, or by the Company due to the Executive's Disability, or by the Executive for Good Reason (each of which will be deemed an involuntary termination), then the Executive will be entitled to payment when due of any unpaid base salary, expense reimbursements, vacation days accrued prior to termination of employment, accrued bonus, employer contribution to retirement savings plans, and, in exchange for the Executive's execution of a separation agreement and general release provided by the Company and expressly subject to the conditions described in Section 4.e.v. below, the following:

a) A lump sum payment equal to one (1) year of the Executive's base salary at the rate in effect as of the day immediately preceding his date of termination, less applicable withholdings, commencing at the conclusion of the Review Period (as described below); and

b) The Executive shall be eligible to continue health benefits pursuant to COBRA or the appropriate state equivalent. If the Executive is eligible for and

properly elects continuation of such coverage during the permissible time frame, the Company will pay the premiums for such group health insurance coverage for the shorter of (i) twelve (12) months or (ii) until the Executive becomes eligible for health benefits through another employer or otherwise. After the shorter period, the Executive will be responsible for premium payments for continuation of such group health insurance coverage.

For purposes of this Agreement, "Change of Control" means (A) the occurrence of a merger or consolidation of the Company whether or not approved by the Board, other than (i) a merger or consolidation which would result in the voting securities of the Company outstanding immediately prior thereto continuing to represent (either by remaining outstanding or by being converted into voting securities of the surviving entity or the parent of such corporation) at least 50% of the total voting power represented by the voting securities of the Company or such surviving entity or parent of such corporation outstanding immediately after such merger or consolidation, or (ii) a merger or consolidation which is in effect a financing transaction for the Company, including, but not limited to, a reverse merger of the Company into a publicly traded "shell" company, or (B) the stockholders of the Company approve an agreement for the sale or disposition by the Company of all or substantially all of the Company's assets, provided that, in any case, "Change of Control" shall be in accordance with Regulation §1.409A-3(i)(5)(v).

v. Payment of the severance pay and benefits described in Section 4.e.ii. or 4.e.iv., as applicable, is expressly conditioned on the Executive's execution without revocation of the separation agreement and general release described therein, and will commence immediately following a sixty (60) day period following the effective date of the Executive's separation from service from the Company (the "Review Period"). The separation agreement and general release will be provided to the Executive on or before the fifth (5^{th}) day following such separation from service. If the Executive fails or refuses to return such agreement within the Review Period, the applicable severance payments and benefits will be forfeited. If the Executive is eligible for the severance pay and benefits described in Section 4.e.ii., then he shall not be eligible for and shall not receive the severance pay and benefits described in Section 4.e.iv. Similarly, if the Executive is eligible for the severance pay and benefits described in Section 4.e.iv., then he shall not be eligible for and shall not receive the severance pay and benefits described in Section 4.e.ii.

5. Nondisclosure, Noncompetition, Nonsolicitation and Inventions. As a condition of the Executive's employment by the Company and the payment of compensation and receipt of benefits referred to above, the Executive agrees to execute the attached standard Employee Nondisclosure, Noncompetition, Nonsolicitation and Inventions Agreement, in the form attached hereto as Exhibit A (the "Nondisclosure Agreement"). The Executive acknowledges that the Company would not offer him employment or provide compensation and/or benefits set forth above if he was not willing to be bound by the terms of such Agreement.

6. Notice.

a. To the Company . The Executive will send all communications to the Company in writing, addressed as follows (or in any other manner the Company notifies him to use):

Douglas M. Fambrough, Ph.D.
President and CEO
Dicerna Pharmaceuticals, Inc.
480 Arsenal Street
Building 1, Suite 120
Watertown, MA 02472

With a copy to: Sam Zucker
O'Melveny & Myers LLP
2765 Sand Hill Road
Menlo Park, CA 94025

b. To the Executive . All communications from the Company to the Executive relating to this Agreement shall be sent to the Executive in writing, addressed as follows (or in any other manner he notifies the Company to use):

Pankaj Bhargava
692 Beacon Street
Newton, MA 02459

With a copy to: Stephanie Meilman & Nelson Costa
Law Office of Meilman & Costa P.C.
70 Wells Avenue, Suite 200
Newton, MA 02459

c. Time Notice Deemed Given . Notice shall be deemed to have been given when delivered or, if earlier (1) three business days after mailing by United States certified or registered mail, return receipt requested, postage prepaid, or (2) faxed with confirmation of delivery, in either case, addressed as required in this section.

7. Amendment . No provisions of this Agreement may be modified, waived, or discharged except by a written document signed by a Company officer duly authorized by the Board and the Executive. A waiver of any conditions or provisions of this Agreement in a given instance shall not be deemed a waiver of such conditions or provisions at any other time in the future.

8. Choice of Law; Forum Selection . The validity, interpretation, construction, and performance of this Agreement shall be governed by the laws of the Commonwealth of Massachusetts without regard to its conflicts of laws principles. Any claims or legal actions by one party against the other regarding this Agreement shall be commenced and maintained exclusively in any state or federal court located in the Commonwealth of Massachusetts, and the parties hereby submit to the jurisdiction and venue of any such court.

9. Successors . This Agreement shall be binding upon, and shall inure to the benefit of, the Executive and his estate, but the Executive may not assign or pledge this Agreement or any rights arising under it. Without the Executive's consent, the Company may assign this Agreement to any affiliate or to a successor to substantially all the business and assets of the Company.

10. Taxes; Code Sections 409A and 280G .

a. The Company shall withhold taxes from payments it makes pursuant to this Agreement as it reasonably determines to be required by applicable law.

b. If the benefits set forth in Section 4.e. of this Agreement constitute "non-qualified deferred compensation" subject to Section 409A, then the following conditions apply to the payment of such benefits:

i. Any termination of the Executive's employment triggering payment of benefits under Section 4.e. must constitute a "separation from service" under Section 409A(a)(2)(A)(i) of the Code and Treas. Reg. §1.409A-1(h) before distribution of such benefits can commence. To the extent that the termination of the Executive's employment does not constitute a separation of service under Section 409A(a)(2)(A)(i) of the Code and Treas. Reg. §1.409A-1(h) (as the result of further services that are reasonably anticipated to be provided by the Executive to the Company at the time the Executive's employment terminates), any benefits payable under Section 4.e. that constitute non-qualified deferred compensation under Section 409A shall be delayed until after the date of a subsequent event constituting a separation of service under Section 409A(a)(2)(A)(i) of the Code and Treas. Reg. §1.409A-1(h). For purposes of clarification, this Section shall not cause any forfeiture of benefits on the Executive's part, but shall only act as a delay until such time as a "separation from service" occurs.

ii. If the Executive is a "specified employee" (as that term is used in Section 409A and regulations and other guidance issued thereunder) on the date his separation from service becomes effective, any benefits payable under Section 4.e. that constitute non-qualified deferred compensation subject to Section 409A shall be delayed until the earlier of: (A) the business day following the six-month anniversary of the date his separation from service becomes effective, or (B) the date of the Executive's death, but only to the extent necessary to avoid the adverse tax consequences and penalties under Section 409A. On the earlier of: (A) the business day following the six-month anniversary of the date his separation from service becomes effective, or (B) the Executive's death, the Company shall pay the Executive in a lump sum the aggregate value of the non-qualified deferred compensation that the Company otherwise would have paid the Executive prior to that date under Section 4.e.

iii. It is intended that each installment of the payments and benefits provided under Section 4.e. shall be treated as a separate "payment" for purposes of Section 409A.

iv. Neither the Company nor the Executive shall have the right to accelerate or defer the delivery of any such payments or benefits except to the extent specifically permitted or required by Section 409A.

c. Notwithstanding any other provision of this Agreement to the contrary, in the event of any ambiguity in the terms of this Agreement, such term(s) shall be interpreted and at all times administered in a manner that avoids the inclusion of compensation in income under Section 409A, or the payment of increased taxes, excise taxes or other penalties under Section 409A.

d. The parties intend this Agreement to be in compliance with Section 409A. Executive acknowledges and agrees that Company does not guarantee the tax treatment or tax consequences associated with any payment or benefit arising under this Agreement, including but not limited to consequences related to Section 409A.

e. If any payment or benefit the Executive would receive under this Agreement, when combined with any other payment or benefit Executive receives pursuant to a Change of Control (for purposes of this section, a "Payment") would: (i) constitute a "parachute payment" within the meaning of Section 280G the Code; and (ii) but for this sentence, be subject to the excise tax imposed by Section 4999 of the Code (the "Excise Tax"), then such Payment shall be either: (A) the full amount of such Payment; or (B) such lesser amount (with cash payments being reduced before stock option compensation) as would result in no portion of the Payment being subject to the Excise Tax, whichever of the foregoing amounts, taking into account the applicable federal, state and local employments taxes, income taxes, and the Excise Tax, results in Executive's receipt, on an after-tax basis, of the greater amount of the Payment notwithstanding that all or some portion of the Payment may be subject to the Excise Tax.

11. Validity . The invalidity or unenforceability of any provision of this Agreement shall not affect the validity or enforceability of any other provision of this Agreement, which shall remain in full force and effect.

12. Counterparts . This Agreement may be executed in one or more counterparts, each of which shall be deemed to be an original but all of which together shall constitute the same instrument.

13. Entire Agreement; Prior Agreements . This Agreement, the Stock Option Agrement and the Nondisclosure Agreement, constitutes the entire agreement among the parties with respect to the subject matter hereof and, unless otherwise provided herein, supersedes all prior agreements, negotiations or understandings, written or oral in respect thereof.

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DICERNA PHARMACEUTICALS, INC.

Date: March 7, 2014

/s/ Douglas Fambrough

By: Douglas Fambrough
Its: President and CEO

Pankaj Bhargava

Date: March 10, 2014

/s/ Pankaj Bhargava

EXHIBIT A
NONDISCLOSURE, NONCOMPETITION, NONSOLICITATION AND INVENTIONS AGREEMENT

This Nondisclosure, Noncompetition and Assignment Agreement (the "Agreement") is made by and between Dicerna Pharmaceuticals, Inc., a Delaware corporation (the "Company"), and Pankaj Bhargava (the "Employee"), as of March 7, 2014.

The Employee acknowledges that his employment or the continuance of that employment with the Company is contingent upon his agreement to sign and adhere to the provisions of this Agreement. In consideration of the employment or continued employment of the Employee by the Company, the Employee and the Company agree as follows:

1. **Duty to Devote Efforts** . The Employee understands that his employment with the Company requires his undivided attention and effort during normal business hours and excluding periods of vacation and sick leave to which he is entitled. As a result, during hisemployment with the Company, he shall not engage in any other employment, occupation, consulting or other activity that conflicts with his/her obligations to the Company, whether directly related to the business in which the Company is involved during the term of his employment with the Company or otherwise. For the avoidance of doubt, the Employee may engage in charitable, civic and educational activities and community affairs, and other activities expressly listed or otherwise contemplated in the Employment Agreement, provided that any such activities and affairs do not, in the aggregate, materially interfere with the proper performance of the Employee's duties and responsibilities to the Company.

2. **Noncompetition** . The Employee recognizes and agrees that the Company will suffer irreparable harm in the event that the Employee enters into competition with the Company, either during or following the Employee's employment with the Company. Therefore, the Employee agrees that while the Employee is employed by the Company and for a period of one year following the termination or cessation of such employment (the "Restricted Period"), regardless of the reasons, the Employee shall not, directly or indirectly, alone or as a consultant, partner, officer, director, employee, joint venturer, lender or stockholder, or in any other capacity whatsoever, of any entity, (a) accept employment with any business or entity that is in competition with the products or services being conceived, designed, created, developed, manufactured, marketed, distributed or sold by the Company, *provided* that nothing contained in this subsection (a) will prevent the Employee from being employed by a subsidiary, division, affiliate or unit (each, a "Unit") of an entity if that Unit is not engaged in any business which is in competition with the products or services being conceived, designed, created, developed, manufactured, marketed, distributed or sold by the Company, irrespective of whether some other Unit of such entity engages in such competition; (b) engage in or undertake any business operations of conceiving, designing, creating, developing, manufacturing, marketing, distributing selling or rendering (or assisting any other person in conceiving, designing, creating, developing, manufacturing, marketing, distributing selling or rendering) products or services that are in competition with the products or services being conceived, designed, created, developed, manufactured, marketed, distributed, sold or rendered by the Company or (c) invest in or assist in any manner any business which directly or indirectly competes with the business or future business plans of the Company, except that he may

own up to one percent (1%) of the outstanding securities of any corporation having a class of equity securities actively traded on a national securities exchange or on the NASDAQ Stock Market. A business or entity shall be deemed to be in competition with the products or services being conceived, designed, created, developed, manufactured, marketed, distributed, sold or rendered by the Company if it is in the business of development, manufacture, license, sale and distribution of RNAi-based therapeutic and diagnostic products for specific diseases and gene targets being pursued by the Company (including, but not limited to, DsiRNA technology). The geographic scope of this Section 2 shall extend to anywhere the Company is doing business, has done business or intends to do business. The Employee acknowledges and agrees that if he violates any of the provisions of this Section 2, the Restricted Period will be extended from the date of termination of employment for a period equal to any period during which he engages in such violation(s), whether such period is during the pendency of litigation or otherwise.

3. **Nonsolicitation of Customers** . The Employee recognizes and agrees that the clients, customers and accounts of the Company, which the Company now or hereafter services during the Employee's employment with the Company, and all prospective clients, customers and accounts from whom the Employee has solicited business while in the employ of the Company, shall be solely the clients, customers and accounts of the Company. Therefore, the Employee agrees that while the Employee is employed by the Company and for a period of one (1) year following the termination or cessation of such employment, regardless of the reasons, the Employee shall not, directly or indirectly, alone or as a consultant, partner, officer, director, employee, joint venturer, lender or stockholder, or in any other capacity whatsoever, of any entity, solicit, divert or take away, attempt to divert or to take away, any client, customer or account of the Company, or any potential client, customer or account of the Company which were contacted, solicited or served by the Employee while employed by the Company or about whom the Employee obtained or became familiar with through Confidential Information (as defined in Section 5). The geographic scope of this Section 3 shall extend to anywhere the Company is doing business, has done business or intends to do business.

4. **Nonsolicitation of Employees** . The Employee recognizes and agrees that the Company has invested substantial resources and effort in assembling its present staff and personnel. Therefore, the Employee agrees that while the Employee is employed by the Company and for a period of one (1) year following the termination or cessation of such employment, regardless of the reasons, the Employee shall not, directly or indirectly: (i) recruit, solicit or hire any employee of the Company; or (ii) induce or attempt to induce any employee of the Company to terminate his employment with, or otherwise cease his/her relationship or engagement with, the Company.

5. **Nondisclosure** . The Employee agrees that all Confidential Information (as defined below), whether or not disclosed orally or in writing, is and shall be the exclusive property of the Company. The Employee shall not at any time, whether during or after the termination or cessation of his employment, without written authorization of the Chief Executive Officer of the Company, unless and until the Confidential Information has become public knowledge without fault by the Employee, (a) reveal any Confidential Information to any person or entity, except to employees of the Company who need to know such Confidential Information for the purposes of their employment, (b) use or attempt to use any Confidential Information for any purposes (other

than in the ordinary course of performing his duties as an employee of the Company), or (c) use any Confidential Information in any manner which may injure or cause loss or may be calculated to injure or cause loss to the Company, whether directly or indirectly. If the Employee receives a subpoena to testify or provide documents at any time in any judicial or non-judicial proceedings, including a trial hearing of any kind, or deposition, the Employee shall notify the Chief Executive Officer of the Company. If the Employee is compelled to testify in any judicial or non-judicial proceeding, then, at the Company's expense, the Employee shall take reasonable steps to ensure the continued confidentiality of the Confidential Information (for example requesting that documents or transcripts be filed under seal or subject to a confidentiality agreement, if possible) and, upon so doing, shall be relieved of the obligations of this provision, insofar as his testimony would otherwise constitute disclosure of Confidential Information. The term "Confidential Information" shall include any information concerning the organization, business, business relationships or finances of the Company or of any third party which the Company is under an obligation to keep confidential or that is maintained by the Company as confidential. Such Confidential Information shall include, but is not limited to, trade secrets or confidential information respecting inventions, products, designs, methods, know-how, techniques, systems, processes, specifications, blueprints, engineering data, software programs, works of authorship, clinical testing programs, marketing material, customer lists, customer information, financial information, pricing information, personnel information, business plans or strategy, projects, plans and proposals.

6. **Company Property** .

a. The Employee agrees that Company Property (as defined below) shall be and is the exclusive property of the Company to be used by the Employee only in the performance of his duties for the Company and further agrees that during his employment with the Company, or after the termination or cessation of such employment, he shall not make, use or permit to be used any Company Property otherwise than for the benefit of the Company. All such Company Property or copies thereof and all tangible property of the Company in the custody or possession of the Employee shall be delivered to the Company, upon the earlier of (i) a request by the Company or (ii) upon the termination or cessation of the Employee's employment. After such delivery, the Employee shall not retain any such Company Property or copies thereof or any other tangible property. The term "Company Property" shall include all files, letters, notes, memoranda, reports, lists, records, drawings, sketches, laboratory notebooks, specifications, software programs, software code, data, computers, cellular telephones, pagers, credit and/or calling cards, keys, access cards, documentation or other materials of any nature and in any form, whether written, photographic, printed, electronic or in digital format or otherwise, relating to any matter within the scope of the business of the Company or concerning any of its dealings or affairs and any other Company property in Employee's possession, custody or control.

b. The Employee agrees that his obligation not to disclose or to use information and materials of the types set forth in Section 6(a) above, and his obligation to return materials and tangible property, set forth in Section 6(a) above, also extends to such types of information, materials and tangible property of clients, customers and accounts of the Company or suppliers to the Company or other third parties who may have disclosed or entrusted the same to the Company or to the Employee.

7. **Assignment of Developments** .

a. If at any time or times during Employee's employment with the Company or prior to the Employee's employment with the Company when working with, for, or on behalf of the Company in a capacity other than as an employee, he did or shall (either alone or with others) make, conceive, create, discover, invent or reduce to practice, whether or not during normal working hours or on the premises of the Company, any Development that (i) relates to the business

of the Company or any customer of or supplier to the Company or any of the products or services being developed, manufactured or sold by the Company or which may be used in relation therewith; (ii) results from tasks assigned to the Employee by the Company; or (iii) results from the use of premises or personal property (whether tangible or intangible) owned, leased or contracted for or by the Company, then all such Developments and the benefits thereof are and shall immediately become the sole and absolute property of the Company and its assigns, as works made for hire or otherwise. The term "Development" shall mean any invention, modification, discovery, design, development, improvement, process, software program, work of authorship, documentation, formula, data, technique, know-how, trade secret or intellectual property right whatsoever or any interest therein (whether or not patentable or registrable under copyright, trademark or similar statutes). The Employee shall fully and promptly disclose to the Company (or any persons designated by it) each such Development. To the extent not already owned by the Company, the Employee agrees to assign and does hereby assign to the Company (or any person or entity designated by the Company) all his right, title and interest (including, but not limited to, rights to inventions, patentable subject matter, copyrights and trademarks) in and to the Developments and all benefits and/or rights resulting therefrom to the Company and its assigns without further compensation and shall communicate, without cost or delay, and without disclosing to others the same, all available information relating thereto (with all necessary plans and models) to the Company. The Employee also hereby waives all claims to moral rights in any Developments.

b. Excluded Developments. This Section 7 shall not apply to Developments which do not relate to the present or planned business or research and development of the Company and which are made and conceived by the Employee not during normal working hours, not on the Company's premises and not using the Company's tools, devices, equipment or Confidential Information, but shall apply to past Developments, including Developments made prior to the Employee's employment as an employee that relate to the present or planned business or research and development of the Company. The Employee represents that the Developments identified in the Appendix, if any, attached hereto comprise the complete list of all the Developments that the Employee has made or conceived or otherwise claimed ownership prior to his employment by the Company, which Developments are excluded from this Agreement. The Employee understands that it is only necessary to list the title of such Developments and the purpose thereof but not details of the Development itself. IF THERE ARE ANY SUCH DEVELOPMENTS TO BE EXCLUDED, THE UNDERSIGNED SHOULD INITIAL HERE; OTHERWISE IT WILL BE DEEMED THAT THERE ARE NO SUCH EXCLUSIONS.

8. **Further Assurances** . The Employee agrees to cooperate fully with the Company, both during and after his employment with the Company, with respect to the procurement, maintenance and enforcement of copyrights, patents and other intellectual property rights (both in the United States and foreign countries) relating to Developments. The Employee shall, during his employment and at any time thereafter, at the request and cost of the Company, promptly sign, execute, make and do all such deeds, documents, acts and things as the Company and its duly authorized officers may reasonably require:

a. to apply for, obtain, register and vest in the name of the Company alone (unless the Company otherwise directs) patents, copyrights, trademarks or other analogous protection in any country throughout the world relating to a Development and when so obtained or vested to renew and restore the same; and

b. to defend any judicial, opposition or other proceedings in respect of such applications and any judicial, opposition or other proceeding, petition or application for revocation of any such patent, copyright, trademark or other analogous protection.

The Employee further agrees that if the Company is unable, after reasonable effort, to secure the Employee's signature on any such papers, application for patent, copyright, trademark or other analogous protection, or other documents regarding any legal protection relating to a Development, whether because of the Employee's physical or mental incapacity or for any other reason whatsoever, the Employee hereby irrevocably designates and appoints the Company and its duly authorized officers and agents as the Employee's agent and attorney-in-fact, to act for and on his behalf and stead to execute and file any such papers, application or applications or other documents and to do any and all other lawfully permitted acts to further the prosecution and issuance of patent, copyright or trademark registrations or any other legal protection thereon with the same legal force and effect as if executed by the Employee.

9. **Employment At Will** . The Employee understands that this Agreement does not constitute an implied or written employment contract and that his employment with the Company is on an "at-will" basis. Accordingly, the Employee understands that either the Company or the Employee may terminate Employee's employment at any time, for any or no reason, with or without prior notice.

10. **Severability** . The Employee hereby agrees that each provision and the subparts of each provision herein shall be treated as separate and independent clauses, and the unenforceability of any one clause shall in no way impair the enforceability of any of the other clauses of the Agreement. Moreover, if one or more of the provisions contained in this Agreement shall for any reason be held to be excessively broad as to scope, activity, subject or otherwise so as to be unenforceable at law, such provision or provisions shall be construed by the appropriate judicial body by limiting or reducing it or them, so as to be enforceable to the maximum extent compatible with the applicable law as it shall then appear. The Employee hereby further agrees that the language of all parts of this Agreement shall in all cases be construed as a whole according to its fair meaning and not strictly for or against either of the parties.

11. **Amendments; Waiver** . Any amendment to or modification of this Agreement, or any waiver of any provision hereof, shall be in writing and signed by the Company. No delay or omission by the Company in exercising any right under this Agreement or any waiver by the Company of a breach of any provision of this Agreement shall not operate or be construed as a waiver of that right or any subsequent breach of such provision or any other provision hereof.

12. **Survival** . This Agreement shall be effective as of the date entered below. The Employee's obligations under this Agreement shall survive the termination or cessation of his employment regardless of the manner of such termination or cessation and shall be binding upon his heirs, executors, administrators and legal representatives.

13. **Assignment** . The term “Company” shall include Dicerna Pharmaceuticals, Inc. and any of its subsidiaries, divisions, or affiliates. The Company shall have the right to assign this Agreement to its successors and assigns, and all covenants and agreements hereunder shall inure to the benefit of and be enforceable by said successors or assigns. The Employee may not assign this Agreement.

14. **Representations** .

a. The Employee hereby represents that, except as the Employee has disclosed in writing to the Company, the Employee is not bound by the terms of any agreement with any previous employer or other party to refrain from using or disclosing any trade secret or confidential or proprietary information in the course of his employment with the Company or to refrain from competing, directly or indirectly, with the business of such previous employer or any other party. The Employee further represents that his performance of all the terms of this Agreement and as an employee of the Company does not and will not breach any agreement to keep in confidence proprietary information, knowledge or data acquired by the Employee in confidence or in trust prior to his employment with the Company, and the Employee will not disclose to the Company or induce the Company to use any confidential or proprietary information or material belonging to any previous employer or others. The Employee further represents that he has returned all property and confidential information belonging to all prior employers. To the extent that Employee has retained any non-confidential and non-proprietary materials and documents of a prior employer, such materials and documents have been disclosed in writing to the Company.

b. The Employee hereby represents that his employment with the Company, the execution of this Agreement and his performance of all of the terms of this Agreement do not and will not conflict with or breach the terms of any other agreement by which the Employee is bound (including, but not limited to, to keeping in confidence proprietary information acquired by the Employee in confidence or in trust prior to his employment by the Company). The Employee further represents that he shall not enter into any agreement, either written or oral, in conflict herewith.

c. The restrictions contained in this Agreement are necessary for the protection of the business and goodwill of the Company and are considered by the Employee to be reasonable for such purpose. The Employee agrees that any breach of this Agreement by him/her is likely to cause substantial and irreparable damage to the Company and that in the event of such breach the Company shall have, in addition to any and all remedies of law, the right to an injunction, specific performance or other equitable relief to prevent the violation of the Employee’s obligations hereunder. The Company may apply for such injunctive relief in any court of competent jurisdiction without the necessity of posting any bond or other security.

15. **Governing Law; Forum Selection Clause** . This Agreement and any claims arising out of this Agreement (or any other claims arising out of the relationship between the parties) shall be governed by and construed in accordance with the laws of the Commonwealth of Massachusetts, without application of the conflict of laws principles thereof. Any claims or legal actions by one party against the other shall be commenced and maintained exclusively in any state or federal court located in the Commonwealth of Massachusetts, and the parties hereby submit to the exclusive jurisdiction and venue of any such court.

16. **Entire Agreement** . This Agreement and the parties' Employment Agrement set forth the complete, sole and entire agreement between the parties on the subject matter herein and supersedes any and all other agreements, negotiations, discussions, proposals, or understandings, whether oral or written, previously entered into, discussed or considered by the parties. The Employee agrees that any change or changes in his duties, salary or compensation after the signing of this Agreement shall not affect the validity or scope of this Agreement.

THE EMPLOYEE ACKNOWLEDGES THAT HE HAS CAREFULLY READ THIS AGREEMENT AND UNDERSTANDS AND AGREES TO ALL OF THE PROVISIONS IN THIS AGREEMENT.

IN WITNESS WHEREOF, the undersigned has executed this Agreement as a sealed instrument as of the 10 th day of March, 2014.

Signature: /s/ Pankaj Bhargava

Name (Please Print): Pankaj Bhargava, MD

Address:

ACKNOWLEDGED BY:

DICERNA PHARMACEUTICALS, INC.

By: /s/ Douglas Fambrough

Name: Douglas Fambrough

Title: CEO

Exhibit 10.26

Dicerna Pharmaceuticals, Inc.
480 Arsenal Street
Building 1, Suite 120
Watertown, Massachusetts 02472
617-621-8097
Fax: 617-252-0927
www.dicerna.com

September 12, 2014

Bruce A. Peacock
142 Tannery Run Circle
Berwyn, PA 19302

Dear Bruce:

On behalf of Dicerna Pharmaceuticals, Inc. (the " Company "), I am pleased to confirm that on Tuesday the Company's Board of Directors (the " Board ") appointed you to serve on the Board and as a member of the Audit Committee, with an understanding that the Audit Committee may wish to elect you Chairperson. You will receive the initial compensation described below in exchange for your performance of duties as a director and member of the Audit Committee.

At the first Board meeting that you attend, the Board will grant you options to purchase 25,000 shares of the Company's Common Stock (the " Option ") with an exercise price equal to the fair market value on the date of grant under the Dicerna Pharmaceuticals, Inc. 2014 Performance Incentive Plan (the " Plan "), a copy of which will be furnished to you. The Option will vest as to one-third of the shares on the one year anniversary of the date of grant and as to the remaining two-thirds of the shares in quarterly installments over the two-year period thereafter, subject to your continued service as a director through the applicable vesting date. In addition, you will receive $35,000 for your initial year of service as a Board member and an additional $5,200 for each committee of the Board on which you serve. If the Audit Committee elects you Chairperson, you will receive an additional $9,800 for your initial year of service. You will receive additional compensation for each year of continuing service as provided by the Board. Currently, continuing Board members receive annual renewal option grants of 15,000 shares and annual cash compensation of $35,000 for Board membership, $5,200 for each committee upon which they serve, and $9,800 for being Chairperson of the Audit Committee, subject to change as determined by the Board.

For so long as you are a member of the Board, the Company will reimburse you for your reasonable out- of-pocket expenses, including reasonable travel expenses, incurred in attending Board meetings and committee meetings and in carrying out your duties as a director or committee member. In addition, the Company will enter into its standard form of indemnification agreement for directors with you and will include you in its directors' and officers' insurance policy.

You understand that you serve on the Board at the pleasure of the stockholders of the Company and that your duties are subject to change at any time without notice. You know of no reason why you would be precluded from serving as a member of the Board or any of its committees, either because of existing contractual restrictions or fiduciary duty obligations or otherwise.

On behalf of the Company, we are excited about the possibility of having you join us at this critical juncture in our growth and development.

Sincerely,

By: /s/ Douglas M. Fambrough, III, Ph.D.
Douglas M. Fambrough, III, Ph.D.

Chief Executive Officer

Acknowledged and agreed to on
this 13th day of September, 2014

Signature: /s/ Bruce A. Peacock
Bruce A. Peacock

Exhibit 10.27

EMPLOYMENT AGREEMENT

This EMPLOYMENT AGREEMENT ("Agreement") is made this 22nd day of November 2014 (the "Effective Date") between Dicerna Pharmaceuticals, Inc. ("Company") on the one hand and Theodore T. Ashburn (the "Executive") on the other hand.

WHEREAS the Company desires to employ the Executive and the Executive desires to be employed by the Company, on terms set forth herein;

NOW, THEREFORE, in consideration of the mutual agreements set forth herein, the parties agree as follows:

1. Term of Employment . The Executive's employment under this Agreement shall commence on December 15, 2014 (the "Start Date") and shall end on such date as the Executive's employment terminates in accordance with Section 4 of this Agreement. Subject to the balance of this Agreement, the Executive shall be an at-will employee of the Company whose employment may be terminated (by the Company or by the Executive) at any time, with or without cause, for any or no reason, in which case the Executive will be entitled to the separation benefits set forth in Section 4, below.

2. Duties . The Executive shall initially have the title of **Senior Vice President, Product Strategy and Operations** The Executive shall devote his full business time and effort to the performance of his duties for the Company, which he shall perform faithfully, to the best of his ability, which shall include: Program Leader for the DCR-PH1 program, Project Management, Manufacturing, and Intellectual Property. The Executive shall have all of the customary powers and duties associated with his position and shall be subject to the Company's policies, procedures, and approval practices, as generally in effect from time to time for all senior executives of the Company and the direction and oversight of the Company's Board of Directors (the "Board"). The Executive will report directly to the President and CEO of the Company.

3. Compensation and Related Matters .

a. Base Salary . The Company shall pay the Executive base salary at a rate of $12,708.33 paid twice monthly (which annualizes to $305,000) less withholdings and deductions required and/or permitted by law. The Executive's base salary shall be paid in conformity with the Company's payroll practices generally applicable to the Company's senior executives.

b. Annual bonus. The Executive shall be eligible to be considered for an Annual Bonus upon achieving certain pre-determined performance targets consistent with any Incentive Compensation Plan established by the Board. The Annual Bonus shall be based, in part, on the Executive's performance. The grant of such a bonus shall be in the sole discretion of the Board. The maximum bonus amount for which the Executive will be eligible is thirty-five percent (35%) of base salary earned for the calendar year. The Annual Bonus will be earned only after it has been granted by the Board. The Annual Bonus shall be paid to the Executive following the close of the fiscal year to which it relates, in no event later than March 15 th of the calendar year immediately following the calendar year in which it was earned. The Executive must be actively employed by the Company at the time the Board considers granting of bonuses to be eligible to receive such bonus.

c. Retention Bonus . The Executive shall be eligible to earn a retention bonus of $70,000 upon the first anniversary of the Start Date, which the Company shall advance to the Executive, less all applicable withholdings, in the first scheduled payroll following the Executive's start date with the Company. A condition precedent to the Executive's earning the retention bonus is the occurrence of the first anniversary of the Start Date without (i) the Executive having terminated his employment with the Company, other than for Good Reason (defined at paragraph 4.b. below), or (ii) the Company having terminated the Executive for Cause (defined at paragraph 4.c. below). If the Executive does not meet this condition precedent, the Executive shall return to the Company the full amount of the advanced retention bonus.

d. Stock/Stock Options . The Executive will receive, pursuant to the Company's 2010 Employee, Director and Consultant Equity Incentive Plan (the "Plan"), incentive stock option grants (the "ISO Grants") to purchase in total up to 230,000 shares of Common Stock at an exercise price equal to the fair market value of each share on the date of grant as determined by the Board in its sole discretion. The first ISO Grant will be for 115,000 shares of Common Stock and shall vest in accordance with the following schedule: 25% of the shares underlying the first ISO Grant will vest on the twelve (12) month anniversary of Executive's Start Date with the Company and the remaining shares will vest and become exercisable on a pro rata, monthly basis, over the subsequent 36 months, beginning with the month after the twelve (12) month anniversary of the Start Date. The second ISO Grant will be for 115,000 shares of Common Stock and shall vest based on the following milestones: 50% of the shares underlying the second ISO grant will vest upon approval of an IND for DCR-PH1 with DCR-PH1 material ready to dose, and 50% upon initiation of a DCR-PH1 pivotal trial, or designation as pivotal of an on- going trial (such as would trigger a milestone payment to Tekmira Pharmaceuticals under the Dicerna-Tekmira Agreement dated November 17, 2014). Vesting of the ISO Grants will be subject to Executive's continued status as a service provider with the Company at each such vesting period. The ISO Grants will be subject to the terms of the Plan and a Stock Option Agreement that the Company and Executive will be required to execute (the "Option Agreement"). The ISO Grants will fully accelerate upon Change of Control of the Company as defined in herein.

e. Benefits . During his employment with the Company, the Executive shall be entitled to participate in all employee benefit plans and programs, including paid sick leave and holidays, life insurance, disability, medical, dental, and retirement savings plans, to the same extent generally available to senior executives of the Company, in accordance with the terms of those plans and programs. The Executive shall be permitted up to four weeks of paid vacation per year, which will accrue on a monthly basis. The Executive will not be allowed to accumulate more than three weeks of unused vacation days at any given time. The Executive may carry over a maximum of five unused vacation days from one calendar year to the next.

f. Expenses . The Company agrees to reimburse the Executive for reasonable out-of-pocket expenses incurred in connection with Company business and within standards to be established by the Board from time to time, including, without limitation, travel and accommodations for authorized business trips, provided vouchers therefore, or other supporting

information as the Company may reasonably require, are presented to the Company. All reimbursements provided under this Agreement shall be made or provided in accordance with the requirements of Section 409A of the Internal Revenue Code and the rules and regulations thereunder ("Section 409A") including, where applicable, the requirement that (i) any reimbursement is for expenses incurred during the Executive's lifetime (or during a shorter period of time specified in this Agreement); (ii) the amount of expenses eligible for reimbursement during a calendar year may not affect the expenses eligible for reimbursement in any other calendar year; (iii) the reimbursement of an eligible expense shall be made no later than the last day of the calendar year following the year in which the expense is incurred; and (iv) the right to reimbursement or in kind benefits is not subject to liquidation or exchange for another benefit.

4. Termination

a. Rights and Duties. The Executive is an employee "at will." Accordingly, the Company or the Executive may terminate his employment, at any time with or without cause, for any lawful reason, or no reason. The Executive and the Company agree that, without modifying or altering the Executive's "at will" status, each will provide the other with at least thirty (30) days' prior written notice of termination of the Executive's employment with the Company. If the Executive gives notice of termination, except in the case of a termination by the Executive for "Good Reason" as set forth below, such notice will be deemed a voluntary resignation by the Executive and the Company, in its sole discretion, may elect to relieve the Executive of any obligation to perform duties during the notice period, waive the notice period and immediately accept termination of the Executive's employment, without changing the status of such termination as a voluntary resignation by the Executive. Should the Company in the event of a voluntary resignation decide to relieve the Executive of any obligation to perform duties during the notice period, waive the notice period and immediately accept termination of the Executive's employment, it shall nonetheless continue his compensation and benefits for the term of the notice period, except that no bonus shall be earned or awarded during and after the notice period.

b. Termination for "Good Reason." The Executive may terminate his employment at any time for "Good Reason." "Good Reason" shall comport with the requirements of Regulation §1.409A-1(n)(ii) and shall mean:

i. A material diminution in the Executive's authority, duties or responsibilities, as defined above in Section 2;

ii. A material diminution by the Company of the Executive's annual base compensation then in effect, except a material diminution generally affecting the members of the Company's management;

iii. Any action or inaction by the Company that constitutes a material breach by the Company of the terms of this Agreement; or

iv. A requirement that the Executive be based more than 50 miles from the offices at which he was principally employed immediately prior to the date of termination.

The parties acknowledge and agree that "Good Reason" shall not be deemed to have occurred unless: (1) the Executive provides the Company with written notice that he intends to terminate his employment hereunder for one of the Good Reason grounds set forth in Section 4.b. within sixty (60) days of the initial occurrence of such ground, with such notice containing a description of such ground, (2) if such Good Reason ground is capable of being cured, the Company has failed to cure such ground within a period of thirty (30) days from the date of such written notice, and (3) the Executive terminates his employment within ninety-one (91) days from the date that such Good Reason ground first occurs. For purposes of clarification, the above-listed conditions shall apply separately to each occurrence of a Good Reason ground, and failure to adhere to such conditions in the event of the occurrence of grounds that would otherwise have constituted Good Reason had the conditions herein been satisfied shall not disqualify the Executive from asserting and satisfying the conditions for Good Reason for any subsequent occurrence that may constitute Good Reason.

c. Termination by the Company for Cause. The Company may terminate the Executive's employment at any time for "Cause." "Cause" shall mean:

i. The Executive's commission of an act of fraud, dishonesty, breach of fiduciary duty or misappropriation which may or does adversely affect the Company;

ii. The Executive's conviction or plea of guilty or *nolo contendere* to or engaging in any felony or crime involving moral turpitude, fraud, misrepresentation or other crime and/or indictment for a crime that, in the reasonable and good faith opinion of the Company, affects the Executive's ability to perform the duties set forth in this Agreement and/or reflects negatively upon the Company;

iii. Unauthorized disclosure by the Executive of the Company's Proprietary Information, as defined in the Nondisclosure Agreement (as defined in Section 5 below) which results or could have been reasonably foreseen to result, in a material financial loss to the Company; or

iv. The Executive's material breach of this Agreement or the Nondisclosure Agreement. If such breach is reasonably possible of being cured in the reasonable and good faith opinion of the Company, then the Executive will be given thirty (30) days after written notice from the Company of such breach to cure.

v. The Executive's failure (which shall not include any Disability as defined below) or refusal to perform the duties and responsibilities of his employment and/or to follow the policies and procedures of the Company, including without limitation the failure or refusal to carry out lawful instructions from the Board. If such failure or refusal is reasonably possible of being cured in the reasonable and good faith opinion of the Company, then the Executive will be given thirty (30) days after written notice from the Company of such failure or refusal to cure.

d. Termination in the Event of Death or Disability. The Agreement shall terminate upon the Executive's death or Disability, and the Executive's employment with the Company shall

thereupon terminate. For purposes of the Agreement, "Disability" is defined as any illness, injury, accident or condition of either a physical or psychological nature as a result of which the Executive is unable to perform the essential functions of his duties and responsibilities hereunder for 90 days during any period of 365 consecutive calendar days or for any consecutive 90-day period.

e. Effect of Termination.

i. If the Executive is terminated by the Company for Cause, or by the Executive voluntarily other than for Good Reason, then the Executive will only be entitled to payment when due of any unpaid base salary, expense reimbursements, and vacation days accrued prior to termination of employment.

ii. If the Executive's employment is terminated by the Company other than for Cause, or by the Company due to the Executive's Disability, or by the Executive for Good Reason (each of which will be deemed an involuntary termination), then the Executive will be entitled to payment when due of any unpaid base salary, expense reimbursements, and vacation days accrued prior to termination of employment and, in exchange for the Executive's execution of a separation agreement and general release provided by the Company and expressly subject to the conditions described in Section 4.e.v. below, the following:

a) Continuation of the Executive's base salary at the rate in effect as of the day immediately preceding his date of termination for a six (6) month period, payable in accordance with the Company's regular payroll practices, less applicable withholdings, commencing at the conclusion of the Review Period (as described below), *provided* that the first installment of such payments shall include all amounts which would have been paid during the period between the Executive's date of termination and the date of such first installment; and

b) The Executive shall be eligible to continue health benefits pursuant to COBRA or the appropriate state equivalent. If the Executive is eligible for and properly elects continuation of such coverage during the permissible time frame, the Company will pay the premiums for such group health insurance coverage for the shorter of (i) six (6) months or (ii) until the Executive becomes eligible for health benefits through another employer or otherwise. After the shorter period, the Executive will be responsible for premium payments for continuation of such group health insurance coverage.

iii. If the Agreement is terminated because of the Executive's death, the Company shall pay to the estate of the Executive the salary and benefits which would otherwise have been payable to the Executive up to the date of termination of his employment because of death.

iv. In the event a Change of Control (as defined below) occurs and, if within one (1) year thereafter, the Executive's employment is terminated by the Company other than for Cause, or by the Company due to the Executive's Disability, or by the Executive

for Good Reason (each of which will be deemed an involuntary termination), then the Executive will be entitled to payment when due of any unpaid base salary, expense reimbursements, and vacation days accrued prior to termination of employment and, in exchange for the Executive's execution of a separation agreement and general release provided by the Company and expressly subject to the conditions described in Section 4.e.v. below, the following:

a) A lump sum payment equal to one (1) year of the Executive's base salary at the rate in effect as of the day immediately preceding his date of termination, less applicable withholdings, commencing at the conclusion of the Review Period (as described below); and

b) The Executive shall be eligible to continue health benefits pursuant to COBRA or the appropriate state equivalent. If the Executive is eligible for and properly elects continuation of such coverage during the permissible time frame, the Company will pay the premiums for such group health insurance coverage for the shorter of (i) twelve (12) months or (ii) until the Executive becomes eligible for health benefits through another employer or otherwise. After the shorter period, the Executive will be responsible for premium payments for continuation of such group health insurance coverage.

For purposes of this Agreement, "Change of Control" means (A) the occurrence of a merger or consolidation of the Company whether or not approved by the Board, other than (i) a merger or consolidation which would result in the voting securities of the Company outstanding immediately prior thereto continuing to represent (either by remaining outstanding or by being converted into voting securities of the surviving entity or the parent of such corporation) at least 50% of the total voting power represented by the voting securities of the Company or such surviving entity or parent of such corporation outstanding immediately after such merger or consolidation, or (ii) a merger or consolidation which is in effect a financing transaction for the Company, including, but not limited to, a reverse merger of the Company into a publicly traded "shell" company, or (B) the stockholders of the Company approve an agreement for the sale or disposition by the Company of all or substantially all of the Company's assets, provided that, in any case, "Change of Control" shall be in accordance with Regulation §1.409A-3(i)(5)(v).

v. Payment of the severance pay and benefits described in Section 4.e.ii. or 4.e.iv., as applicable, is expressly conditioned on the Executive's execution without revocation of the separation agreement and general release described therein, and will commence immediately following a sixty (60) day period following the effective date of the Executive's separation from service from the Company (the "Review Period"). The separation agreement and general release will be provided to the Executive on or before the fifth (5 th) day following such separation from service. If the Executive fails or refuses to return such agreement within the Review Period, the applicable severance payments and benefits will be forfeited. If the Executive is eligible for the severance pay and benefits described in Section 4.e.ii., then he shall not be eligible for and shall not receive the severance pay and benefits described in Section 4.e.iv. Similarly, if the Executive is eligible for the severance pay and benefits described in Section 4.e.iv., then he shall not be eligible for and shall not receive the severance pay and benefits described in Section 4.e.ii.

5. Nondisclosure, Noncompetition, Nonsolicitation and Inventions. As a condition of the Executive's employment by the Company and the payment of compensation and receipt of benefits referred to above, the Executive agrees to execute the attached standard Employee Nondisclosure, Noncompetition, Nonsolicitation and Inventions Agreement, in the form attached hereto as Exhibit A (the "Nondisclosure Agreement"). The Executive acknowledges that the Company would not offer him employment or provide compensation and/or benefits set forth above if he was not willing to be bound by the terms of such Agreement.

6. Notice.

a. To the Company . The Executive will send all communications to the Company in writing, addressed as follows (or in any other manner the Company notifies him to use):

Douglas M. Fambrough, Ph.D.
President and CEO
Dicerna Pharmaceuticals, Inc.
480 Arsenal Street
Building 1, Suite 120
Watertown, MA 02472

With a copy to: Sam Zucker
Sidley and Austin LLP
1001 Page Mill Rd, Building 1
Palo Alto, CA 94304

b. To the Executive . All communications from the Company to the Executive relating to this Agreement shall be sent to the Executive in writing, addressed as follows (or in any other manner he notifies the Company to use):

Theodore T. Ashburn
1688 WASHINGTON STREET, NUMBER ONE,
BOSTON, MA 02118-3318

With a copy to: _____
_____
_____

c. Time Notice Deemed Given . Notice shall be deemed to have been given when delivered or, if earlier (1) three business days after mailing by United States certified or registered mail, return receipt requested, postage prepaid, or (2) faxed with confirmation of delivery, in either case, addressed as required in this section.

7. Amendment . No provisions of this Agreement may be modified, waived, or discharged except by a written document signed by a Company officer duly authorized by the

Board and the Executive. A waiver of any conditions or provisions of this Agreement in a given instance shall not be deemed a waiver of such conditions or provisions at any other time in the future.

8. Choice of Law; Forum Selection . The validity, interpretation, construction, and performance of this Agreement shall be governed by the laws of the Commonwealth of Massachusetts without regard to its conflicts of laws principles. Any claims or legal actions by one party against the other regarding this Agreement shall be commenced and maintained exclusively in any state or federal court located in the Commonwealth of Massachusetts, and the parties hereby submit to the jurisdiction and venue of any such court.

9. Successors . This Agreement shall be binding upon, and shall inure to the benefit of, the Executive and his estate, but the Executive may not assign or pledge this Agreement or any rights arising under it. Without the Executive's consent, the Company may assign this Agreement to any affiliate or to a successor to substantially all the business and assets of the Company.

10. Taxes; Code Sections 409A and 280G .

a. The Company shall withhold taxes from payments it makes pursuant to this Agreement as it reasonably determines to be required by applicable law.

b. If the benefits set forth in Section 4.e. of this Agreement constitute "non-qualified deferred compensation" subject to Section 409A, then the following conditions apply to the payment of such benefits:

i. Any termination of the Executive's employment triggering payment of benefits under Section 4.e. must constitute a "separation from service" under Section 409A(a)(2)(A)(i) of the Code and Treas. Reg. §1.409A-1(h) before distribution of such benefits can commence. To the extent that the termination of the Executive's employment does not constitute a separation of service under Section 409A(a)(2)(A)(i) of the Code and Treas. Reg. §1.409A-1(h) (as the result of further services that are reasonably anticipated to be provided by the Executive to the Company at the time the Executive's employment terminates), any benefits payable under Section 4.e. that constitute non-qualified deferred compensation under Section 409A shall be delayed until after the date of a subsequent event constituting a separation of service under Section 409A(a)(2)(A)(i) of the Code and Treas. Reg. §1.409A-1(h). For purposes of clarification, this Section shall not cause any forfeiture of benefits on the Executive's part, but shall only act as a delay until such time as a "separation from service" occurs.

ii. If the Executive is a "specified employee" (as that term is used in Section 409A and regulations and other guidance issued thereunder) on the date his separation from service becomes effective, any benefits payable under Section 4.e. that constitute non-qualified deferred compensation subject to Section 409A shall be delayed until the earlier of: (A) the business day following the six-month anniversary of the date his separation from service becomes effective, or (B) the date of the Executive's death, but only to the extent necessary to avoid the adverse tax consequences and penalties under

Section 409A. On the earlier of: (A) the business day following the six-month anniversary of the date his separation from service becomes effective, or (B) the Executive's death, the Company shall pay the Executive in a lump sum the aggregate value of the non-qualified deferred compensation that the Company otherwise would have paid the Executive prior to that date under Section 4.e.

iii. It is intended that each installment of the payments and benefits provided under Section 4.e. shall be treated as a separate "payment" for purposes of Section 409A.

iv. Neither the Company nor the Executive shall have the right to accelerate or defer the delivery of any such payments or benefits except to the extent specifically permitted or required by Section 409A.

c. Notwithstanding any other provision of this Agreement to the contrary, in the event of any ambiguity in the terms of this Agreement, such term(s) shall be interpreted and at all times administered in a manner that avoids the inclusion of compensation in income under Section 409A, or the payment of increased taxes, excise taxes or other penalties under Section 409A.

d. The parties intend this Agreement to be in compliance with Section 409A. Executive acknowledges and agrees that Company does not guarantee the tax treatment or tax consequences associated with any payment or benefit arising under this Agreement, including but not limited to consequences related to Section 409A.

e. If any payment or benefit the Executive would receive under this Agreement, when combined with any other payment or benefit Executive receives pursuant to a Change of Control (for purposes of this section, a "Payment") would: (i) constitute a "parachute payment" within the meaning of Section 280G the Code; and (ii) but for this sentence, be subject to the excise tax imposed by Section 4999 of the Code (the "Excise Tax"), then such Payment shall be either: (A) the full amount of such Payment; or (B) such lesser amount (with cash payments being reduced before stock option compensation) as would result in no portion of the Payment being subject to the Excise Tax, whichever of the foregoing amounts, taking into account the applicable federal, state and local employments taxes, income taxes, and the Excise Tax, results in Executive's receipt, on an after-tax basis, of the greater amount of the Payment notwithstanding that all or some portion of the Payment may be subject to the Excise Tax.

11. Validity . The invalidity or unenforceability of any provision of this Agreement shall not affect the validity or enforceability of any other provision of this Agreement, which shall remain in full force and effect.

12. Counterparts . This Agreement may be executed in one or more counterparts, each of which shall be deemed to be an original but all of which together shall constitute the same instrument.

13. Entire Agreement; Prior Agreements . This Agreement, the Stock Option Agreement and the Nondisclosure Agreement, constitutes the entire agreement among the parties with respect to the subject matter hereof and, unless otherwise provided herein, supersedes all prior agreements, negotiations or understandings, written or oral in respect thereof.

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DICERNA PHARMACEUTICALS, INC.

Date: November 22, 2014 /s/ Douglas Fambrough

Theodore T. Ashburn

Date: November 22, 2014 /s/ Theodore T. Ashburn

EXHIBIT A
NONDISCLOSURE, NONCOMPETITION, NONSOLICITATION AND INVENTIONS AGREEMENT

This Nondisclosure, Noncompetition and Assignment Agreement (the "Agreement") is made by and between Dicerna Pharmaceuticals, Inc., a Delaware corporation (the "Company"), and Theodore T. Ashburn (the "Employee"), as of December 15, 2014.

The Employee acknowledges that his employment or the continuance of that employment with the Company is contingent upon his agreement to sign and adhere to the provisions of this Agreement. In consideration of the employment or continued employment of the Employee by the Company, the Employee and the Company agree as follows:

1. **Duty to Devote Efforts** . The Employee understands that his employment with the Company requires his undivided attention and effort during normal business hours and excluding periods of vacation and sick leave to which he is entitled. As a result, during his employment with the Company, he shall not engage in any other employment, occupation, consulting or other activity that conflicts with his/her obligations to the Company, whether directly related to the business in which the Company is involved during the term of his employment with the Company or otherwise. For the avoidance of doubt, the Employee may engage in charitable, civic and educational activities and community affairs, provided that any such activities and affairs do not, in the aggregate, materially interfere with the proper performance of the Employee's duties and responsibilities to the Company.

2. **Noncompetition** . The Employee recognizes and agrees that the Company will suffer irreparable harm in the event that the Employee enters into competition with the Company, either during or following the Employee's employment with the Company. Therefore, the Employee agrees that while the Employee is employed by the Company and for a period of one year following the termination or cessation of such employment (the "Restricted Period"), regardless of the reasons, the Employee shall not, directly or indirectly, alone or as a consultant, partner, officer, director, employee, joint venturer, lender or stockholder, or in any other capacity whatsoever, of any entity, (a) accept employment with any business or entity that is in competition with the products or services being conceived, designed, created, developed, manufactured, marketed, distributed or sold by the Company, *provided* that nothing contained in this subsection (a) will prevent the Employee from being employed by a subsidiary, division, affiliate or unit (each, a "Unit") of an entity if that Unit is not engaged in any business which is in competition with the products or services being conceived, designed, created, developed, manufactured, marketed, distributed or sold by the Company, irrespective of whether some other Unit of such entity engages in such competition; (b) engage in or undertake any business operations of conceiving, designing, creating, developing, manufacturing, marketing, distributing selling or rendering (or assisting any other person in conceiving, designing, creating, developing, manufacturing, marketing, distributing selling or rendering) products or services that are in competition with the products or services being conceived, designed, created, developed, manufactured, marketed, distributed, sold or rendered by the Company or (c) invest in or assist in any manner any business which directly or indirectly competes with the business or future business plans of the Company, except that he may

own up to one percent (1%) of the outstanding securities of any corporation having a class of equity securities actively traded on a national securities exchange or on the NASDAQ Stock Market. A business or entity shall be deemed to be in competition with the products or services being conceived, designed, created, developed, manufactured, marketed, distributed, sold or rendered by the Company if it is in the business of development, manufacture, license, sale and distribution of RNAi-based therapeutic and diagnostic products (including, but not limited to, DsiRNA technology). The geographic scope of this Section 2 shall extend to anywhere the Company is doing business, has done business or intends to do business. The Employee acknowledges and agrees that if he violates any of the provisions of this Section 2, the Restricted Period will be extended from the date of termination of employment for a period equal to any period during which he engages in such violation(s), whether such period is during the pendency of litigation or otherwise.

3. **Nonsolicitation of Customers** . The Employee recognizes and agrees that the clients, customers and accounts of the Company, which the Company now or hereafter services during the Employee's employment with the Company, and all prospective clients, customers and accounts from whom the Employee has solicited business while in the employ of the Company, shall be solely the clients, customers and accounts of the Company. Therefore, the Employee agrees that while the Employee is employed by the Company and for a period of one (1) year following the termination or cessation of such employment, regardless of the reasons, the Employee shall not, directly or indirectly, alone or as a consultant, partner, officer, director, employee, joint venturer, lender or stockholder, or in any other capacity whatsoever, of any entity, solicit, divert or take away, attempt to divert or to take away, any client, customer or account of the Company, or any potential client, customer or account of the Company which were contacted, solicited or served by the Employee while employed by the Company or about whom the Employee obtained or became familiar with through Confidential Information (as defined in Section 5). The geographic scope of this Section 3 shall extend to anywhere the Company is doing business, has done business or intends to do business.

4. **Nonsolicitation of Employees** . The Employee recognizes and agrees that the Company has invested substantial resources and effort in assembling its present staff and personnel. Therefore, the Employee agrees that while the Employee is employed by the Company and for a period of one (1) year following the termination or cessation of such employment, regardless of the reasons, the Employee shall not, directly or indirectly: (i) recruit, solicit or hire any employee of the Company; or (ii) induce or attempt to induce any employee of the Company to terminate his employment with, or otherwise cease his/her relationship or engagement with, the Company.

5. **Nondisclosure** . The Employee agrees that all Confidential Information (as defined below), whether or not disclosed orally or in writing, is and shall be the exclusive property of the Company. The Employee shall not at any time, whether during or after the termination or cessation of his employment, without written authorization of the Chief Executive Officer of the Company, unless and until the Confidential Information has become public knowledge without fault by the Employee, (a) reveal any Confidential Information to any person or entity, except to employees of the Company who need to know such Confidential Information for the purposes of their employment, (b) use or attempt to use any Confidential Information for any purposes (other

than in the ordinary course of performing his duties as an employee of the Company), or (c) use any Confidential Information in any manner which may injure or cause loss or may be calculated to injure or cause loss to the Company, whether directly or indirectly. The term "Confidential Information" shall include any information concerning the organization, business, business relationships or finances of the Company or of any third party which the Company is under an obligation to keep confidential or that is maintained by the Company as confidential. Such Confidential Information shall include, but is not limited to, trade secrets or confidential information respecting inventions, products, designs, methods, know-how, techniques, systems, processes, specifications, blueprints, engineering data, software programs, works of authorship, clinical testing programs, marketing material, customer lists, customer information, financial information, pricing information, personnel information, business plans or strategy, projects, plans and proposals.

6. **Company Property** .

a. The Employee agrees that Company Property (as defined below) shall be and is the exclusive property of the Company to be used by the Employee only in the performance of his duties for the Company and further agrees that during his employment with the Company, or after the termination or cessation of such employment, he shall not make, use or permit to be used any Company Property otherwise than for the benefit of the Company. All such Company Property or copies thereof and all tangible property of the Company in the custody or possession of the Employee shall be delivered to the Company, upon the earlier of (i) a request by the Company or (ii) upon the termination or cessation of the Employee's employment. After such delivery, the Employee shall not retain any such Company Property or copies thereof or any other tangible property. The term "Company Property" shall include all files, letters, notes, memoranda, reports, lists, records, drawings, sketches, laboratory notebooks, specifications, software programs, software code, data, computers, cellular telephones, pagers, credit and/or calling cards, keys, access cards, documentation or other materials of any nature and in any form, whether written, photographic, printed, electronic or in digital format or otherwise, relating to any matter within the scope of the business of the Company or concerning any of its dealings or affairs and any other Company property in Employee's possession, custody or control.

b. The Employee agrees that his obligation not to disclose or to use information and materials of the types set forth in Section 6(a) above, and his obligation to return materials and tangible property, set forth in Section 6(a) above, also extends to such types of information, materials and tangible property of clients, customers and accounts of the Company or suppliers to the Company or other third parties who may have disclosed or entrusted the same to the Company or to the Employee.

7. **Assignment of Developments** .

a. If at any time or times during Employee's employment with the Company or prior to the Employee's employment with the Company when working with, for, or on behalf of the Company in a capacity other than as an employee, he did or shall (either alone or with others) make, conceive, create, discover, invent or reduce to practice, whether or not during normal working hours or on the premises of the Company, any Development that (i) relates to the business

of the Company or any customer of or supplier to the Company or any of the products or services being developed, manufactured or sold by the Company or which may be used in relation therewith; (ii) results from tasks assigned to the Employee by the Company; or (iii) results from the use of premises or personal property (whether tangible or intangible) owned, leased or contracted for or by the Company, then all such Developments and the benefits thereof are and shall immediately become the sole and absolute property of the Company and its assigns, as works made for hire or otherwise. The term "Development" shall mean any invention, modification, discovery, design, development, improvement, process, software program, work of authorship, documentation, formula, data, technique, know-how, trade secret or intellectual property right whatsoever or any interest therein (whether or not patentable or registrable under copyright, trademark or similar statutes). The Employee shall fully and promptly disclose to the Company (or any persons designated by it) each such Development. To the extent not already owned by the Company, the Employee agrees to assign and does hereby assign to the Company (or any person or entity designated by the Company) all his right, title and interest (including, but not limited to, rights to inventions, patentable subject matter, copyrights and trademarks) in and to the Developments and all benefits and/or rights resulting therefrom to the Company and its assigns without further compensation and shall communicate, without cost or delay, and without disclosing to others the same, all available information relating thereto (with all necessary plans and models) to the Company. The Employee also hereby waives all claims to moral rights in any Developments.

b. Excluded Developments. This Section 7 shall not apply to Developments which do not relate to the present or planned business or research and development of the Company and which are made and conceived by the Employee not during normal working hours, not on the Company's premises and not using the Company's tools, devices, equipment or Confidential Information, but shall apply to past Developments, including Developments made prior to the Employee's employment as an employee. The Employee represents that the Developments identified in the Appendix, if any, attached hereto comprise the complete list of all the Developments that the Employee has made or conceived or otherwise claimed ownership prior to his employment by the Company, which Developments are excluded from this Agreement. The Employee understands that it is only necessary to list the title of such Developments and the purpose thereof but not details of the Development itself. IF THERE ARE ANY SUCH DEVELOPMENTS TO BE EXCLUDED, THE UNDERSIGNED SHOULD INITIAL HERE; OTHERWISE IT WILL BE DEEMED THAT THERE ARE NO SUCH EXCLUSIONS.

8. **Further Assurances** . The Employee agrees to cooperate fully with the Company, both during and after his employment with the Company, with respect to the procurement, maintenance and enforcement of copyrights, patents and other intellectual property rights (both in the United States and foreign countries) relating to Developments. The Employee shall, during his employment and at any time thereafter, at the request and cost of the Company, promptly sign, execute, make and do all such deeds, documents, acts and things as the Company and its duly authorized officers may reasonably require:

a. to apply for, obtain, register and vest in the name of the Company alone (unless the Company otherwise directs) patents, copyrights, trademarks or other analogous protection in any country throughout the world relating to a Development and when so obtained or vested to renew and restore the same; and

b. to defend any judicial, opposition or other proceedings in respect of such applications and any judicial, opposition or other proceeding, petition or application for revocation of any such patent, copyright, trademark or other analogous protection.

The Employee further agrees that if the Company is unable, after reasonable effort, to secure the Employee's signature on any such papers, application for patent, copyright, trademark or other analogous protection, or other documents regarding any legal protection relating to a Development, whether because of the Employee's physical or mental incapacity or for any other reason whatsoever, the Employee hereby irrevocably designates and appoints the Company and its duly authorized officers and agents as the Employee's agent and attorney-in-fact, to act for and on his behalf and stead to execute and file any such papers, application or applications or other documents and to do any and all other lawfully permitted acts to further the prosecution and issuance of patent, copyright or trademark registrations or any other legal protection thereon with the same legal force and effect as if executed by the Employee.

9. **Employment At Will** . The Employee understands that this Agreement does not constitute an implied or written employment contract and that his employment with the Company is on an "at-will" basis. Accordingly, the Employee understands that either the Company or the Employee may terminate Employee's employment at any time, for any or no reason, with or without prior notice.

10. **Severability** . The Employee hereby agrees that each provision and the subparts of each provision herein shall be treated as separate and independent clauses, and the unenforceability of any one clause shall in no way impair the enforceability of any of the other clauses of the Agreement. Moreover, if one or more of the provisions contained in this Agreement shall for any reason be held to be excessively broad as to scope, activity, subject or otherwise so as to be unenforceable at law, such provision or provisions shall be construed by the appropriate judicial body by limiting or reducing it or them, so as to be enforceable to the maximum extent compatible with the applicable law as it shall then appear. The Employee hereby further agrees that the language of all parts of this Agreement shall in all cases be construed as a whole according to its fair meaning and not strictly for or against either of the parties.

11. **Amendments; Waiver** . Any amendment to or modification of this Agreement, or any waiver of any provision hereof, shall be in writing and signed by the Company. No delay or omission by the Company in exercising any right under this Agreement or any waiver by the Company of a breach of any provision of this Agreement shall not operate or be construed as a waiver of that right or any subsequent breach of such provision or any other provision hereof.

12. **Survival** . This Agreement shall be effective as of the date entered below. The Employee's obligations under this Agreement shall survive the termination or cessation of his employment regardless of the manner of such termination or cessation and shall be binding upon his heirs, executors, administrators and legal representatives.

13. **Assignment** . The term “Company” shall include Dicerna Pharmaceuticals, Inc. and any of its subsidiaries, divisions, or affiliates. The Company shall have the right to assign this Agreement to its successors and assigns, and all covenants and agreements hereunder shall inure to the benefit of and be enforceable by said successors or assigns. The Employee may not assign this Agreement.

14. **Representations** .

a. The Employee hereby represents that, except as the Employee has disclosed in writing to the Company, the Employee is not bound by the terms of any agreement with any previous employer or other party to refrain from using or disclosing any trade secret or confidential or proprietary information in the course of his employment with the Company or to refrain from competing, directly or indirectly, with the business of such previous employer or any other party. The Employee further represents that his performance of all the terms of this Agreement and as an employee of the Company does not and will not breach any agreement to keep in confidence proprietary information, knowledge or data acquired by the Employee in confidence or in trust prior to his employment with the Company, and the Employee will not disclose to the Company or induce the Company to use any confidential or proprietary information or material belonging to any previous employer or others. The Employee further represents that he has returned all property and confidential information belonging to all prior employers. To the extent that Employee has retained any non-confidential and non-proprietary materials and documents of a prior employer, such materials and documents have been disclosed in writing to the Company.

b. The Employee hereby represents that his employment with the Company, the execution of this Agreement and his performance of all of the terms of this Agreement do not and will not conflict with or breach the terms of any other agreement by which the Employee is bound (including, but not limited to, to keeping in confidence proprietary information acquired by the Employee in confidence or in trust prior to his employment by the Company). The Employee further represents that he shall not enter into any agreement, either written or oral, in conflict herewith.

c. The restrictions contained in this Agreement are necessary for the protection of the business and goodwill of the Company and are considered by the Employee to be reasonable for such purpose. The Employee agrees that any breach of this Agreement by him/her is likely to cause substantial and irreparable damage to the Company and that in the event of such breach the Company shall have, in addition to any and all remedies of law, the right to an injunction, specific performance or other equitable relief to prevent the violation of the Employee’s obligations hereunder. The Company may apply for such injunctive relief in any court of competent jurisdiction without the necessity of posting any bond or other security.

15. **Governing Law; Forum Selection Clause** . This Agreement and any claims arising out of this Agreement (or any other claims arising out of the relationship between the parties) shall be governed by and construed in accordance with the laws of the Commonwealth of Massachusetts, without application of the conflict of laws principles thereof. Any claims or legal actions by one party against the other shall be commenced and maintained exclusively in any state or federal court located in the Commonwealth of Massachusetts, and the parties hereby submit to the exclusive jurisdiction and venue of any such court.

16. **Entire Agreement** . This Agreement and the parties' Employment Agreement set forth the complete, sole and entire agreement between the parties on the subject matter herein and supersedes any and all other agreements, negotiations, discussions, proposals, or understandings, whether oral or written, previously entered into, discussed or considered by the parties. The Employee agrees that any change or changes in his duties, salary or compensation after the signing of this Agreement shall not affect the validity or scope of this Agreement.

THE EMPLOYEE ACKNOWLEDGES THAT HE HAS CAREFULLY READ THIS AGREEMENT AND UNDERSTANDS AND AGREES TO ALL OF THE PROVISIONS IN THIS AGREEMENT.

IN WITNESS WHEREOF, the undersigned has executed this Agreement as a sealed instrument as of the 15 th day of December, 2014.

Signature: /s/ Theodore T. Ashburn

Name: Theodore T. Ashburn

ACKNOWLEDGED BY:

DICERNA PHARMACEUTICALS, INC.

By: /s/ Douglas Fambrough

Name: Douglas Fambrough

Title: CEO & President

Exhibit 10.28

EXECUTION VERSION

LICENSE AGREEMENT

by and between

DICERNA PHARMACEUTICALS, INC.,

on the one hand,

and

PROTIVA BIOTHERAPEUTICS INC.

and

TEKMIRA PHARMACEUTICALS CORPORATION

on the other hand

Dated: November 16, 2014

THE COMPANY HAS REQUESTED AN ORDER FROM THE SECURITIES AND EXCHANGE COMMISSION (THE "COMMISSION") PURSUANT TO RULE 406 UNDER THE SECURITIES ACT OF 1933, AS AMENDED, GRANTING CONFIDENTIAL TREATMENT TO SELECTED PORTIONS. ACCORDINGLY, THE CONFIDENTIAL PORTIONS HAVE BEEN OMITTED FROM THIS EXHIBIT, AND HAVE BEEN FILED SEPARATELY WITH THE COMMISSION. OMITTED PORTIONS ARE INDICATED IN THIS EXHIBIT WITH "*****".

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

LICENSE AGREEMENT

This LICENSE AGREEMENT (this " Agreement ") is entered into as of November 16, 2014 (the " Effective Date "), by and between Dicerna Pharmaceuticals, Inc., a Delaware corporation with offices at 480 Arsenal Street, Building 1, Suite 120, Watertown, MA 02472 USA and its Affiliates (" Dicerna "), on the one hand, and Protiva Biotherapeutics Inc., a British Columbia corporation with a principal place of business at 100-8900 Glenlyon Parkway, Burnaby, B.C., Canada V5J 5J8 (" Protiva "), and Tekmira Pharmaceuticals Corporation, a British Columbia corporation with a principal place of business at 100-8900 Glenlyon Parkway, Burnaby, B.C., Canada V5J 5J8 (" Tekmira "), on the other hand.

RECITALS

WHEREAS, Protiva and its Affiliates (as defined below) possess, and develop and improve from time to time Protiva Patents and LNP Technology (each as defined below);

WHEREAS, Dicerna possesses and develops and improves from time to time intellectual property relating to Dicerna Material (as defined below);

WHEREAS, pursuant to a Material Transfer Agreement, dated August 13, 2014, among Dicerna, Protiva and Tekmira (the " MTA "), the parties performed certain studies in order to determine the potential utility of the Licensed Intellectual Property (as defined below) as it relates to the Product (as defined below) as the basis of this Agreement, with the intent to provide for further studies and activities to formulate, develop for regulatory approval, and commercialize one or more products;

WHEREAS, the Parties are, contemporaneously herewith, entering into a Supply Agreement, pursuant to which Protiva shall Manufacture and supply to Dicerna the Product for certain purposes in accordance with the terms set forth therein;

WHEREAS, Protiva desires to grant Dicerna licenses to the Protiva Intellectual Property (as defined below) to Develop, Manufacture and Commercialize (each as defined below) Products directed to treatment of PH1 upon the terms and subject to the conditions set forth in this Agreement;

WHEREAS, Tekmira desires to grant Dicerna licenses to the Tekmira Patents (as defined below) to Develop, Manufacture and Commercialize Products directed to treatment of PH1 upon the terms and subject to the conditions set forth in this Agreement; and

WHEREAS, Tekmira is the parent of Protiva and is willing to guarantee Protiva's performance under this Agreement, upon the terms and subject to the conditions set forth in this Agreement.

NOW, THEREFORE, in consideration of the mutual covenants contained herein, and other good and valuable consideration, the receipt of which is hereby acknowledged, Dicerna and Protiva enter into this Agreement effective as of the Effective Date:

ARTICLE I – DEFINITIONS

1.1 General . When used in this Agreement, each of the following terms, whether used in the singular or plural, shall have the meanings set forth in this Article I.

" Affiliate " means, with respect to a Person, any corporation, company, partnership, joint venture or firm which controls, is controlled by, or is under common control with such Person. For purposes of the foregoing sentence, "control" means (a) in the case of corporate entities, direct or indirect ownership of at least fifty percent (50%) of the stock or shares having the right to vote for the election of directors, or (b) in the case of non-corporate entities, direct or indirect ownership of at least fifty percent (50%) of the equity interest with the power to direct the management and policies of such non-corporate entities.

" Agreement " has the meaning set forth in the introductory paragraph.

" Applicable Laws " means all applicable laws, statutes, rules, regulations, guidelines, guidances, ordinances, orders, decrees, writs, judicial or administrative decisions and the like of any nation or government, any state or other political subdivision thereof, any entity exercising executive, judicial, regulatory or administrative functions of or pertaining to government (including any Governmental Authority), any tribunal or arbitrator of competent jurisdiction, and any trade organization whose regulations have the force of law.

" Arbitrators " has the meaning set forth in Section 9.7(b).

" CMO " means a contract manufacturing organization.

" Code " has the meaning set forth in Section 2.4(b).

" Commercialize " or " Commercialization " means, excluding Manufacturing, any and all activities directed to marketing, promoting, distributing, importing, having imported, exporting, having exported, selling and having sold products and services, including, subject to the terms of this Agreement, having Third Parties conduct such activities on behalf of the Person receiving the rights to Commercialize.

" Commercially Reasonable Efforts " means the efforts and resources that would reasonably be used (including the promptness with which such efforts and resources would be applied) by a similarly sized company within the biopharmaceutical industry for the pharmaceutical or clinical development, manufacture or commercialization of a pharmaceutical product of similar market and profit potential and at a similar stage in development or product life as compared to the Product or for the other activities to which this term applies.

" Confidential Information " means all confidential information and confidential materials, patentable or otherwise, of a Party disclosed by or on behalf of such Party to the other Party before, on or after the Effective Date in connection with the discussions and negotiations pertaining to, or in the course of performing, this Agreement, the Supply Agreement or the Quality Agreement, including the terms of such agreements, including chemical substances, equipment, data, reports, Know-How, sources of supply, patent positioning, business plans, and also each Party's proprietary and confidential information of Third Parties in possession of such Party under an obligation of confidentiality, whether or not related to making, using or selling the Product.

" Control ," " Controls " or " Controlled by " means, with respect to Licensed Intellectual Property, the possession of (whether by ownership or license, other than pursuant to this Agreement), or the ability of Protiva or Tekmira, as applicable, to grant access to, or a license or sublicense of, the Licensed Intellectual Property as provided for herein.

" Cover ," " Covers " or " Covered by " means, with respect to the Product, that, but for ownership of or a license or sublicense granted under a Valid Claim of a Protiva Patent, the Development, Manufacture, or Commercialization with respect to the Product would infringe such Patent (or, if such Patent is a patent application, would infringe a patent issued from such patent application based on the claims pending in the patent application as of the moment the determination of "Cover," "Covers," or "Covered by" is being made).

" CTA " means a Clinical Trial Application filed with the national competent authority in an EU member state for regulatory approval of a clinical trial of the Product, including all amendments and supplements to the application.

" Develop ," " Developing " or " Development " means Manufacturing and any and all activities and studies required to develop products and services for Regulatory Approval or for Commercialization, including, subject to the terms of this Agreement, having Third Parties conduct such activities and studies on behalf of the Person receiving the rights to Develop.

" Dicerna " has the meaning set forth in the Preamble.

" Dicerna Indemnitees " has the meaning set forth in Section 7.1.

" Directed to " means, in respect of any Product, the initial Development Program, the initial IND and the initial NDA submitted with a Regulatory Authority for Regulatory Approval in respect of such Product are intended for the treatment of PH1.

" Disclosing Party " means the Party that discloses its Confidential Information.

" Discover ", " Discovering " or " Discovery " means any and all research or discovery activities in respect of products and services, including, subject to the terms of this Agreement, having Third Parties conduct such activities on behalf of the Person receiving the rights to Discover.

" Dispute " has the meaning set forth in Section 9.7(b).

" DMF " means Protiva's Drug Master File(s) filed with any Regulatory Authority covering the Manufacture of Product.

" Effective Date " has the meaning set forth in the introductory paragraph.

" EMA " means the European Medicines Agency, a body of the European Union and established by Regulation (EC) No 726/2004 of the European Parliament and of the Council of March 31, 2004, or any successor agency(ies) thereof performing similar functions.

" Enforcement Costs " has the meaning set forth in Section 5.3(c)(ii)(a).

" Enforcing Party " has the meaning set forth in Section 5.3(c)(i).

" European Union " or " EU " means the European Union which, following the entry into force of the Treaty of Lisbon on December 1, 2009, replaced and succeeded the European Community established by the Treaty of Rome signed on March 15, 1957.

" Excluded Target " means *****.

" FDA " means The Food and Drug Administration of the United States Department of Health and Human Services, or any successor agency(ies) thereof performing similar functions.

" Field " means treatment, prevention or diagnosis of (i) human disease or other medical disorder and (ii) animal (excluding fish and arthropods) disease or other medical disorder; provided, however, that the term "Field" shall not include any Product directed to any Excluded Target.

" Final Inventory " has the meaning set forth in Section 8.6(b).

" First Commercial Sale " means the first *bona fide* sale of the Product to a non-Sublicensee Third Party in an arm's length transaction after Regulatory Approval in response to a submission of an NDA.

" GAAP " means United States generally accepted accounting principles as in effect from time to time, consistently applied.

" Governmental Authority " means any United States or supra-national, foreign, federal, state, local, provincial, or municipal government, governmental, regulatory or administrative authority, agency, body, branch, bureau, instrumentality or commission or any court, tribunal, or judicial or arbitral body having relevant jurisdiction over a subject matter, including any Regulatory Authority.

" HAO1 " means Hydroxyacid Oxidase (Glycolate Oxidase) 1, a gene transcribing for the protein 2-hydroxyacid oxidase 1.

" IND " means, with respect to the Product, an Investigational New Drug Application filed with respect to the Product, as described in the FDA regulations, including all amendments and supplements to the application, and any equivalent filing with any Regulatory Authority outside the United States.

" Indemnified Party " has the meaning set forth in Section 7.3.

" Indemnifying Party " has the meaning set forth in Section 7.3.

" Insolvent Party " has the meaning set forth in Section 8.5.

" Joint Patent " has the meaning set forth in the Supply Agreement.

" Know-How " means biological materials and other tangible materials, information, data, inventions, practices, methods, methodologies, protocols, formulas, formulations, oligonucleotide sequences, knowledge, trade secrets, processes, assays, skills, experience, techniques and results of experimentation and testing, patentable or otherwise.

" Licensed Intellectual Property " means the Protiva Intellectual Property and the Tekmira Patents.

" Lipid Nanoparticles " means lipid particles (plus or minus encapsulated drug), lipid components of lipid particles, formulations comprising lipid particles and methods of manufacturing lipid particles.

" LNP Technology " means the intellectual property (other than Protiva Patents) covering nucleic acid delivery technology directed to (i) the composition of matter of Lipid Nanoparticles, (ii) the method of use of Lipid Nanoparticles, or (iii) the method of manufacturing Lipid Nanoparticles (plus or minus encapsulated drug), in each case, Controlled by Protiva.

" Losses " has the meaning set forth in Section 7.1.

" MAA " means a Marketing Authorization Application and all amendments and supplements thereto for the Product filed with the EMA or a national competent authority in an EU member state, including all documents, data, and other information concerning the Product that are necessary for obtaining Regulatory Approval to place the Product on the market in the EU or in an EU member state.

" Manufacture " or " Manufacturing " means, with respect to a Lipid Nanoparticle or product, all activities associated with the production, manufacture, testing, fill/finish, packaging, labeling, releasing or processing of such raw material or product, including having Third Parties conduct such activities on behalf of the Person having the rights to Manufacture.

" MTA " has the meaning set forth in the recitals.

" Milestone Payment " has the meaning set forth in Section 3.1(b).

" NDA " means the New Drug Application and all amendments and supplements thereto for the Product filed with the FDA, including all documents, data, and other information concerning the Product that are necessary for gaining Regulatory Approval to market and sell the Product in the United States.

" Net Sales " *****

*****

" New York Courts " has the meaning set forth in Section 9.7(c).

" Non-PH1 Patent Infringement Action " has the meaning set forth in Section 5.3(b).

" Party " means either Dicerna or Protiva (or, where specified, Tekmira); " Parties " means Dicerna and Protiva (and, where specified, Tekmira).

" Patent " means any patent (including any reissue, extension, substitution, confirmation, re-registrations, re-examination, revival, supplementary protection certificate, patents of addition, continuation, continuation-in-part, or divisional) or patent application (including any provisional application, non-provisional patent application, continuation, continuation-in-part, divisional, PCT international applications or national phase applications), in each case whether in the U.S. or any foreign country.

" Patent Infringement Action " has the meaning set forth in Section 5.3(c).

" Permitted Contractor " means a Third Party (*e.g.* a contractor or consultant) that performs the activities assigned to Protiva under this Agreement or the Supply Agreement under a *bona fide* contract services arrangement for which Protiva has received Dicerna's prior written consent (such consent not to be unreasonably withheld, conditioned or delayed) as to the identity of the Third Party and the scope of activities to be performed by such Third Party.

" Person " means an individual, corporation, limited liability company, syndicate, association, trust, partnership, joint venture, unincorporated organization, government agency or any agency, instrumentality or political subdivision thereof, or other entity.

" PH1 " means Primary Hyperoxaluria 1.

" PH1 Patent Infringement Action " has the meaning set forth in Section 5.3(c).

" Pivotal Trial " means a (a) clinical trial that is designed to study the safety and efficacy of the Product (and to help evaluate its overall risks and benefits) and is intended to form the primary basis for Regulatory Approval for Commercialization of the Product in one or more countries in the Territory, (b) clinical trial that Dicerna or its Affiliate expressly refers to in a press release as a "pivotal" trial or study, or (c) clinical trial that satisfies either of the following: (i) the protocol for that clinical trial shall have been reviewed by the FDA or other relevant Regulatory Authority under its procedures for reaching agreement on the design and size of clinical trials intended to form the primary basis of Regulatory Approval for Commercialization of the Product, such as the FDA Guidance for Industry: Special Protocol Assessment (May 2002) (or equivalent guidance issued in the future), and any comments from the FDA or other relevant Regulatory Authority on that protocol shall have been incorporated in the final protocol for that clinical trial or resolved to the satisfaction of the FDA or other relevant Regulatory Authority as evidenced by further written communications from the FDA or other relevant Regulatory Authority; or (ii) the FDA or other relevant Regulatory Authority has determined in writing that the clinical trial can be considered as the primary basis for Regulatory Approval for Commercialization of the Product. For the avoidance of doubt, a clinical trial satisfying any of the requirements sufficient to render it a Pivotal Trial under this definition shall be considered a Pivotal Trial even if more than one such trial is required by the FDA or other Regulatory Authority for Regulatory Approval for Commercialization of the Product. Such a trial shall be considered initiated on the later of: (1) the date that it first satisfied the requirements of this definition; or (2) the date of the first dosage of a patient in such trial.

" Proceeds " has the meaning set forth in Section 5.3(c)(ii).

" Product " means one or more formulations using Licensed Intellectual Property formulated with one or more nucleic acid compositions (including oligonucleotide constructs that are designed to function using RNA interference) for the treatment of PH1.

" Product Composition Patent " has the meaning set forth in the Supply Agreement.

" Protiva " has the meaning set forth in the Preamble.

" Protiva Indemnitees " has the meaning set forth in Section 7.2.

" Protiva Intellectual Property " means, collectively, the Protiva Patents, LNP Technology and Confidential Information of Protiva.

" Protiva Materials " means all materials not supplied by or on behalf of Dicerna, its Affiliates or their Sublicensee that Protiva uses for the performance of the Studies and the Services.

" Protiva Patents " means all Patents Controlled by Protiva that include claims that Cover (i) the composition of matter of Lipid Nanoparticles, (ii) the method of use of Lipid Nanoparticles, or (iii) the method of Manufacturing Lipid Nanoparticles (plus or minus encapsulated drug), in each case that are useful or necessary for the Development, Manufacture or Commercialization of the Product, or otherwise Cover any Product, including the Patents listed on Exhibit A , but excluding the Patents listed on Exhibit C and all Joint Patents.

" Quality Agreement " means the quality agreement dated as of the date hereof between the Parties.

" Receiving Party " means the Party that receives Confidential Information of the other Party.

" Record Retention Period " has the meaning set forth in Section 3.3(b).

" Regulatory Approval " means any registration, license, approval or authorization from any Regulatory Authority required for the Development, Manufacture or Commercialization of the Product in a regulatory jurisdiction anywhere in the world.

" Regulatory Authority " means any federal, national, multinational, state, provincial or local regulatory agency, department, bureau or other governmental entity anywhere in the world with authority over the Development, Manufacture or Commercialization of the Product under this Agreement. The term "Regulatory Authority" includes the FDA, the EMA, the European Commission and relevant national competent authorities in the EU member states.

" Royalty " has the meaning set forth in Section 3.2(a).

" Royalty Payment Term " means, for any Product on a country-by-country basis, the term beginning on the Effective Date and ending on the later of (i) the last to expire Valid Claim of a Royalty Term Patent infringed by such Product in such country, (ii) the expiration of the data exclusivity granted by the Regulatory Authority in such country in respect of such Product, and (iii) the tenth (10th) anniversary of the First Commercial Sale of such Product in such country.

" Royalty Term Patents " means (i) any Protiva Patents or Tekmira Patents provided such Patents have been identified to Dicerna in writing at any time during the Term and Protiva has provided Dicerna with a copy thereof, and (ii) subject to Section 7.3(e) of the Supply Agreement, the Product Composition Patent, if any.

" Services " has the meaning set forth in the Supply Agreement.

" Solvent Party " has the meaning set forth in Section 8.5.

" Studies " has the meaning set forth in the MTA.

" Sublicense Agreement " has the meaning set forth in Section 2.2(a).

" Sublicensee " means a Third Party to whom Dicerna has granted a sublicense in a Sublicense Agreement pursuant to the terms hereof.

" Supply Agreement " means the Development and Supply Agreement dated as of the date hereof between the Parties.

" Tekmira Patents " means all Patents Controlled by Tekmira that include claims that Cover (i) the composition of matter of Lipid Nanoparticles, (ii) the method of use of Lipid Nanoparticles that are useful or necessary for the Development, Manufacture or Commercialization of the Product, or otherwise Cover any Product, including the Patents listed on Exhibit B , but excluding the Patents listed on Exhibit C , or (iii) the method of manufacturing Lipid Nanoparticles (plus or minus encapsulated drug).

" Term " means the term described in Section 8.1.

" Territory " means worldwide.

" Third Party " means any Person other than Protiva, Dicerna or any of their respective Affiliates.

" Third Party Claim " has the meaning set forth in Section 7.3.

" Valid Claim " means a claim of: (a) an issued and unexpired Protiva Patent, Tekmira Patent or Product Composition Patent, which claim has not been revoked or held unenforceable, unpatentable or invalid by a decision of a court or other governmental agency of competent jurisdiction, which is not appealable or has not been appealed within the time allowed for appeal, and which has not been abandoned, disclaimed, denied, or admitted to be invalid or unenforceable through reissue, re-examination or disclaimer or otherwise; or (b) a patent application that is a Protiva Patent, Tekmira Patent or Product Composition Patent that has not been pending for more than ***** years after the original priority date for said application, and that has not been cancelled, withdrawn or abandoned, or finally rejected by an administrative agency action, and which is not appealable or has not been appealed within the time allowed for appeal.

1.2 Interpretation .

(a) Words such as "herein", "hereinafter", "hereof" and "hereunder" refer to this Agreement as a whole and not merely to a section, paragraph or clause in which such words appear, unless the context otherwise requires. Enumerative references to sections, paragraphs or clauses, or exhibits, without reference to an explicit agreement, document or exhibit, refer to this Agreement or exhibits attached to this Agreement, as applicable. The singular shall include the plural, and each masculine, feminine and neuter reference shall include and refer also to the others, unless the context otherwise requires. The words "include", "includes" and "including" are deemed to be followed by "without limitation" or words of similar import. Except where the context otherwise requires, the word "or" is used in the inclusive sense (and/or). All dollar amounts are expressed in U.S. dollars.

(b) In the event of any direct conflict between this Agreement and the Supply Agreement, the provisions of this Agreement shall prevail; provided , however , that if either this Agreement or the Supply Agreement expressly contemplates such conflict, the terms of such agreement shall control.

ARTICLE II – LICENSE GRANTS AND RELATED RIGHTS

2.1 License Grants to Dicerna .

(a) Protiva hereby grants to Dicerna, and Dicerna hereby accepts, a worldwide, sublicensable (subject to Section 2.2), irrevocable (except as set forth in Article VIII), perpetual (subject to Article VIII) right and license under Protiva Intellectual Property (including the Patents listed on Exhibit A) to Develop, Manufacture and Commercialize Products that both (i) are Directed to treatment of PH1, and (ii) are for use in the Field.

(b) Tekmira hereby grants to Dicerna, and Dicerna hereby accepts, a worldwide, sublicensable (subject to Section 2.2), irrevocable (except as set forth in Article VIII), perpetual (subject to Article VIII) right and license under Tekmira Patents (including the Patents listed on Exhibit B) to Develop, Manufacture and Commercialize Products that both (i) are Directed to treatment of PH1, and (ii) are for use in the Field.

(c) The licenses in Sections 2.1(a) and 2.1(b) are exclusive (even as to Protiva and Tekmira), except with respect to the license rights granted by Protiva or Tekmira to the Licensed Intellectual Property prior to the Effective Date set forth on Exhibit D .

2.2 Sublicensing .

(a) Dicerna may grant written sublicenses (each, a " Sublicense Agreement ") to the Licensed Intellectual Property (subject to Section 2.4 (b)) solely to Develop, Manufacture and Commercialize Products are solely directed to the treatment of PH1 for use in the Field, including to CMOs; provided , however , that any sublicense granted by Dicerna shall be subject and, except as set forth below, subordinate to the terms and conditions of this Agreement and shall contain terms and conditions consistent with those in this Agreement. Dicerna shall assume full responsibility for the performance of all obligations and observance of all terms herein under the licenses granted to it. If Dicerna becomes aware of a material breach of any Sublicense Agreement by a Sublicensee, Dicerna shall promptly notify Protiva of the particulars of same and take Commercially Reasonable Efforts to enforce the terms of such Sublicense Agreement. All Sublicense Agreements shall provide that the Sublicensee may only use the Confidential Information of Protiva in accordance with terms of this Agreement applicable to Dicerna's use of such Confidential Information and subject to provisions at least as stringent as those set forth in Article VI. Dicerna shall use Commercially Reasonable Efforts to make Protiva an express third-party beneficiary of each CMO Agreement (as defined in the Supply Agreement), and Protiva shall be an express third-party beneficiary of any other Sublicense Agreement, including the provisions related to use and disclosure of Protiva's Confidential Information. Upon expiration or termination of this Agreement, and provided any Sublicensee is in good standing and has not contributed to the breach or other circumstance that led to any termination, such Sublicense Agreement will remain in full force and effect and Dicerna will be required, until the expiration or termination of each Sublicense Agreement, to: (i) remit to Protiva all royalties or other payments Dicerna receives from any Sublicensee regarding the sale or other disposition of any Products; and (ii) enforce the terms of the Sublicense Agreement at the direction and expense of Protiva.

(b) Unless otherwise provided in this Agreement, Dicerna shall notify Protiva within ***** days after execution of a Sublicense Agreement and provide a copy of the fully executed Sublicense Agreement to Protiva within the same time, which shall be treated as Confidential Information of Dicerna under Article VI. Dicerna may redact any financial or other competitively sensitive information from any Sublicense Agreement prior to disclosure to Protiva.

2.3 Grant Back . Dicerna agrees to grant and hereby grants (a) to Protiva a non-exclusive, non-royalty-bearing, sublicensable right and license under the Licensed Intellectual Property solely for purposes of performing its obligations under this Agreement, the Supply Agreement and the Quality Agreement and (b) to Tekmira a non-exclusive, non-royalty-bearing, sublicensable right and license under the Tekmira Patents solely for purposes of performing its obligations under this Agreement, the Supply Agreement and the Quality Agreement.

2.4 Retained Rights .

(a) Each of Protiva and Tekmira expressly retains any rights not expressly granted to Dicerna under this Article II (or otherwise under this Agreement) or under the Supply Agreement. Nothing in Section 2.1 limits Protiva's ability to perform its obligations under this Agreement or the Supply Agreement.

(b) Notwithstanding anything to the contrary contained herein but subject to terms set forth in the Supply Agreement, including Section 7.2 of the Supply Agreement, (i) neither Tekmira nor Protiva is granting to Dicerna a license to Research, Develop or otherwise improve upon the Lipid Nanoparticles based on Tekmira Patents or Protiva Intellectual Property or Confidential Information it has received from Tekmira or Protiva (but, for clarity, Dicerna may otherwise Research, Develop and improve upon Lipid Nanoparticles without the use of Tekmira Patents, Protiva Intellectual Property or Confidential Information it has received from Tekmira or Protiva); and (ii) no license is provided from either Party to the other to use its Know-How, except as may be necessary or useful for a Party to fulfill its obligations to any Regulatory Authority (subject to the penultimate sentence in Section 6.3) or necessary for a Party to perform the activities required or expressly permitted under this Agreement, the Supply Agreement or the Quality Agreement and with respect to the Product.

2.5 Rights in Bankruptcy . All licenses and rights to licenses granted under or pursuant to this Agreement by Protiva to Dicerna are, and shall otherwise be deemed to be, for purposes of Section 365(n) of the United States Bankruptcy Code (the " Code "), licenses of rights to "intellectual property" as defined under Section 101(35A) of the Code. Dicerna, as a licensee of such rights under this Agreement, shall retain and may fully exercise all of its rights and elections under the Code, and that upon commencement of a bankruptcy proceeding by or against Protiva (or any Affiliate of Protiva that owns or Controls Protiva Intellectual Property or Tekmira Patents) under the Code, Dicerna shall be entitled to a complete duplicate of, or complete access to (as Dicerna deems appropriate), any such intellectual property and all embodiments of such intellectual property.

2.6 Contractors . Notwithstanding Sections 2.1 and 2.2, Protiva may utilize Permitted Contractors to perform its obligations in accordance with this Agreement or the Supply

Agreement provided that Protiva shall not share Dicerna's Confidential Information with any Permitted Contractor unless Protiva and its Permitted Contractor shall have executed a binding agreement which contains (i) obligations of confidentiality, non-use, and invention assignment consistent with and at least as protective of Dicerna's rights as the provisions of this Agreement, and (ii) other reasonable and customary terms and conditions, so as to enable Protiva to comply with its obligations under this Agreement and the Supply Agreement.

ARTICLE III – FINANCIAL PROVISIONS

3.1 Upfront Payment and Milestone Payments.

(a) On or before the third (3rd) day following the Effective Date, Dicerna shall make a one-time fully-earned, non-refundable and non-creditable payment to Protiva in the amount of US $2,500,000 as partial consideration for the rights granted under this Agreement.

(b) Subject to the terms and conditions of this Agreement, Dicerna shall make the following fully-earned, non-refundable and non-creditable milestone payments upon the achievement of the specified milestones with respect to a Product (each a " Milestone Payment "):

Milestone Event	Milestone Fee
*****	*****
*****	*****
*****	*****

(c) If there is more than one Product in Development or Commercialization at the same time, Dicerna shall be obligated to make each Milestone Payment for every Product that achieves the milestone set forth above (i.e., if there is more than one Product that satisfies the applicable milestone event, more than one Milestone Payment for the milestone event shall be owed by Dicerna to Protiva); provided, however, that if the first milestone event in Section 3.1(b) has been reached for a Product (i.e., initiation of a first Pivotal Trial) and the Milestone Payment made, but such Product does not ultimately obtain Regulatory Approval in the United States, any EU market or the market of any EU member state, then on any subsequent Product there will not by any Milestone Payment due upon the initiation of a first Pivotal Trial for that subsequent Product.

(d) Dicerna shall act in good faith in determining whether to designate its clinical trials for Products as "pivotal trials" and shall not manipulate the structure of its clinical trials for Products that would otherwise meet the definition of a Pivotal Trial in such a manner as to avoid meeting such definition for purposes of delaying payment of the applicable Milestone Payment.

3.2 Royalty Payments .

(a) In addition to the payments set forth in Section 3.1, during the Royalty Payment Term, Dicerna shall pay to Protiva the following royalty amounts with respect to the Net Sales of Products (the " Royalty "):

Royalty Table

Net Sales	Royalty (Percent of Net Sales)
For all cumulative, worldwide Net Sales less than *****	*****
For cumulative, worldwide Net Sales equal to or exceeding ***** but less than *****	*****
For cumulative, worldwide Net Sales equal to or exceeding *****	*****

(b) For clarity, the application of the Royalty tiers in the above Royalty Table will be progressive, meaning that the Royalty percentage in each tier only applies to Net Sales in that tier and not retroactively to prior Net Sales in a lower tier.

(c) No royalty offsets shall apply for Third Parties owed royalties by Dicerna for DCR-PH1 or any adjuvant or additional active substance. The Royalties are inclusive of royalties, if any, owed by Protiva to Third Parties for any intellectual property licensed to Dicerna under this Agreement, which third-party royalties are exclusively the obligation of Protiva.

3.3 Royalty Reports; Expense Reports; Records and Audits .

(a) Within ***** days after the end of each calendar quarter during the Royalty Payment Term until the calendar quarter after which Dicerna or any of its Affiliates or Sublicensees is no longer selling any Products, Dicerna shall provide to Protiva a written report (in electronic form) that includes, for each calendar quarter, (i) the gross invoiced sales of the Product sold during such quarter, (ii) the Net Sales of the Products, and (ii) the calculated amount of the Royalty owed by Dicerna pursuant to Section 3.2 in respect of the sale of the Products. If reasonably requested by Protiva, Dicerna will also provide non-binding estimates for Net Sales and Royalties after the calendar quarter end but prior to delivery of the written report.

(b) Until the fifth (5 th) anniversary of the date any book or record is created or such longer period required by Applicable Law (the " Record Retention Period "), Dicerna shall

maintain and retain complete and accurate books of account and records covering all transactions relating to payment of amounts that may be due under Section 3.2 of this Agreement. Upon the reasonable advance notice of Protiva (of at least ***** days), Dicerna shall make such books and records available for inspection and audit by Protiva's authorized representative (which shall be a national certified public accounting firm designated by Protiva), subject to reasonable precautions to protect the confidential information of Dicerna. Protiva may not audit Dicerna's books and records more than once in any *****-month period. All audits must be conducted during normal business hours of Dicerna and conducted in a manner so as to minimize the impact on the normal operations of Dicerna. The accounting firm conducting any such audit must provide a report of its findings of any audit to both Parties, may only identify in such report whether the amount of Royalties paid was correct and the actual amount of Royalties payable and may not disclose any other Confidential Information of Dicerna. The auditor's report and all other information disclosed to the auditor or generated by the auditor in such audit will be the Confidential Information of Dicerna. Protiva shall pay the cost of such audits unless it discovers that Dicerna has underreported aggregate Net Sales during any year in the Record Retention Period by an amount of ***** or more, in which case the costs of such audit shall be borne by Dicerna. If an audit reveals an underpayment or overpayment, the Party responsible for making payment shall promptly pay to the other Party the amount of the underpayment or overpayment discovered unpaid under this Section 3.3(b), subject to Section 3.4(d).

3.4 Payment Procedure .

(a) Remittance of payments under this Article III shall be made by means of wire transfer of immediately available funds to a bank account designated in advance in writing by Protiva. All amounts payable to Protiva under this Agreement shall be paid in United States Dollars. In those cases in which the amounts due in United States Dollars is calculated based on one or more currencies other than United States Dollars, such amounts shall be converted into United States Dollars using the spot exchange rate for the relevant currency on the date of the applicable transaction, as such exchange rate is published by the Wall Street Journal (or comparable publication if not available).

(b) Any Milestone Payment owed pursuant to Section 3.1(b) shall be paid by Dicerna to Protiva within ***** days after the occurrence of the event triggering the payment of such Milestone Payment.

(c) Any Royalty shall accrue in accordance with Section 3.2 during the applicable Royalty Payment Term. Royalty obligations that accrue during a calendar quarter shall be paid within ***** days after the end of such quarter.

(d) Any payments due from one Party to the other Party under this Article III that are not paid by the date such payments are due shall bear interest from the date such unpaid payments are due until paid in full at the lesser of: (i) ***** per month; or (ii) the highest amount of interest permitted by Applicable Law. The foregoing interest shall be in addition to any other remedies that either Party may have pursuant to this Agreement.

(e) Protiva is solely responsible for any sales, use, excise, value-added, services, consumption, or other similar tax that is assessed in connection with any payment due hereunder

and shall either pay such payment directly or reimburse Dicerna for the same. Any withholding or other taxes that Dicerna or its Affiliates are required by Applicable Law to withhold or pay on behalf of Protiva may be deducted from such payments and paid to the appropriate tax authority contemporaneously with the remittance to Protiva, provided that (i) Dicerna promptly furnishes to Protiva proper evidence of the taxes so paid and (ii) Dicerna cooperates with and furnishes to Protiva appropriate documents to secure application of the most favorable rate of withholding tax under Applicable Law (or exemption from such withholding tax payments, as applicable). Dicerna and Protiva shall use Commercially Reasonable Efforts to cooperate to minimize any such taxes, assessments and fees to the extent permitted by Applicable Law.

3.5 Term of Payments . Following expiry of the Royalty Payment Term in respect of any country (a) the licenses granted to Dicerna with respect to such country become fully paid-up, sublicensable, royalty-free, exclusive (subject to Section 2.1(b)), transferable, perpetual and irrevocable licenses continuing indefinitely and (b) the obligation of Dicerna to pay any Royalties with respect to sales of Products in such country terminates.

ARTICLE IV – ADDITIONAL OBLIGATIONS

4.1 Obligations of Protiva . Protiva shall, itself or through its Affiliates or Permitted Contractors upon Dicerna's reasonable request, use Commercially Reasonable Efforts to assist Dicerna in obtaining any license from any Third Party needed for Dicerna or its Affiliates to exploit the LNP Technology as contemplated by this Agreement (provided that such efforts would not require Protiva to make any payment to any such Third Party).

4.2 Obligations of Dicerna .

(a) Dicerna shall, itself or through its Affiliates or Sublicensees, use Commercially Reasonable Efforts to Develop and Commercialize the Product, provided that Protiva's sole remedy for Dicerna's breach of this Section 4.2(a) is as set forth in Section 8.3.

(b) Until the earlier of (i) termination of this Agreement or (ii) the First Commercial Sale of the Product, Dicerna shall not, directly or indirectly, in-license from any Third Party for use with the Product a drug delivery system competitive with (A) the composition of matter of Lipid Nanoparticles, (B) the method of use of Lipid Nanoparticles or (C) the method of manufacturing Lipid Nanoparticles (plus or minus encapsulated drug), in each case, Controlled by Protiva or Tekmira and licensed to Dicerna hereunder; provided , however , that if, after such period, Dicerna in-licenses from a Third Party such drug delivery system, then, as the sole remedy to Protiva, the license grant by Protiva in Section 2.1 shall thereafter be on a non-exclusive basis. The foregoing does not prohibit Dicerna from licensing any Third Party technology or intellectual property necessary to Develop, Manufacture, or Commercialize the Products.

4.3 Other Obligations and Agreements of the Parties .

(a) Each Party agrees that from the Effective Date until the expiration of one (1) year after the expiration of the Term of this Agreement, it shall not, except upon the express prior written consent of the other Party in each instance, directly or indirectly employ in any capacity (whether as a full or part time employee or as a consultant or contractor) any individual who is

then employed by such other Party and has worked in any capacity related to this Agreement, the Supply Agreement or the Quality Agreement. This provision shall not apply to or prohibit general solicitations, such as job postings though public media, not focused on or directed specifically to the personnel of the other Party or hiring or employing any individual who is hired by a Party in response to those general solicitations.

(b) The Parties acknowledge and agree that, in respect of the Product, all regulatory dossiers filed by Dicerna with the Regulatory Authorities and Regulatory Approvals granted (excluding in either case any content directed exclusively to Licensed Intellectual Property), are the sole and exclusively property of Dicerna.

(c) The Parties shall cooperate with each other to provide all reasonable assistance and take all actions that are necessary to comply with any Applicable Laws in connection with their respective Regulatory Authority obligations in relation to the Product under this Agreement. In addition, the Parties shall work together in good faith to develop such necessary regulatory strategies which may be required for purposes of this Agreement.

ARTICLE V – INTELLECTUAL PROPERTY

5.1 Ownership .

(a) Subject to the licenses granted by Protiva herein, Protiva is and shall at all times remain the sole and exclusive owner of the Protiva Intellectual Property.

(b) Subject to the licenses granted by Tekmira herein, Tekmira is and shall at all times remain the sole and exclusive owner of the Tekmira Patents, including, for the avoidance of doubt, the Excluded Patents.

(c) Dicerna is and shall at all times remain the sole and exclusive owner of Dicerna's Confidential Information.

5.2 Prosecution and Maintenance of Patents . Protiva shall have the sole right and responsibility, in its sole discretion and at its sole cost and expense, to file, prosecute, maintain or abandon patent protection in the Territory for Protiva Patents. Tekmira shall have the sole right and responsibility, in its sole discretion and at its sole cost and expense, to file, prosecute, maintain or abandon patent protection in the Territory for Tekmira Patents.

5.3 Third-Party Infringement of Protiva Patents and Tekmira Patents .

(a) Each Party shall use Commercially Reasonable Efforts to promptly report in writing to the other Party during the Term any known or suspected commercially relevant infringement by a Third Party of any of the Protiva Patents or Tekmira Patents Covering the Product of which such Party becomes aware and provide the other Party with all evidence supporting or relating to such infringement in its possession.

(b) Protiva shall have the sole and exclusive right to initiate an infringement or other appropriate suit with respect to infringements or suspected infringements of any of the Protiva Patents and Tekmira shall have the sole and exclusive right to initiate an infringement or other

appropriate suit with respect to infringements or suspected infringements of any of the Tekmira Patents, in each case, in respect of infringing activity that is not directed to the treatment of PH1 with a Product (each such suit or other action, a " Non-PH1 Patent Infringement Action "), or to take such other actions as Protiva or Tekmira, in its sole discretion, deems appropriate with respect to such infringements or suspected infringements, all at Protiva's or Tekmira's sole cost and expense, as applicable. Protiva and Tekmira shall notify Dicerna promptly after initiating any such Non-PH1 Patent Infringement Action that has a reasonable possibility of harming or damaging Dicerna's rights or licenses to the Licensed Intellectual Property.

(c) Protiva shall have the first right to initiate an infringement or other appropriate suit with respect to infringements or suspected infringements of any of the Protiva Patents and Tekmira shall have the first right to initiate an infringement or other appropriate suit with respect to infringements or suspected infringements of any of the Tekmira Patents, in each case, by Products that are directed to the treatment of PH1 (each such suit or other action, a " PH1 Patent Infringement Action "; and, together with the Non-PH1 Patent Infringement Action, a " Patent Infringement Action "), all at Protiva's sole cost and expense. Protiva shall: (A) notify Dicerna promptly after initiating any such PH1 Patent Infringement Action and (B) consult closely with Dicerna regarding all aspects of such PH1 Patent Infringement Action and permit Dicerna to have an attorney of its own choosing participate in such PH1 Patent Infringement Action. Protiva shall not enter into any settlement or compromise in connection with an PH1 Patent Infringement Action that would materially eliminate, diminish, or otherwise modify any right, title, or interest of Dicerna in any Licensed Intellectual Property or that would require any payments, concessions, or otherwise bind Dicerna, without Dicerna's prior written consent, which consent shall not be unreasonably withheld, delayed or conditioned. If Protiva elects not to initiate, pursue or maintain any such PH1 Patent Infringement Action, Protiva shall provide Dicerna with prompt written notice of the same and, thereafter, Dicerna will have the right, but not the obligation, to initiate, pursue or maintain any PH1 Patent Infringement Action Dicerna deems appropriate with respect to such infringements or suspected infringements, all at Dicerna's sole cost and expense. Thereafter, Dicerna shall consult closely with Protiva regarding all aspects of such PH1 Patent Infringement Action and permit Protiva to have an attorney of its own choosing participate in such PH1 Patent Infringement Action. Dicerna shall not enter into any settlement or compromise in connection with a PH1 Patent Infringement Action that would materially eliminate, diminish, or otherwise modify any right, title, or interest of Protiva or Tekmira in any Licensed Intellectual Property or that would require any payments, concessions, or otherwise bind Protiva, without Protiva's prior written consent, which consent shall not be unreasonably withheld, delayed or conditioned.

(i) Upon the request of the Party bringing a PH1 Patent Infringement Action under this Section 5.3(c) (the " Enforcing Party "), the other Party shall cooperate with the Enforcing Party in such PH1 Patent Infringement Action, including joining such PH1 Patent Infringement Action as a party with the Enforcing Party if necessary or required by Applicable Law. If the non-Enforcing Party is requested to join as a party to a PH1 Patent Infringement Action it may be represented, at the cost of the Enforcing Party, by counsel mutually agreed by the Parties.

(ii) The Parties shall share in the proceeds from any PH1 Patent Infringement Action under this Section 5.3(c), including settlements thereof (the " Proceeds "), as follows:

(a) First, for the costs and expenses, including legal fees, that are incurred by the Enforcing Party as part of or in preparation of the PH1 Patent Infringement Action, including the costs and expenses of the non-Enforcing Party reimbursed by the Enforcing Party in accordance with this Section (the " Enforcement Costs "); and

(b) The remainder of the Proceeds will be treated as Net Sales, with Protiva receiving Royalties on such remainder of the Proceeds in accordance with Section 3.2 and Dicerna receiving the rest of the remainder of the Proceeds.

(d) With respect to any infringement or suspected infringements of any of the Protiva Patents or Tekmira Patents that would result in action that could reasonably be considered both an PH1 Patent Infringement Action and a Non-PH1 Patent Infringement Action, Protiva shall have the first right to initiate an infringement or other appropriate suit, subject to Section 5.3(c). If Protiva elects not to initiate, pursue or maintain any such Patent Infringement Action, Protiva shall provide Dicerna with prompt written notice of the same and, thereafter, Dicerna will have the right, but not the obligation, to initiate, pursue or maintain only the claims that would form the basis of an PH1 Patent Infringement Action, all at Dicerna's sole cost and expense, subject to Section 5.3(c). The Parties will share in any Proceeds from any such Patent Infringement Action consistent with Section 5.3(b) and 5.3(c) above (i.e., after reimbursement of each Party's Enforcement Costs, Protiva retains all Proceeds resulting from infringing activity not directed to the treatment of PH1 with a Product and Proceeds resulting from infringing activity related to Products directed to the treatment of PH1 will be shared in accordance with Section 5.3(c)(ii)).

5.4 Defense of Brought by Third Parties . Each Party shall promptly notify the other Party if it becomes aware of any claim that Dicerna's actual use, sale or practice of Product in connection with its exercise of its license under Section 2.1 infringes, misappropriates, or otherwise violates the intellectual property rights of any Third Party.

ARTICLE VI – CONFIDENTIAL INFORMATION AND PUBLICITY

6.1 Limitation of Disclosure . With the exception of information essential for Regulatory Authority filings and documentation not fulfilled by use of the DMF, neither Party shall be obligated to disclose to the other Party confidential information related to its technology. Protiva shall disclose specific information regarding the chemical composition of a formulation in Lipid Nanoparticles used in the Product for purposes of filings with the Regulatory Authorities; provided , however , that (i) Protiva shall not be obligated to disclose to Dicerna the details related to any process in which such formulation was selected, nor the chemistry of any other lipids not used in the formulation and (ii) subject to Section 6.3, if Protiva discloses Confidential Information to Dicerna for use with Regulatory Authorities, Dicerna shall not disclose such Confidential Information without Protiva's prior written consent.

6.2 Non-Disclosure of Confidential Information . Each Party agrees that, for itself and its Affiliates, until the tenth (10th) anniversary of the termination or expiration of this Agreement, a Receiving Party shall maintain all Confidential Information of the Disclosing Party in strict confidence and shall not (a) disclose Confidential Information to any Third Party without the prior written consent of the Disclosing Party, except for disclosures expressly permitted below and to the Receiving Party's and its Affiliates' Sublicensees and each of their employees

who have a need to know such Confidential Information for purposes of exploiting the licenses granted herein or otherwise conducting their activities under this Agreement or (b) use Confidential Information for any purpose except those explicitly licensed or otherwise authorized or permitted by this Agreement; provided that the foregoing obligations shall survive with respect to any Confidential Information that is receiving protection as a trade secret under Applicable Law for so long as such Confidential Information continues to receive such protection.

6.3 Exceptions . The obligations in this Article VI shall not apply with respect to any portion of the Confidential Information that the Receiving Party can show by competent documented proof: (i) was known to the Receiving Party or its Affiliates, without any obligation to keep it confidential or any restriction on its use, prior to disclosure by the Disclosing Party; (ii) is subsequently disclosed to the Receiving Party or its Affiliates by a Third Party lawfully in possession thereof and without any obligation to keep it confidential or any restriction on its use; (iii) is or otherwise becomes generally available to the public or enters the public domain, either before or after it is disclosed to the Receiving Party and such public availability is not the result, directly or indirectly, of any fault of, or improper taking, use or disclosure by, the Receiving Party or its Affiliates or anyone working in concert or participation with the Receiving Party or its Affiliates; or (iv) has been independently developed by employees or contractors of the Receiving Party or its Affiliates without the aid, application or use of Confidential Information of the Disclosing Party. Notwithstanding the foregoing, (A) specific Confidential Information disclosed by a Disclosing Party shall not be deemed to be within any exceptions set forth in (i), (ii), or (iii) above merely because it is embraced by more general information to which one or more of those exceptions may apply, (B) no combination of information shall be deemed to be within any such exceptions unless the combination itself and its principle of operation are within the public domain and (C) disclosure of Confidential Information to Regulatory Authorities shall not constitute a public disclosure (i.e., it shall remain Confidential Information after such disclosure). Even though Confidential Information may be within one of the exceptions described in the preceding sentence, the Receiving Party shall not disclose to Third Parties that the excepted Confidential Information was received from the Disclosing Party.

6.4 Permitted Uses; Protection . Confidential Information of a Disclosing Party may be used by the Receiving Party in the performance of its obligations under this Agreement, the Supply Agreement and the Quality Agreement, including disclosures to Permitted Contractors who are bound by enforceable confidentiality agreements with terms consistent with and at least as protective as this Article VI, as otherwise expressly authorized in this Agreement or as expressly authorized by the Disclosing Party in writing. Confidential Information that is Licensed Intellectual Property may be used by Dicerna subject to and in accordance with the provisions of this Agreement, the Supply Agreement and the Quality Agreement, to the extent applicable to Dicerna's license to Licensed Intellectual Property. Each Receiving Party shall take steps to maintain the confidentiality of the Disclosing Party's Confidential Information that are consistent with the steps it takes to maintain the confidentiality of its own confidential information of a similar value, but in no event less than commercially reasonable steps; provided , however , that nothing in this Agreement shall be deemed to eliminate, restrict, or otherwise limit Dicerna's license to use such Confidential Information in accordance with the terms and conditions of this Agreement, even if such use may result, directly or indirectly, in the disclosure of such Confidential Information, so long as such disclosures are made in a manner than complies with Section 6.5 below.

6.5 Permitted Disclosures . The Receiving Party may disclose Confidential Information belonging to the Disclosing Party to the extent (and only to the extent) such disclosure is reasonably necessary in the following instances: (i) subject to the proviso below, by either Party hereto, in order to comply with non-patent Applicable Law (including any securities Applicable Law or the rules of a securities exchange in a relevant jurisdiction) and with judicial process, if based on the reasonable advice of the Receiving Party's counsel, such disclosure is necessary for such compliance; (ii) subject to the proviso below, by either Party hereto, in connection with prosecuting or defending litigation; and (iii) subject to the proviso below, by Dicerna, its Sublicensees, or their sublicensees in connection with any legal or regulatory requirements related to the Development, Manufacture or Commercialization of Product that use or employ Licensed Intellectual Property, such as labeling requirements, disclosures in connection with obtaining Regulatory Approvals, and the like, so long as the Development, Manufacture or Commercialization of Product has been and is performed in a manner that complies with the terms and conditions of Dicerna's license to such Licensed Intellectual Property and reasonable steps are taken to maintain the confidentiality of said Confidential Information even when disclosed for legal or regulatory purposes; provided , however , that with respect to clause (i), (ii) and (iii) where legally permissible, (a) the Receiving Party shall notify the Disclosing Party of the Receiving Party's intent to make any disclosure pursuant thereto sufficiently prior to making such disclosure so as to allow the Disclosing Party adequate time to take whatever action it may deem appropriate to protect the confidentiality of the information to be disclosed, including seeking protective orders or injunctive relief, and (b) consistent with Applicable Law, the Disclosing Party shall have the right to suggest reasonable changes to the disclosure to protect its interests, and the Receiving Party shall not unreasonably refuse to include such changes in its disclosure.

6.6 Press Release . Each Party shall publicize the execution of this Agreement by issuing its respective press release attached hereto as Exhibit E . After such initial press release, neither Party shall issue a press release or public announcement relating to the other Party or the collaboration activities undertaken pursuant this Agreement or the Supply Agreement without the prior written approval of the other Party, which approval shall not be unreasonably withheld, delayed or conditioned; provided , however , that (a) either Party may issue a press release or public announcement as required by Applicable Law; and (b) nothing in the foregoing will prevent Dicerna from issuing press releases and public announcements regarding the Product that do not reference Protiva, Tekmira or the LNP Technology, except that Dicerna shall (without Protiva's consent) acknowledge that Protiva licensed to Dicerna the LNP Technology and Protiva Patents in respect of such Product. Except as otherwise provided herein, each Party agrees not to use the name, trademark, service mark, or design registered to the other Party or its Affiliates in any publicity, promotional, or advertising material, without prior written approval of the other Party.

ARTICLE VII – INDEMNIFICATION AND INSURANCE

7.1 Protiva Indemnification . Protiva agrees to indemnify Dicerna and its Affiliates, and their respective agents, directors, officers, employees, representatives, successors and

permitted assigns (the " Dicerna Indemnitees ") against and to hold each of them harmless from any and all losses, costs, damages, fees or expenses (" Losses ") actually incurred or suffered by a Dicerna Indemnitee to the extent arising out of or in connection with any claim, suit, demand, investigation or proceeding brought by a Third Party based on: (a) any breach of any representation, warranty or covenant by Protiva under this Agreement; or (b) Protiva's, its Affiliates' or its Permitted Contractors' gross negligence, willful misconduct or violation of Applicable Law. The foregoing indemnification shall not apply to the extent that any Losses are due to Dicerna's, its Affiliates' or its Sublicensees' gross negligence or willful misconduct.

7.2 Dicerna Indemnification . Dicerna agrees to indemnify Protiva and its Affiliates, and their respective agents, directors, officers, employees, representatives, successors and permitted assigns (the " Protiva Indemnitees ") against and to hold each of them harmless from any and all Losses actually incurred or suffered by a Protiva Indemnitee to the extent arising out of or in connection with any claim, suit, demand, investigation or proceeding brought by a Third Party based on: (a) any breach of any representation, warranty or covenant by Dicerna under this Agreement; (b) Dicerna's, its Affiliates' or its Sublicensees' gross negligence, willful misconduct or violation of Applicable Law; or (c) product recall, products' liability or similar claims based on the Development or Commercialization of the Product (except to the extent that Protiva is required to indemnify the Dicerna Indemnitees for such Losses pursuant to the Supply Agreement). The foregoing indemnification obligations shall not apply to the extent that any Losses are due to Protiva's, its Affiliates' or its Permitted Contractors' gross negligence or willful misconduct.

7.3 Tender of Defense; Counsel . Any Person (the " Indemnified Party ") seeking indemnification under this Article VII agrees to give prompt notice in writing to the other Party (the " Indemnifying Party ") of the assertion of any claim or the commencement of any action by any Third Party (a " Third Party Claim ") in respect of which indemnity may be sought under this Article. Such notice shall set forth in reasonable detail such Third Party Claim and the basis for indemnification (taking into account the information then available to the Indemnified Party). The failure to so notify the Indemnifying Party shall not relieve the Indemnifying Party of its indemnification and hold harmless obligations hereunder, except to the extent such failure shall have materially and adversely prejudiced the Indemnifying Party. The Indemnifying Party shall be entitled to participate in the defense of any Third Party Claim and shall be entitled to control and appoint lead counsel reasonably satisfactory to the Indemnified Party for such defense by written notice to the Indemnified Party within ***** calendar days after the Indemnifying Party has received notice of the Third Party Claim, in each case at its own expense; provided , however , that the Indemnifying Party must use Commercially Reasonable Efforts to conduct the defense of the Third Party Claim in a manner designed to protect the rights of the Indemnified Parties, and otherwise conduct such defense actively and diligently, thereafter in order to preserve its rights in this regard. The Indemnifying Party shall not be entitled to assume or maintain control of the defense of any Third Party Claim and shall pay the fees and expenses of one counsel retained by the Indemnified Party if: (a) the Third Party Claim relates to or arises in connection with any criminal proceeding, action, indictment or allegation; (b) the Third Party Claim seeks an injunction or equitable relief against a Indemnified Party or any of its Affiliates; or (c) the Indemnifying Party has failed or is failing to prosecute or defend vigorously the Third Party Claim. Each Indemnified Party shall obtain the prior written consent of the Indemnifying Party, such consent not to be unreasonably withheld, delayed or conditioned, before entering into

any settlement of a Third Party Claim. Notwithstanding the foregoing, the Indemnifying Party shall not be entitled to enter into or approve any settlement of a Third Party Claim without the consent of the Indemnified Party (which may be withheld in its sole discretion), if the settlement (i) does not expressly unconditionally release all applicable Indemnified Parties and their Affiliates from all Losses with respect to such Third Party Claim, (ii) imposes injunctive or other equitable relief against the Indemnified Party or any of its Affiliates, (iii) involves any admission of criminal or similar liability, or (iv) involves any monetary damages that may not be fully covered by the Indemnifying Party. In the event that the Indemnifying Party fails to assume the defense of the Third Party Claim in accordance with this Section 7.3, (1) the Indemnified Party may defend against the Third Party Claim in any manner it reasonably may deem appropriate, and (2) the Indemnifying Party shall remain responsible for any Losses of the Indemnified Party as a result of such Third Party Claim. In circumstances where the Indemnifying Party is controlling the defense of a Third Party Claim in accordance with this Section 7.3, the Indemnified Party shall be entitled to participate in the defense of any Third Party Claim and to employ separate counsel of its choice for such purpose, in which case the fees and expenses of such separate counsel shall be borne by such Indemnified Party. Notwithstanding anything herein to the contrary, in circumstances where there is a conflict of interest that would reasonably make it inappropriate under applicable standards of professional conduct to have common counsel for the Indemnifying Party and the Indemnified Party, the Indemnified Party shall be entitled to employ separate counsel, that is reasonably acceptable to the Indemnifying Party, and the Indemnifying Party shall pay the reasonable fees and expenses of such separate counsel. Each Party shall cooperate, and cause their respective Affiliates to cooperate in all reasonable respects, in the defense or prosecution of any Third Party Claim and shall furnish or cause to be furnished such records, information and testimony, and attend such conferences, discovery proceedings, hearings, trials or appeals, as may be reasonably requested in connection therewith, all at the expense of the Indemnifying Party.

7.4 Insurance . Each Party shall maintain insurance, including product liability insurance, with respect to its activities under this Agreement regarding the Product in such amount as such Party customarily maintains with respect to similar activities for its other products. Each Party shall maintain such insurance for so long as it continues its activities under this Agreement, the Supply Agreement or the Quality Agreement, and thereafter for so long as such Party customarily maintains insurance for itself covering similar activities for its other products. Notwithstanding the foregoing, the Parties agree that during such time that Tekmira is an Affiliate of Protiva, Protiva shall have satisfied its obligations under this Section 7.4 provided it is covered by Tekmira's existing insurance policies that also satisfy the obligations under this Section 7.4.

ARTICLE VIII – TERM AND TERMINATION

8.1 Term . The term of this Agreement (the " Term ") shall begin on the Effective Date and, unless terminated earlier as provided herein, shall continue in perpetuity.

8.2 Termination for Material Breach . If either Party commits a material breach or material default in the performance or observance of any of its obligations under this Agreement, and such breach or default continues without cure for a period of ***** days after delivery by the other Party of written notice reasonably detailing such breach or default, then the

non-breaching or non-defaulting Party shall have the right to terminate this Agreement, with immediate effect, by giving written notice to the breaching or defaulting Party. The Parties shall retain all rights and remedies (at law or in equity) in respect of any breach hereof.

8.3 Termination for Failure to Actively Develop or Commercialize . If Protiva reasonably concludes that Dicerna is failing to use Commercially Reasonable Efforts to actively Develop or Commercialize the Product, Protiva can request from Dicerna written confirmation that Dicerna or its Affiliates or Sublicensees are actively Developing and Commercializing the Product. Following receipt of such request, if Dicerna either: (a) fails to deliver such written confirmation to Protiva within ***** days of Protiva's delivery of such request; or (b) provides such written confirmation but does not thereafter, in a timely and diligent manner, actually use Commercially Reasonable Efforts to actively Develop or Commercialize the Product, Protiva may terminate this Agreement immediately on written notice to Dicerna.

8.4 Challenges of Protiva's Patents or Tekmira Patents . If Dicerna or any of its Affiliates or Sublicensees directly and voluntarily commences or participates in any action or proceeding (including any patent opposition or re-examination proceeding), or otherwise asserts in writing (to Protiva or any of its Affiliates or to the U.S. Patent and Trademark Office) any claim, challenging or denying the validity of any of the Protiva Patents or Tekmira Patents, Protiva or Tekmira, as applicable, shall have the right to give notice to Dicerna (which notice must be given, if at all, within ***** days after Protiva's CEO or General Counsel first learns of the foregoing) that the licenses granted by Protiva to Dicerna hereunder to such Protiva Patent(s) or by Tekmira to Dicerna hereunder to such Tekmira Patent(s) shall terminate ***** days following Dicerna's receipt of such notice, and, unless Dicerna or its Affiliate or Sublicensees, as applicable, withdraws or causes to be withdrawn all such challenge(s) within such ***** period, such licenses to such Protiva Patent or Tekmira Patent, as applicable, shall so terminate; provided that if such action, proceeding or assertion is made by a Sublicensee the license shall only terminate with respect to the sublicense granted to such Sublicensee. Neither Dicerna's, its Affiliates', a Sublicensee, or any of their employees' participating in or appearing in any such action, proceeding or claim as a result of receiving a subpoena or other court order requiring such participation or appearance will give rise to a right for Protiva to terminate as set forth in this Section 8.4.

8.5 Rights in Bankruptcy . Each Party (the " Insolvent Party ") shall promptly notify the other Party (the " Solvent Party ") in writing upon the initiation of any proceeding in bankruptcy, reorganization, dissolution, liquidation or arrangement for the appointment of a receiver or trustee to take possession of the assets of the Insolvent Party or similar proceeding under law for release of creditors by or against the Insolvent Party or if the Insolvent Party shall make a general assignment for the benefit of its creditors. To the extent permitted by Applicable Law, if the applicable circumstances described above shall have continued for ***** days undismissed, unstayed, unbonded and undischarged, the Solvent Party may terminate this Agreement upon written notice to the Insolvent Party at any time. If Protiva is the Insolvent Party, the rights and remedies granted to Dicerna (as the Solvent Party) pursuant to this Section 8.5 shall be in addition to, and not in lieu of, Dicerna's rights and remedies under Section 2.4(b) above.

8.6 Consequences of Termination; Survival .

(a) In the event this Agreement is properly terminated in accordance with its terms, then Dicerna's rights and licenses under the Licensed Intellectual Property shall terminate upon the effective date of such termination, except as set forth in Sections 2.2(a) and 8.6(b). Termination of this Agreement shall not relieve the Parties of any obligation accruing prior to or upon such expiration or termination and the provisions of this Section 8.6, Section 3.3(b), Section 4.3(a) and ARTICLE I – (Definitions), ARTICLE V – (Intellectual Property), ARTICLE VI – (Confidential Information and Publicity), ARTICLE VII – (Indemnification and Insurance), and ARTICLE IX – (Miscellaneous) shall survive any expiration or termination of this Agreement.

(b) On the effective date of termination of this Agreement, the Supply Agreement and Quality Agreement between the Parties, shall each automatically terminate, subject to the survival obligations of each such agreement; provided, however, that (i) within ***** days after expiration or termination of this Agreement, Dicerna will provide Protiva with an inventory of all Products in Protiva's, its Affiliates' and their Sublicensees' (including CMO's) possession or control, including finished products and works-in-process (" Final Inventory ") and (ii) for a period of ***** months after such expiration or termination Dicerna will have the right to have its CMOs complete the Manufacture of all works-in-process in the Final Inventory and to sell off all Final Inventory (including Product created from completed works-in-process) in accordance with the terms of this Agreement (including Section 3.2).

(c) After the expiration or termination of this Agreement, Dicerna shall have no further obligations of payment to Protiva under this Agreement (including for Milestone Payments), except for the Royalty payment obligations in accordance with Section 3.2 related to Dicerna's sale of Products sold prior to the date of termination and sales of the Final Inventory in accordance with Section 8.6(b).

8.7 Remedies . The Parties acknowledge and agree that, in the event of a breach or a threatened breach by either Party of this Agreement for which it shall have no adequate remedy at law, the other Party may suffer irreparable damage and, accordingly, may be entitled to injunctive and other equitable remedies to prevent or restrain such breach or threatened breach, in addition to any other remedy they might have at law or at equity. In the event of a breach or threatened breach by a Party of any such provision, the other Party shall be authorized and entitled to seek from any court of competent jurisdiction injunctive relief, whether preliminary or permanent, arising from such breach, which rights shall be cumulative and in addition to any other rights or remedies to which the other Party may be entitled in law or equity.

ARTICLE IX – MISCELLANEOUS

9.1 Representations and Warranties .

(a) Mutual Representations and Warranties by Protiva and Dicerna .

(i) Each Party hereby represents and warrants to the other Party as of the Effective Date that:

(a) it is duly organized and validly existing under the laws of the jurisdiction of its incorporation or formation, and has all necessary power and authority to conduct its business in the manner in which it is currently being conducted, to own and use its assets in the manner in which its assets are currently owned and used, and to enter into and perform its obligations under this Agreement;

(b) the execution, delivery and performance of this Agreement has been duly authorized by all necessary action on the part of such Party and its Board of Directors or other governing body and no consent, approval, order or authorization of, or registration, declaration or filing with any Third Party or Governmental Authority is necessary for the execution, delivery or performance of this Agreement;

(c) this Agreement constitutes the legal, valid and binding obligation of such Party, enforceable against it in accordance with its terms, subject to (A) Applicable Laws of general application relating to bankruptcy, insolvency and the relief of debtors, and (B) Applicable Laws governing specific performance, injunctive relief and other equitable remedies; and

(d) neither it nor any of its Affiliates or their employees have ever been (i) convicted of a crime for which a Person can be debarred under Section 306(a) or 306(b) of the Generic Drug Enforcement Act of 1992 or under 42 U.S.C. Section 1320-7 or (ii) sanctioned by, suspended, excluded or otherwise ineligible to participate in any federal health care program, including Medicare and Medicaid or in federal procurement or non-procurement programs. If at any time this representation and warranty is no longer accurate, Protiva or Dicerna, as the case may be, shall immediately notify the other of such fact.

(b) Protiva Representations, Warranties, and Covenants . Protiva hereby represents, warrants, and covenants to Dicerna that:

(i) Protiva shall perform its obligations herein in compliance with all Applicable Laws;

(ii) as of the Effective Date, Protiva has no actual knowledge that the manufacture, use, sale and import of Protiva Intellectual Property and the LNP Technology, including as used in the Product, infringes, misappropriates or otherwise violates any issued Patent or other intellectual property right of any Third Party anywhere in the Territory;

(iii) as of the Effective Date, no Affiliate of Protiva or Tekmira (other than Protiva and Tekmira) Controls (including by joint ownership) any intellectual property rights relevant to or useful to the Development, Manufacture and Commercialization of Products directed to the treatment of PH1;

(iv) neither Protiva nor any of its Affiliates has assigned, transferred, conveyed or otherwise encumbered, nor during the Term will assign, transfer, convey or otherwise encumber, its right, title and interest in the Patents, Confidential Information and other intellectual property either owned by or exclusively licensed to Protiva as of the Effective Date in a manner that conflicts with any rights granted to Dicerna hereunder, subject only to the non-exclusive licenses granted by Protiva prior to the Effective Date as set forth on Exhibit D, and none of the exclusive licenses granted by Protiva prior to the Effective Date as set forth on Exhibit D conflict with any rights granted to Dicerna hereunder;

(v) as of the Effective Date, except for the grant of license rights set forth at Section 2.1(b), Tekmira is a party to this Agreement and the Supply Agreement for the sole purpose of providing the representations, warranties and covenants set forth in this Section 9.1(c);

(vi) for each country or jurisdiction in which Protiva Controls any Protiva Patent as of the Effective Date, Exhibit A lists the Protiva Patent in such country or jurisdiction with the latest twenty year expiration date, calculated from the earliest filed, non-provisional, application from which benefit of priority is claimed, for any Protiva Patent in such country or jurisdiction; and

(vii) Protiva shall not file any new Patent applications in any country or jurisdiction for the predominant purpose of extending the duration of the Royalty Payment Term.

(c) Tekmira Representations, Warranties, and Covenants . Tekmira hereby represents, warrants, and covenants to Dicerna that:

(i) as of the Effective Date, it is duly organized and validly existing under the laws of the jurisdiction of its incorporation or formation, and has all necessary power and authority to conduct its business in the manner in which it is currently being conducted, to own and use its assets in the manner in which its assets are currently owned and used, and to enter into and perform its obligations under this Agreement;

(ii) as of the Effective Date, the execution, delivery and performance of this Agreement has been duly authorized by all necessary action on the part of Tekmira and its Board of Directors and no consent, approval, order or authorization of, or registration, declaration or filing with any Third Party or Governmental Authority is necessary for the execution, delivery or performance of this Agreement;

(iii) as of the Effective Date, Tekmira has no actual knowledge that the manufacture, use, sale and import of Tekmira Patents, including as used in the Product, infringes, misappropriates or otherwise violates any issued Patent or other intellectual property right of any Third Party anywhere in the Territory;

(iv) as of the Effective Date, this Section 9.1(c) constitutes the legal, valid and binding obligation of Tekmira, enforceable against it in accordance with its terms, subject to (A) Applicable Laws of general application relating to bankruptcy, insolvency and the relief of debtors, and (B) Applicable Law governing specific performance, injunctive relief and other equitable remedies;

(v) as of the Effective Date, neither it nor any of its Affiliates or their employees have ever been (i) convicted of a crime for which a Person can be debarred under Section 306(a) or 306(b) of the Generic Drug Enforcement Act of 1992 or under 42 U.S.C. Section 1320-7 or (ii) sanctioned by, suspended, excluded or otherwise ineligible to participate in any federal health care program, including Medicare and Medicaid or in federal procurement or non-procurement programs;

(vi) if at any time the representation and warranty in Section 9.1(c)(v) is no longer accurate, Tekmira shall promptly notify Dicerna of such fact;

(vii) neither Tekmira nor any of its Affiliates has assigned, transferred, conveyed or otherwise encumbered, nor during the Term will assign, transfer, convey or otherwise encumber, its right, title and interest in the Patents owned by or exclusively licensed to Tekmira as of the Effective Date in a manner that conflicts with any rights granted to Dicerna hereunder, subject only to the non-exclusive licenses granted by Tekmira prior to the Effective Date as set forth on Exhibit D, and none of the exclusive licenses granted by Tekmira prior to the Effective Date as set forth on Exhibit D conflict with any rights granted to Dicerna hereunder; and

(viii) Tekmira shall cause Protiva to perform and to comply with the provisions of this Agreement, and shall remain responsible for and guarantee the performance of Protiva under this Agreement, and is liable to Dicerna for any breach of this Agreement by Protiva and for the actions and omissions of Protiva undertaken pursuant to this Agreement as if taken by Tekmira itself.

(ix) for each country or jurisdiction in which Tekmira Controls any Tekmira Patent as of the Effective Date, Exhibit B lists the Tekmira Patent in such country or jurisdiction with the latest twenty year expiration date, calculated from the earliest filed, non-provisional, application from which benefit of priority is claimed, for any Tekmira Patent in such country or jurisdiction; and

(x) Tekmira shall not file any new Patent applications in any country or jurisdiction for the predominant purpose of extending the duration of the Royalty Payment Term.

(d) Warranty Disclaimer . EXCEPT AS OTHERWISE EXPRESSLY PROVIDED IN THIS AGREEMENT, NEITHER PARTY MAKES ANY REPRESENTATION OR EXTENDS ANY WARRANTY OR CONDITIONS OF ANY KIND, EITHER EXPRESS OR IMPLIED, TO THE OTHER PARTY WITH RESPECT TO ANY INTELLECTUAL PROPERTY, PRODUCTS, GOODS, RIGHTS OR OTHER SUBJECT MATTER OF THIS AGREEMENT AND HEREBY DISCLAIMS ALL IMPLIED CONDITIONS, REPRESENTATIONS, AND WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OR VALIDITY OF PATENT RIGHTS WITH RESPECT TO ANY AND ALL OF THE FOREGOING. EACH PARTY HEREBY DISCLAIMS ANY REPRESENTATION OR WARRANTY THAT THE DEVELOPMENT, MANUFACTURE OR COMMERCIALIZATION OF ANY PRODUCT PURSUANT TO THIS AGREEMENT SHALL BE SUCCESSFUL OR THAT ANY PARTICULAR SALES LEVEL WITH RESPECT TO ANY SUCH PRODUCT SHALL BE ACHIEVED.

9.2 Force Majeure . Except with respect to payment obligations, a Party shall neither be held liable or responsible to any other Party, nor be deemed to have defaulted under or

breached this Agreement, for failure or delay in fulfilling or performing any term of this Agreement to the extent, and for so long as, such failure or delay is caused by or results from causes beyond the reasonable control of the affected Party, including fire, floods, embargoes, power shortage or failure, acts of war (whether war be declared or not), insurrections, riots, terrorism, civil commotions, strikes, lockouts or other labor disturbances, acts of God or any acts, omissions or delays in acting by any Governmental Authority or any other Party, and such affected Party promptly begins performing under this Agreement once such causes have been removed.

9.3 Consequential Damages . UNDER NO CIRCUMSTANCES WILL ANY PARTY BE LIABLE TO ANY OTHER PARTY WITH RESPECT TO THIS AGREEMENT, AND THE ACTIVITIES CONTEMPLATED HEREBY, FOR ANY CONSEQUENTIAL, INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL OR SIMILAR DAMAGES, WHETHER FORESEEABLE OR UNFORESEEABLE AND REGARDLESS OF THE CAUSE OF ACTION FROM WHICH THEY ARISE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES OCCURRING. NOTWITHSTANDING THE FOREGOING, NOTHING IN THIS SECTION 9.3 IS INTENDED TO OR SHALL LIMIT OR RESTRICT THE INDEMNIFICATION RIGHTS OF A PARTY OR DAMAGES AVAILABLE FOR A PARTY'S BREACH OF CONFIDENTIALITY OBLIGATIONS IN ARTICLE VI.

9.4 Assignment . Neither Party shall assign any of its rights and obligations hereunder without the prior written consent of the other Party, except (a) to a purchaser of all or substantially all of the assets or business of such Party to which this Agreement relates, or to the successor resulting from any merger, acquisition, consolidation or similar transaction with such Party and (b) to an Affiliate; provided , however , that (i) such assignment to an Affiliate shall not relieve such Party of its obligations herein, and (ii) in each case, the assigning Party shall provide the other Party with written notice of such assignment. Any purported transfer or assignment in contravention of this Section 9.4 shall, at the option of the non-assigning Party, be null and void and of no effect. This Agreement shall be binding upon and inure to the benefit of the Parties and their permitted successors and assigns.

9.5 Notices .

Notices to Dicerna shall be addressed to:

Dicerna Pharmaceuticals, Inc.
480 Arsenal St., #120
Watertown, MA 02472
United States
Attention: CEO and President

With a copy to:

Dicerna Pharmaceuticals, Inc.
480 Arsenal St., #120
Watertown, MA 02472
United States
Attention: Chief Financial Officer

Notices to Protiva shall be addressed to:

Protiva Pharmaceuticals Corporation
100-8900 Glenlyon Parkway
Burnaby, B.C.
Canada V5J 5J8
Attention: President & CEO
Facsimile No.: (604) 630-5103

Notices to Tekmira shall be addressed to:

Tekmira Pharmaceuticals Corporation
100-8900 Glenlyon Parkway
Burnaby, B.C.
Canada V5J 5J8
Attention: President & CEO
Facsimile No.: (604) 630-5103

In each case with copy to:

Orrick, Herrington & Sutcliffe LLP
51 West 52 nd Street
New York, NY 10019
Attention: R. King Milling
Facsimile No.: (212) 506-5151

Any party hereto may change their address by giving notice to the other parties in the manner provided in this Section 9.5. Any notice required or provided for by the terms of this Agreement shall be in writing and shall be (a) sent by certified mail, return receipt requested, postage prepaid, (b) sent via a reputable international express courier service, or (c) sent by facsimile transmission, with a copy by regular mail. The effective date of the notice shall be the actual date of receipt by the receiving party.

9.6 Independent Contractors . It is understood and agreed that the relationship between the Parties is that of independent contractors and that nothing in this Agreement shall be construed as authorization for either Party to act as the agent for the other Party.

9.7 Governing Law; Dispute Resolution; Arbitration . This Agreement shall be governed and interpreted in accordance with the substantive laws of the State of New York, excluding its conflicts of laws principles.

(a) The Parties and Tekmira recognize that a bona fide dispute as to certain matters may from time to time arise during the Term that relate to a Party or Tekmira's rights or obligations hereunder. In the event of the occurrence of any Dispute, the Parties and Tekmira shall first have such Dispute referred to their respective executives designated below for

attempted resolution by good faith negotiations within ***** calendar days after such notice is received. If either Party or Tekmira desires to pursue arbitration under Section 9.7(b) below to resolve any such Dispute, unless expressly provided for otherwise herein, a referral to such executives under this Section 9.7(a) shall be a mandatory condition precedent. Said designated executives as of the Effective Date are as follows.

For Dicerna: Douglas Fambrough, Ph.D., President and CEO

For Protiva: Mark Murray, President and CEO

For Tekmira: Mark Murray, President and CEO

In the event that they shall be unable to resolve the Dispute by consensus within such *****-day period, the Dispute shall be finally settled by binding arbitration as provided below.

(b) Except as expressly otherwise provided in this Agreement, in the event of any dispute arising out of or relating to the interpretation of any provision of this Agreement or the failure of either Party or Tekmira to perform or comply with any obligation of such party pursuant to this Agreement or the breach, termination or validity hereof (a " Dispute "), such Dispute will be finally settled by arbitration in accordance with the commercial arbitration rules of the American Arbitration Association, then in force and the Federal Arbitration Act, 9 U.S.C. § 1 et seq., by three (3) arbitrators (the " Arbitrators "); provided that the appointed arbitrators shall have appropriate experience in the pharmaceutical industry. Dicerna shall appoint one Arbitrator and Protiva and Tekmira, collectively, shall appoint one Arbitrator, and such two Arbitrators shall jointly appoint the third Arbitrator. If any party is not able to appoint its Arbitrator or the two initial Arbitrators are not able to appoint the third Arbitrator within a reasonable amount of time after the initiation of such process, the applicable Arbitrator or Arbitrators will be appointed in accordance with the above identified commercial arbitration rules. The place of arbitration will be New York, New York, and the Arbitrators must decide the Dispute in accordance with the substantive laws of the State of New York. The Arbitrators, by accepting their appointment, undertake to conduct the process such that the award is rendered within ***** months of their appointment and is final and binding upon all parties participating in such arbitration. The judgment rendered by the Arbitrators may, at the Arbitrator's discretion, include costs of arbitration, reasonable attorneys' fees and reasonable costs for any expert and other witnesses. Judgment upon the award may be entered in any court having jurisdiction, or application may be made to such court for judicial acceptance of the award or an order of enforcement as the case may be. Any period of limitations or survival period that would otherwise expire between the initiation of the procedures described in this Section 9.7 and the conclusion of such procedures will be extended until ***** days following the conclusion of such procedures. This Section 9.7 does not prohibit a Party or Tekmira from seeking preliminary injunctive relief in aid of arbitration from a court of competent jurisdiction.

(c) The Parties and Tekmira consent to (i) the exclusive jurisdiction of the Federal courts and the State courts of the State of New York, in each case, located in the borough of Manhattan, City of New York (the " New York Courts ") for (A) any action referenced in Section 9.7(d) and (B) any action in aid of arbitration, for provisional relief of the status quo or to prevent irreparable harm prior to the appointment of the Arbitrators in Section 9.7(b) above, and

(ii) the non-exclusive jurisdiction of the New York Courts for any action to enter or enforce any arbitral award entered in connection with this Agreement. THE PARTIES AND TEKMIRA HEREBY IRREVOCABLY WAIVE, AND AGREE TO CAUSE THEIR RESPECTIVE AFFILIATES TO WAIVE, THE RIGHT TO TRIAL BY JURY IN SUCH ACTIONS.

(d) Unless agreed by the Parties, the foregoing alternative dispute resolution procedures shall not be used with respect to any claim by one Party against another regarding the validity, infringement, misappropriation or violation of a Patent, copyright, trade secret or trademark.

9.8 Severability . In the event that any provision of this Agreement is held by a court of competent jurisdiction to be unenforceable because it is invalid or in conflict with any law of the relevant jurisdiction, the validity of the remaining provisions shall not be affected and the rights and obligations of the Parties and Tekmira shall be construed and enforced as if the Agreement did not contain the particular provisions held to be unenforceable, provided that the Parties and Tekmira, shall negotiate in good faith a modification of this Agreement with a view to revising this Agreement in a manner which reflects, as closely as is reasonably practicable, the commercial terms of this Agreement as originally signed.

9.9 No Implied Waivers . The waiver by either Party or Tekmira of a breach or default of any provision of this Agreement by the other Party or Tekmira shall not be construed as a waiver of any succeeding breach of the same or any other provision, nor shall any delay or omission on the part of either Party or Tekmira to exercise or avail itself of any right, power or privilege that it has or may have hereunder operate as a waiver of any right, power or privilege by such Party or Tekmira.

9.10 Headings . The headings of articles and sections contained this Agreement are intended solely for convenience and ease of reference and do not constitute any part of this Agreement, or have any effect on its interpretation or construction.

9.11 Entire Agreement; Amendment . This Agreement (along with the attachments), the Supply Agreement, and the Quality Agreement contain the entire understanding of the Parties and Tekmira with respect to the subject matter hereof and thereof and supersede and replace any and all previous arrangements and understandings, whether oral or written, between the Parties and Tekmira with respect to the subject matter hereof and thereof. This Agreement (including the attachments hereto) may be amended only by a writing signed by each of the Parties and Tekmira.

9.12 Waiver of Rule of Construction . Each Party and Tekmira has had the opportunity to consult with counsel in connection with the review, drafting and negotiation of this Agreement. Accordingly, the rule of construction that any ambiguity in this Agreement shall be construed against the drafting party shall not apply.

9.13 No Third-Party Beneficiaries . Except as expressly contemplated herein, no Third Party, including any employee of either Party or Tekmira, shall have or acquire any rights by reason of this Agreement.

9.14 Further Assurances . Each Party and Tekmira shall provide such further documents or instruments required by the other Party or Tekmira as may be reasonably necessary or desirable to give effect to the purpose of this Agreement and carry out its provisions.

9.15 Performance by Affiliates . Either Party may use one or more of its Affiliates to perform its obligations and duties hereunder, and Affiliates of a Party are expressly granted certain rights herein; provided that each such Affiliate shall be bound by the corresponding obligations of such Party and the relevant Party shall remain liable hereunder for the prompt payment and performance of all their respective obligations hereunder.

9.16 Counterparts . This Agreement may be executed in any number of counterparts in original or by facsimile or PDF copy, each of which shall be deemed an original, and all of which together shall constitute one and the same instrument.

[*Signature Page Follows*]

IN WITNESS WHEREOF, authorized representatives of Dicerna, Protiva and Tekmira have executed and delivered this License Agreement effective as of the Effective Date.

DICERNA PHARMACEUTICALS, INC.

By: /s/ Douglas Fambrough
Name: Douglas Fambrough
Title: CEO & President

DICERNA PHARMACEUTICALS, INC.

By: /s/ James E. Dentzer
Name: James E. Dentzer
Title: Chief Financial Officer

PROTIVA BIOTHERAPEUTICS INC.

By: /s/ B. Cousins
Name: B. Cousins
Title: EVP & CFO

By: /s/ Paul Brennan
Name: Paul Brennan
Title: SVP Business Development

TEKMIRA PHARMACEUTICALS CORPORATION

By: /s/ B. Cousins
Name: B. Cousins
Title: EVP & CFO

By: /s/ Paul Brennan
Name: Paul Brennan
Title: SVP Business Development

Exhibit A

Protiva Patents

*****

THE COMPANY HAS REQUESTED AN ORDER FROM THE COMMISSION PURSUANT TO RULE 406 UNDER THE SECURITIES ACT OF 1933, AS AMENDED, GRANTING CONFIDENTIAL TREATMENT TO SELECTED PORTIONS. ACCORDINGLY, THE CONFIDENTIAL PORTIONS HAVE BEEN OMITTED FROM THIS EXHIBIT, AND HAVE BEEN FILED SEPARATELY WITH THE COMMISSION. OMITTED PORTIONS ARE INDICATED IN THIS EXHIBIT WITH "*****".

Exhibit B

Tekmira Patents

*****

THE COMPANY HAS REQUESTED AN ORDER FROM THE COMMISSION PURSUANT TO RULE 406 UNDER THE SECURITIES ACT OF 1933, AS AMENDED, GRANTING CONFIDENTIAL TREATMENT TO SELECTED PORTIONS. ACCORDINGLY, THE CONFIDENTIAL PORTIONS HAVE BEEN OMITTED FROM THIS EXHIBIT, AND HAVE BEEN FILED SEPARATELY WITH THE COMMISSION. OMITTED PORTIONS ARE INDICATED IN THIS EXHIBIT WITH "*****".

Exhibit C

Excluded Patents

*****

THE COMPANY HAS REQUESTED AN ORDER FROM THE COMMISSION PURSUANT TO RULE 406 UNDER THE SECURITIES ACT OF 1933, AS AMENDED, GRANTING CONFIDENTIAL TREATMENT TO SELECTED PORTIONS. ACCORDINGLY, THE CONFIDENTIAL PORTIONS HAVE BEEN OMITTED FROM THIS EXHIBIT, AND HAVE BEEN FILED SEPARATELY WITH THE COMMISSION. OMITTED PORTIONS ARE INDICATED IN THIS EXHIBIT WITH "*****".

*****

THE COMPANY HAS REQUESTED AN ORDER FROM THE COMMISSION PURSUANT TO RULE 406 UNDER THE SECURITIES ACT OF 1933, AS AMENDED, GRANTING CONFIDENTIAL TREATMENT TO SELECTED PORTIONS. ACCORDINGLY, THE CONFIDENTIAL PORTIONS HAVE BEEN OMITTED FROM THIS EXHIBIT, AND HAVE BEEN FILED SEPARATELY WITH THE COMMISSION. OMITTED PORTIONS ARE INDICATED IN THIS EXHIBIT WITH “*****”.

Exhibit D

Existing License Grants

*****

THE COMPANY HAS REQUESTED AN ORDER FROM THE COMMISSION PURSUANT TO RULE 406 UNDER THE SECURITIES ACT OF 1933, AS AMENDED, GRANTING CONFIDENTIAL TREATMENT TO SELECTED PORTIONS. ACCORDINGLY, THE CONFIDENTIAL PORTIONS HAVE BEEN OMITTED FROM THIS EXHIBIT, AND HAVE BEEN FILED SEPARATELY WITH THE COMMISSION. OMITTED PORTIONS ARE INDICATED IN THIS EXHIBIT WITH “*****”.

Exhibit E

Press Releases

Dicerna Press Release – See Attachment E-1.

Protiva Press Release – See Attachment E-2.

Attachment E-1.

Dicerna Announces License Agreement with Tekmira to Advance Dicerna's PH1 Development Program

WATERTOWN, Mass., November 17, 2014 – Dicerna Pharmaceuticals, Inc. (NASDAQ: DRNA), a leading developer of RNA interference (RNAi) therapeutics, today announced a licensing agreement for Dicerna to use Tekmira's proprietary lipid nanoparticle (LNP) technology for delivery of DCR-PH1, Dicerna's investigational product candidate for primary hyperoxaluria type 1 (PH1), a rare, inherited liver disorder that often results in kidney failure, and for which there are no approved therapies.

This announcement follows the successful testing of DCR-PH1 in combination with Tekmira's LNP technology in animal models, including mice and non-human primates. Under the agreement, Dicerna will pay Tekmira $2.5 million upfront, as well as $22 million in potential development milestones, and a mid-single-digit royalty on future PH1 sales.

Tekmira's LNP system has shown in other human clinical studies to provide potent, safe and effective RNA delivery to hepatocytes (liver cells). Licensing Tekmira's LNP will streamline the development path for DCR-PH1 and allows Dicerna to focus its LNP efforts on its oncology pipeline.

"Dicerna is focused on realizing the full clinical potential of our proprietary pipeline of highly targeted RNAi therapies by applying proven technologies," said Douglas Fambrough, Ph.D., Chief Executive Officer of Dicerna. "By drawing on Tekmira's extensive and deep experience with lipid nanoparticle delivery to the liver, the agreement will streamline the development path for DCR-PH1. We look forward to initiating Phase 1 trials of DCR-PH1 in 2015, aiming to fill a high unmet medical need for patients with PH1."

"This new agreement validates our leadership position in RNAi delivery and underscores the significant value we can bring to partners who leverage our LNP technology," said Dr. Mark J. Murray, President and CEO of Tekmira. "Our LNP technology is enabling the most advanced applications of RNAi therapeutics in the clinic. We are excited to be working with Dicerna in advancing a needed, investigational therapeutic for the treatment of PH1."

About RNAi

RNAi therapeutics have the potential to treat a number of human diseases by "silencing" disease-causing genes. The discoverers of RNAi, a gene silencing mechanism used by all cells, were awarded the 2006 Nobel Prize for Physiology or Medicine. RNAi trigger molecules often require delivery technology to be effective as therapeutics.

About Tekmira's LNP Technology

Tekmira LNP technology represents the most widely adopted delivery technology for the systemic delivery of RNAi triggers. Tekmira's LNP platform is being utilized in multiple clinical trials by Tekmira and its partners. Tekmira's LNP technology (formerly referred to as stable nucleic acid-lipid particles, or SNALP) encapsulates RNAi triggers with high efficiency in uniform lipid nanoparticles that are effective in delivering these therapeutic compounds to disease sites. Tekmira's LNP formulations are manufactured by a proprietary method that is robust, scalable and highly reproducible, and LNP-based products have been reviewed by multiple regulatory agencies for use in clinical trials. LNP formulations comprise several lipid components that can be adjusted to suit the specific application.

About Primary Hyperoxaluria Type 1 (**PH1)**

PH1 is a rare, inherited liver disorder that often results in severe damage to the kidneys. The disease can be fatal unless the patient undergoes a liver-kidney transplant, a major surgical procedure that is often difficult to perform due to the lack of donors and the threat of organ rejection. In the event of a successful transplant, the patient must live the rest of his or her life on immunosuppressant drugs, which have substantial associated risks. Currently, there are no FDA approved treatments for PH1.

PH1 is characterized by a genetic deficiency of the liver enzyme alanine:glyoxalate-aminotransferase (AGT), which is encoded by the AGXT gene. AGT deficiency induces overproduction of oxalate by the liver, resulting in the formation of crystals of calcium oxalate in the kidneys. Oxalate crystal formation often leads to chronic and painful cases of kidney stones and subsequent fibrosis (scarring), which is known as nephrocalcinosis. Many patients progress to end-stage renal disease (ESRD) and require dialysis or transplant. Aside from having to endure frequent dialysis, PH1 patients with ESRD may experience a build-up of oxalate in the bone, skin, heart and retina, with concomitant debilitating complications. While the true prevalence of primary hyperoxaluria is unknown, it is estimated to be one to three cases per one million people. [1] Fifty percent of patients with PH1 reach ESRD by their mid-30s. [2]

About DCR-PH1

Dicerna is developing DCR-PH1, which is in preclinical development, for the treatment of PH1. DCR-PH1 is engineered to address the pathology of PH1 by targeting and destroying the messenger RNA (mRNA) produced by HAO1, a gene implicated in the pathogenesis of PH1. HAO1 encodes glycolate oxidase, a protein involved in producing oxalate. By reducing oxalate production, this approach is designed to prevent the complications of PH1. In preclinical studies, DCR-PH1 has been shown to induce potent and long-term inhibition of HAO1 and to significantly reduce levels of urinary oxalate, while demonstrating long-term efficacy and tolerability in animal models of PH1.

About Dicerna's Dicer Substrate Technology

Dicerna's proprietary RNAi molecules are known as Dicer substrates, or DsiRNAs, so called because they are processed by the Dicer enzyme, which is the initiation point for RNAi in the human cell cytoplasm. Dicerna's discovery approach is believed to maximize RNAi potency because the DsiRNAs are structured to be ideal for processing by Dicer. Dicer processing enables the preferential use of the correct RNA strand of the DsiRNA, which may increase the efficacy of the RNAi mechanism, as well as the potency of the DsiRNA molecules relative to other molecules used to induce RNAi.

About Tekmira

Tekmira Pharmaceuticals Corporation is a biopharmaceutical company focused on advancing novel RNAi therapeutics and providing its leading lipid nanoparticle (LNP) delivery technology to pharmaceutical partners. Tekmira has been working in the field of nucleic acid delivery for over a decade, and has broad intellectual property covering its delivery technology. Further information about Tekmira can be found at www.tekmira.com. Tekmira is based in Vancouver, Canada and Seattle, USA.

About Dicerna

Dicerna Pharmaceuticals, Inc., is a biopharmaceutical company focused on the discovery and development of innovative treatments for rare, inherited diseases involving the liver and for cancers that are genetically defined. The company is using its proprietary RNA interference (RNAi) technology platform to build a broad pipeline in these therapeutic areas. In both rare diseases and oncology, Dicerna is pursuing targets that have been difficult to address using conventional approaches, but where connections between targets and diseases are well understood and documented. The company intends to discover, develop and commercialize novel therapeutics either on its own or in collaboration with pharmaceutical partners.

Cautionary Note on Forward-Looking Statements

This press release includes forward-looking statements. Such forward-looking statements are subject to risks and uncertainties that could cause actual results to differ materially from those expressed or implied in such statements. Applicable risks and uncertainties include that LNP technology may fail to deliver DCR-PH1 to the liver in human beings or otherwise fail to accelerate clinical development, and that clinical trials may not demonstrate the effectiveness of DCR-PH1. Additional risks, including those relating to Dicerna's preclinical research and clinical development and other risks, are identified under the heading "Risk Factors" included in Dicerna's most recent Form 10-Q filing and in other future filings with the SEC. The forward-looking statements contained in this press release reflect Dicerna's current views with respect to future events, and Dicerna does not undertake and specifically disclaims any obligation to update any forward-looking statements.

References

[1] Cochat, P, Rumsby, G. Primary hyperoxaluria. *The New England Journal of Medicine* 2013; 369(7): 649-658.
[2] Rare Kidney Stone Consortium. Primary Hyperoxaluria. 2010. Available at: http://www.rarekidneystones.org/hyperoxaluria/physicians.html. Accessed October 14, 2014.

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Attachment E-2.

Not For Immediate Release **November 17, 2014**

Tekmira Announces Licensing and Collaboration Agreement with Dicerna

Tekmira's LNP to enable Dicerna's PH1 Candidate

Vancouver, B.C. – Tekmira Pharmaceuticals Corporation (NASDAQ:TKMR; TSX:TKM) a leading developer of RNA interference (RNAi) therapeutics, today announces a licensing and collaboration agreement with Dicerna Pharmaceuticals, Inc. Tekmira has licensed its proprietary lipid nanoparticle (LNP) delivery technology for exclusive use in Dicerna's primary hyperoxaluria type 1 (PH1) development program.

Under the agreement, Dicerna will pay Tekmira $2.5 million upfront and payments of $22 million in aggregate development milestones, plus a mid-single-digit royalty on future PH1 sales. This new partnership also includes a supply agreement with Tekmira providing clinical drug supply and regulatory support in the rapid advancement of the product candidate.

The agreement announced today follows the successful testing and demonstration of positive results combining Tekmira's LNP technology with DCR-PH1 in pre-clinical animal models.

Dicerna will use Tekmira's third generation LNP technology for delivery of DCR-PH1, Dicerna's Dicer substrate RNA (DsiRNA) molecule, for the treatment of PH1, a rare, inherited liver disorder that often results in kidney failure and for which there are no approved therapies.

"This new agreement validates our leadership position in RNAi delivery with LNP technology, and it underscores the significant value we can bring to partners who leverage our technology. Our LNP technology is enabling the most advanced applications of RNAi therapeutics in the clinic, and it continues to do so. We are excited to be working with Dicerna to be able to advance a needed therapeutic for the treatment of PH1," said Dr. Mark J. Murray, Tekmira's President and CEO.

"As a core pillar of our business strategy, we continue to engage in partnerships where our technology improves the risk profile and accelerates the development programs of our collaborators and provides meaningful non-dilutive financing to TKMR," added Dr. Murray.

“Dicerna is focused on realizing the full clinical potential of our proprietary pipeline of highly targeted RNAi therapies by applying proven technologies,” said Douglas Fambrough, Ph.D., Chief Executive Officer of Dicerna. “By drawing on Tekmira’s extensive and deep experience with lipid nanoparticle delivery to the liver, the agreement will streamline the development path for DCR-PH1. We look forward to initiating Phase 1 trials of DCR-PH1 in 2015, aiming to fill a high unmet medical need for patients with PH1.”

About RNAi

RNAi therapeutics have the potential to treat a number of human diseases by “silencing” disease-causing genes. The discoverers of RNAi, a gene silencing mechanism used by all cells, were awarded the 2006 Nobel Prize for Physiology or Medicine. RNAi trigger molecules often require delivery technology to be effective as therapeutics.

About Tekmira’s LNP Technology

Tekmira believes its LNP technology represents the most widely adopted delivery technology for the systemic delivery of RNAi triggers. Tekmira’s LNP platform is being utilized in multiple clinical trials by Tekmira and its partners. Tekmira’s LNP technology (formerly referred to as stable nucleic acid-lipid particles, or SNALP) encapsulates RNAi triggers with high efficiency in uniform lipid nanoparticles that are effective in delivering these therapeutic compounds to disease sites. Tekmira’s LNP formulations are manufactured by a proprietary method which is robust, scalable and highly reproducible, and LNP-based products have been reviewed by multiple regulatory agencies for use in clinical trials. LNP formulations comprise several lipid components that can be adjusted to suit the specific application.

About Primary Hyperoxaluria Type 1 (**PH1)**

PH1 is a rare, inherited liver disorder that often results in severe damage to the kidneys. The disease can be fatal unless the patient undergoes a liver-kidney transplant, a major surgical procedure that is often difficult to perform due to the lack of donors and the threat of organ rejection. In the event of a successful transplant, the patient must live the rest of his or her life on immunosuppressant drugs, which have substantial associated risks. Currently, there are no FDA approved treatments for PH1.

PH1 is characterized by a genetic deficiency of the liver enzyme alanine:glyoxalate-aminotransferase (AGT), which is encoded by the AGXT gene. AGT deficiency induces overproduction of oxalate by the liver, resulting in the formation of crystals of calcium oxalate in the kidneys. Oxalate crystal formation often leads to chronic and painful cases of kidney stones and subsequent fibrosis (scarring), which is known as

nephrocalcinosis. Many patients progress to end-stage renal disease (ESRD) and require dialysis or transplant. Aside from having to endure frequent dialysis, PH1 patients with ESRD may experience a build-up of oxalate in the bone, skin, heart and retina, with concomitant debilitating complications. While the true prevalence of primary hyperoxaluria is unknown, it is estimated to be one to three cases per one million people. [1] Fifty percent of patients with PH1 reach ESRD by their mid-30s. [2]

About DCR-PH1

Dicerna is developing DCR-PH1, which is in preclinical development, for the treatment of PH1. DCR-PH1 is engineered to address the pathology of PH1 by targeting and destroying the messenger RNA (mRNA) produced by HAO1, a gene implicated in the pathogenesis of PH1. HAO1 encodes glycolate oxidase, a protein involved in producing oxalate. By reducing oxalate production, this approach is designed to prevent the complications of PH1. In preclinical studies, DCR-PH1 has been shown to induce potent and long-term inhibition of HAO1 and to significantly reduce levels of urinary oxalate, while demonstrating long-term efficacy and tolerability in animal models of PH1.

About Dicerna's Dicer Substrate Technology

Dicerna's proprietary RNAi molecules are known as Dicer substrates, or DsiRNAs, so called because they are processed by the Dicer enzyme, which is the initiation point for RNAi in the human cell cytoplasm. Dicerna's discovery approach is believed to maximize RNAi potency because the DsiRNAs are structured to be ideal for processing by Dicer. Dicer processing enables the preferential use of the correct RNA strand of the DsiRNA, which may increase the efficacy of the RNAi mechanism, as well as the potency of the DsiRNA molecules relative to other molecules used to induce RNAi.

About Tekmira

Tekmira Pharmaceuticals Corporation is a biopharmaceutical company focused on advancing novel RNAi therapeutics and providing its leading lipid nanoparticle (LNP) delivery technology to pharmaceutical partners. Tekmira has been working in the field of nucleic acid delivery for over a decade, and has broad intellectual property covering its delivery technology. Further information about Tekmira can be found at www.tekmira.com. Tekmira is based in Vancouver, Canada and Seattle, USA.

About Dicerna

Dicerna Pharmaceuticals, Inc., is a biopharmaceutical company focused on the discovery and development of innovative treatments for rare, inherited diseases involving the liver and for cancers that are genetically defined. The company is using its proprietary RNA interference (RNAi) technology platform to build a broad pipeline in these therapeutic areas. In both rare diseases and oncology, Dicerna is pursuing

targets that have been difficult to address using conventional approaches, but where connections between targets and diseases are well understood and documented. The company intends to discover, develop and commercialize novel therapeutics either on its own or in collaboration with pharmaceutical partners.

Forward-Looking Statements and Information

This news release contains “forward-looking statements” or “forward-looking information” within the meaning of applicable securities laws (collectively, “forward-looking statements”). Forward-looking statements in this news release include statements about Tekmira’s strategy, future operations, clinical trials, prospects and the plans of management; RNAi (ribonucleic acid interference) product development programs; the licensing and collaboration agreement with Dicerna; the upfront and development milestones, and royalties on future sales payable by Dicerna to Tekmira; the supply agreement with Dicerna; and initiation of Phase I trials of DCR-PH1 in 2015.

With respect to the forward-looking statements contained in this news release, Tekmira has made numerous assumptions regarding, among other things: LNP’s status as a leading RNAi delivery technology. While Tekmira considers these assumptions to be reasonable, these assumptions are inherently subject to significant business, economic, competitive, market and social uncertainties and contingencies.

Additionally, there are known and unknown risk factors which could cause Tekmira’s actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by the forward-looking statements contained herein. Known risk factors include, among others: the use of Tekmira’s LNP delivery technology for delivery of DCR-PH1 may have no positive effect on the treatment of PH1; Tekmira may not receive milestone payments or royalties from Dicerna in the quantum anticipated, or at all; the initiation of Phase I trials of DCR-PH1 may not occur as currently contemplated, or at all; Tekmira’s products may not prove to be effective or as potent as currently believed; the FDA may refuse to approve Tekmira’s products, or place restrictions on Tekmira’s ability to commercialize its products; Tekmira may not obtain and protect intellectual property rights, and operate without infringing on the intellectual property rights of others; Tekmira may face competition from other pharmaceutical or biotechnology companies and the possibility that other organizations have made advancements in RNAi delivery technology that Tekmira is not aware of; anticipated pre-clinical and clinical trials may be more costly or take longer to complete than anticipated, and may never be initiated or completed, or may not generate results that warrant future development of the tested drug candidate; and economic and capital market conditions.

A more complete discussion of the risks and uncertainties facing Tekmira appears in Tekmira's Annual Report on Form 10-K and Tekmira's continuous disclosure filings, which are available at www.sedar.com or at www.sec.gov. All forward-looking statements herein are qualified in their entirety by this cautionary statement, and Tekmira disclaims any obligation to revise or update any such forward-looking statements or to publicly announce the result of any revisions to any of the forward-looking statements contained herein to reflect future results, events or developments, except as required by law.

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References

1 Cochat, P, Rumsby, G. Primary hyperoxaluria. *The New England Journal of Medicine* 2013; 369(7): 649-658.

2 Rare Kidney Stone Consortium. Primary Hyperoxaluria. 2010. Available at: http://www.rarekidneystones.org/hyperoxaluria/physicians.html. Accessed October 14, 2014.

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Media Contacts:

Tekmira:
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Exhibit 10.29

Execution Version

DEVELOPMENT AND SUPPLY AGREEMENT

By and Among

PROTIVA BIOTHERAPEUTICS INC.

And

TEKMIRA PHARMACEUTICALS CORPORATION

ON THE ONE HAND,

And

DICERNA PHARMACEUTICALS, INC.

ON THE OTHER HAND

THE COMPANY HAS REQUESTED AN ORDER FROM THE SECURITIES AND EXCHANGE COMMISSION (THE "COMMISSION") PURSUANT TO RULE 406 UNDER THE SECURITIES ACT OF 1933, AS AMENDED, GRANTING CONFIDENTIAL TREATMENT TO SELECTED PORTIONS. ACCORDINGLY, THE CONFIDENTIAL PORTIONS HAVE BEEN OMITTED FROM THIS EXHIBIT, AND HAVE BEEN FILED SEPARATELY WITH THE COMMISSION. OMITTED PORTIONS ARE INDICATED IN THIS EXHIBIT WITH "*****".

TABLE OF CONTENTS

Exhibits

DEVELOPMENT AND SUPPLY AGREEMENT

THIS DEVELOPMENT AND SUPPLY AGREEMENT (this " **Supply Agreement** ") is entered into as of November 16, 2014 (the " **Effective Date** "), by and among **Dicerna Pharmaceuticals, Inc.** , a Delaware corporation having its principal place of business at 480 Arsenal Street, Building 1, Suite 120, Watertown, MA 02472 USA (" **Dicerna** "), on the one hand, and **Protiva Biotherapeutics Inc.** a British Columbia corporation having its principal place of business at 100-8900 Glenlyon Way, Burnaby, B.C.V5J 5J8, Canada (" **Protiva** "), and (with respect to Section 12.1(c) only) **Tekmira Pharmaceuticals Corporation** , a British Columbia corporation having its principal place of business at 100-8900 Glenlyon Way, Burnaby, B.C.V5J 5J8, Canada (" **Tekmira** ") on the other hand.

RECITALS

WHEREAS , the Parties entered into a Material Transfer Agreement dated August 13, 2014 and a License Agreement (as defined below) as of the date hereof;

WHEREAS , the Parties desire to enter into this Supply Agreement pursuant to which Protiva shall perform certain development and other services for Dicerna and Manufacture and test Manufactured Product for Dicerna upon the terms and subject to the conditions set forth in this Supply Agreement (as each term is defined below);

WHEREAS , the Parties are, contemporaneously herewith, entering into a License Agreement, pursuant to which Protiva is licensing Dicerna to develop, have manufactured and commercialize Products (as defined in the License Agreement) directed to treatment of PH1; and

WHEREAS , Tekmira is the parent of Protiva and is willing to guarantee Protiva's performance under this Supply Agreement, upon the terms and subject to the conditions set forth in this Supply Agreement.

NOW THEREFORE , in consideration of the mutual covenants and agreements herein contained, and other good and valuable consideration, the receipt of which is hereby acknowledged, the Parties agree as follows:

Article 1 DEFINITIONS AND INTERPRETATION

1.1 Definitions.

Unless the context otherwise requires, the terms in this Supply Agreement, the Quality Agreement, and any SOW, with initial letters capitalized, shall have the meanings set forth below, or the meaning as designated in the indicated places throughout this Supply Agreement.

(a) " **Additional Formulation** " means any formulation (other than a Product) directed to the treatment of PH1 using the LNP Technology and the Dicerna Materials necessary or useful to support Dicerna's preclinical studies and clinical trials that is Manufactured by Protiva.

(b) " **Affiliate** " has the meaning set forth in the License Agreement.

(c) " **Applicable Laws** " has the meaning set forth in the License Agreement.

(d) " **Applicable Requirements** " means, with respect to any task or activity, all Applicable Laws (including GMPs), Specifications and SOPs applicable to such task or activity.

(e) " **Arbitrators** " has the meaning set forth at Section 12.7(b).

(f) " **Associated Documentation** " means, with respect to each Dicerna Material, the material safety data sheet (" **MSDS** "), Certificate of Analysis, and instructions for proper handling and storage applicable to such Dicerna Material.

(g) " **Batch** " means a specific quantity of a Manufactured Product having a particular Specification, and that (i) has uniform character and quality within specified limits, and (ii) is produced according to a single Manufacturing SOW during a single Run.

(h) " **Batch Forecast** " means a non-binding, good faith, ***** rolling forecast of Dicerna's estimated requirements for GMP Batches and Non-GMP Batches of Manufactured Product, as applicable, during the ***** period covered by such Batch Forecast.

(i) " **Batch Price** " means, with respect to the Manufacture of each Batch of Manufactured Product, the amount, measured in Dollars, to be paid to Protiva as specified in the applicable SOW, which amount shall be equal to the Reimbursable Expenses.

(j) " **Business Day** " means any day that is not a Saturday, a Sunday, or other day which is a statutory holiday in the Province of British Columbia, Canada or a State or Federal holiday in Massachusetts.

(k) " **Calendar Quarter** " means the respective periods of three (3)-consecutive calendar months ending on March 31, June 30, September 30 and December 31.

(l) " **Certificate of Analysis** " or " **CoA** " means a document signed by an authorized representative of either Party, a Permitted Contractor, or a CMO, as the case may be, describing, with respect to a particular material or Batch (i) the characteristics of such material or Batch, measured on the basis of the applicable Specifications for, and testing methods applied to, such material or Batch and (ii) certifying the accuracy of each of the foregoing.

(m) " **Certificate of Compliance** " or " **CoC** " means, as further specified in the Quality Agreement, for each Batch, a document prepared by Protiva (i) listing the manufacturing date, unique Batch number, and quantity of Manufactured Product in such Batch, and (ii) certifying that such Batch was manufactured in conformance and in accordance with the warranties set forth in Section 12.1(b). The Parties shall from time to time agree upon a format or formats for the Certificate of Compliance to be used under this Supply Agreement.

(n) " **Change Order** " has the meaning set forth in Section 3.5(c).

(o) " **CMO** " means a contract manufacturing organization.

(p) " **CMO Agreement** " means a manufacturing or service agreement entered into by Dicerna, one of its Affiliates or one of their Sublicensees with any Designated CMO or Secondary CMO for the Manufacture of Product.

(q) " **Commercialize** " or " **Commercialization** " has the meaning set forth in the License Agreement.

(r) " **Commercially Reasonable Efforts** " has the meaning set forth in the License Agreement.

(s) " **Confidential Information** " has the meaning set forth in the License Agreement.

(t) " **CTA** " means a Clinical Trial Application filed with the national competent authority in an EU member state for regulatory approval of a clinical trial of the Product, including all amendments and supplements to the application.

(u) " **Delay Event** " means any event resulting in the delay or interruption of the performance of the Services arising out of or in connection with any act or omission of Dicerna, its Affiliate, their Sublicensee, or any Designated CMO or Secondary CMO, including any failure to provide required Dicerna Materials to Protiva and any interruption to the performance of an SOW arising out a visit to the Facilities by Dicerna, its Affiliate, their Sublicensee or any Designated CMO or Secondary CMO.

(v) " **Delivery Joint Patent** " has the meaning set forth in Section 7.3(a).

(w) " **Designated CMO** " means any CMO selected by Dicerna, its Affiliate or their Sublicensees as its primary manufacturer of Product for commercial sales.

(x) " **Develop," "Developing" o** r " **Development** " has the meaning set forth in the License Agreement.

(y) " **Dicerna** " has the meaning set forth in the Preamble.

(z) " **Dicerna Indemnitees** " has the meaning set forth in Section 9.1.

(aa) " **Dicerna Materials** " means all double stranded siRNA molecules targeting HAO1 and any other nucleic acid constructs, biological materials or active substance(s) related to the Product, which in each case are to be provided by Dicerna, its Affiliates or their Sublicensees to Protiva for use in the performance of the Services.

(bb) " **Dicerna Rights and Technology** " means Patents, rights to Patents, Know-How, Inventions and other intellectual property (including methods, processes, or compositions of matter) directed to Dicer Substrates or Products directed to treatment of PH1.

(cc) " **Dicer Substrates** " means double stranded siRNA molecules.

(dd) " **Dispute** " has the meaning set forth at Section 12.7(b).

(ee) " **Disputed Batch** " has the meaning set forth at Section 4.9.

(ff) " **DMF** " means Protiva's Drug Master File filed with any Regulatory Authority covering the Manufacture of Manufactured Product.

(gg) " **Dollars** " and " **$** " mean the lawful currency of the United States of America.

(hh) " **Effective Date** " has the meaning set forth in the introductory paragraph.

(ii) " **EMA** " means the European Medicines Agency, a body of the European Union and established by Regulation (EC) No 726/2004 of the European Parliament and of the Council of March 31, 2004, or any successor agency(ies) thereof performing similar functions.

(jj) " **Equipment** " means any part or whole of the manufacturing or testing equipment designed by or for Protiva, and used by Protiva, Dicerna or any Designated CMO or Secondary CMO in connection with the Services or the Technical Transfer.

(kk) " **Executed Batch Record** " means a compilation of records containing the Manufacturing history and control of a specific Batch. These records are generated by the Manufacturing and Quality Control personnel and reviewed and approved by the Quality Assurance personnel of the Manufacturing Party or its Affiliate, Sublicensee, Designated CMO or Secondary CMO, as applicable.

(ll) " **Facilities** " means, Protiva's facilities at 100 – 8900 Glenlyon Parkway, Burnaby, B.C. V5J 5J8, Canada, and such other locations as the Parties may agree in writing from time to time, subject to Section 2.4(d).

(mm) " **FDA** " has the meaning set forth in the License Agreement.

(nn) " **FD&C Act** " means the United States Federal Food, Drug and Cosmetic Act, as amended from time to time.

(oo) " **Finished Product** " means any Manufactured Product that has been Manufactured through completion of all Manufacturing stages, including filling, finishing, packaging, and release.

(pp) " **Fees** " *****

(qq) " **First Commercial Sale** " has the meaning set forth in the License Agreement.

(rr) " **Force Majeure Event** " has the meaning set forth in Section 12.2(a).

(ss) " **GLP"** means the good laboratory practices regulations applicable to Manufacture that are promulgated by the Regulatory Authorities in the United States, or any other Regulatory Authorities designated in the applicable SOW as the applicable Regulatory Authorities.

(tt) " **GMP** " means the regulatory requirements for current good manufacturing practices promulgated by the FDA under the U.S. Food, Drug and Cosmetic Act and the regulations promulgated thereunder, particularly 21 C.F.R. Parts 210 and 211, any applicable foreign equivalents thereof, and the quality guidelines of the International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH), all as may be amended from time to time.

(uu) " **GMP Batch** " means a Batch that is intended to meet GMP requirements.

(vv) " **HAO1** " means Hydroxyacid Oxidase (Glycolate Oxidase) 1, a gene transcribing for the protein 2-hydroxyacid oxidase 1.

(ww) " **IND** " has the meaning set forth in the License Agreement.

(xx) " **Indemnified Party** " has the meaning set forth in Section 9.3.

(yy) " **Indemnifying Party** " has the meaning set forth in Section 9.3.

(zz) " **Initial Deposit** " has the meaning set forth in Section 6.1(b).

(aaa) " **Initiation Deposit** " has the meaning set forth in Section 6.1(b).

(bbb) " **Initiating Party** " has the meaning set forth in Section 7.4(e).

(ccc) " **Insolvent Party** " has the meaning set forth in Section 11.3.

(ddd) " **Invention** " means all technology and discoveries, innovations, developments, improvements, enhancements and Know-How conceived, or reduced to practice, including the intellectual property rights embodying the foregoing, such as Patents, copyrights or trade secrets.

(eee) " **JDC** " has the meaning set forth in Section 2.4(a).

(fff) " **Joint Invention** " has the meaning set forth in Section 7.2(d).

(ggg) " **Joint Patent Infringement Action** " has the meaning set forth in Section 7.4(d).

(hhh) " **Joint Patents** " means Patents that cover Joint Inventions.

(iii) " **Know-How** " has the meaning set forth in the License Agreement.

(jjj) " **License Agreement** " means the License Agreement of even date hereof between the Parties.

(kkk) " **Licensed Intellectual Property** " has the meaning set forth in the License Agreement.

(lll) " **Lipid Nanoparticle** " has the meaning set forth in the License Agreement.

(mmm) " **LNP Technology** " has the meaning set forth in the License Agreement.

(nnn) " **Losses** " has the meaning set forth in Section 9.1.

(ooo) " **MAA** " has the meaning set forth in the License Agreement.

(ppp) " **Manufacture** " or " **Manufacturing** " has the meaning set forth in the License Agreement.

(qqq) " **Manufactured Product** " means, for each Batch, the Product or Additional Formulation that is Manufactured in such Batch, as identified in the applicable SOW.

(rrr) " **Manufacturing Process** " means any and all processes (or any step in any process) and analytical methods used or planned to be used by Protiva to Manufacture any Manufactured Product, excluding packaging and labeling.

(sss) " **Master Batch Record** " or " **MBR** " means the manufacturing and control instructions for the Manufacture of a specific Batch of Manufactured Product.

(ttt) " **Materials** " means Protiva Materials and Dicerna Materials.

(uuu) " **NDA** " has the meaning set forth in the License Agreement.

(vvv) " **New York Courts** " has the meaning set forth in Section 12.7(c).

(www) " **Nonconforming Batch** " has the meaning set forth in Section 4.11.

(xxx) " **Non-GMP Batch** " means any Batch intended for non-clinical use, including those intended to meet the requirement for pre-clinical use pursuant to GLP requirements, such as, for example, a batch intended for use in GLP toxicology studies.

(yyy) " **Non-Initiating Party** " has the meaning set forth in Section 7.4(e).

(zzz) " **Party** " means Dicerna or Protiva; and " **Parties** " means Dicerna and Protiva.

(aaaa) " **Patent** " has the meaning set forth in the License Agreement.

(bbbb) " **Patent Infringement Action** " has the meaning set forth in the License Agreement.

(cccc) " **Payload Joint Patent** " has the meaning set forth in Section 7.3(b).

(dddd) " **Permitted Contractor** " has the meaning set forth in the License Agreement.

(eeee) " **Person** " has the meaning set forth in the License Agreement.

(ffff) " **PH1** " means Primary Hyperoxaluria 1.

(gggg) " **Phase 3 Trial** " means a clinical trial that is designed to gather further evidence of safety and efficacy of a Product in the Field (and to help evaluate its overall risks and benefits) and is intended to support Regulatory Approval for a Product in the Field in one or more countries in the Territory.

(hhhh) " **Pivotal Trial** " has the meaning set forth in the License Agreement.

(iiii) " **Product** " has the meaning set forth in the License Agreement.

(jjjj) " **Product Composition Patent** " has the meaning set forth in Section 7.2(e)(iii).

(kkkk) " **Production Plan** " means a plan for Manufacturing the Manufactured Product during a specified period, which plan shall include Protiva's requirements for Dicerna Materials and a production schedule, including scheduled Manufacture dates, for the period covered by such plan.

(llll) " **Protiva** " has the meaning set forth in the Preamble.

(mmmm) " **Protiva Indemnitees** " has the meaning set forth in Section 9.2.

(nnnn) " **Protiva Intellectual Property** " has the meaning set forth in the License Agreement.

(oooo) " **Protiva Materials** " has the meaning set forth in the License Agreement.

(pppp) " **Protiva Rights and Technology** " means Patents, rights to Patents, Know-How, Inventions and other intellectual property (including methods, processes, or compositions of matter) directed to Lipid Nanoparticles.

(qqqq) " **Quality Agreement** " means the quality agreement between the Parties to be entered into within ***** days of the Effective Date, which will govern the Parties' respective quality and regulatory responsibilities for the Manufacture of GMP Batches of Manufactured Product, including equipment cleaning, qualification, calibration and maintenance, testing, sample retention, records and record retention, regulatory inspections, quality audits, out-of-specifications, deviations, investigations, recalls, voluntary withdrawals, and environmental monitoring.

(rrrr) " **Raw Material** " means any component used in the Manufacture of any Manufactured Product.

(ssss) " **Record Retention Period** " has the meaning set forth in Section 6.5.

(tttt) " **Reimbursable Expenses** " *****

(uuuu) " **Regulatory Approval** " has the meaning set forth in the License Agreement.

(vvvv) " **Regulatory Authority** " has the meaning set forth in the License Agreement.

(wwww) " **Replacement Batch** " has the meaning set forth in Section 4.11.

(xxxx) " **Run** " means a single Manufacturing run of Manufactured Product at a Facility and progressing though quality testing and release.

(yyyy) " **Secondary CMO** " means any one or more CMO(s) selected by Dicerna, its Affiliate or their Sublicensees as a back-up manufacturer of Product for commercial sales.

(zzzz) " **Services Forecast** " means a non-binding, good faith, *****-month rolling forecast of Dicerna's estimated requirements for all Services other than the Manufacture of GMP Batches and Non-GMP Batches, during the *****-month period covered by such non-Batch Forecast.

(aaaaa) " **Shipping and Handling Procedures** " means Dicerna's procedures for packaging, preserving, monitoring and shipping any and all Dicerna property.

(bbbbb) " **Services** " means the obligations to be performed by Protiva pursuant to this Supply Agreement.

(ccccc) " **Solvent Party** " has the meaning set forth in Section 11.3.

(ddddd) " **SOP** " means the duly authorized and documented standard operating procedure practiced by each of Dicerna and Protiva in the performance of a specified process.

(eeeee) " **Specifications** " means the list of tests, test procedures, references to any analytical procedures, and appropriate acceptance criteria (i) to which any Manufactured Product at any stage of Manufacture must conform to be considered acceptable for its intended use, or (ii) to which Raw Materials (including Materials) must conform to be considered acceptable for their intended use, in each case that are mutually approved by the Parties, as such Specifications are amended or supplemented from time to time by mutual agreement of the Parties in writing, it being understood, however, that references herein to "Specifications" in the context of Non-GMP Batches shall not imply that such Specifications conform with the standards of GMP, and, as such, Specifications for Non-GMP Batches shall be considered for regulatory and quality control purposes to be draft Specifications. As used in this Supply Agreement, " **Product Specifications** " means the Specifications applicable to a particular Manufactured Product, " **Finished Product Specification** " means the Specifications applicable to a particular Finished Product, " **Raw Materials Specifications** " means the Specifications applicable to a particular Raw Material, and " **Equipment Specifications** " means the Specifications applicable to any part or whole of the Equipment. For clarity, the Product Specifications and Finished Product Specifications will identify which Lipid Nanoparticle will be used in the Manufactured Product *****.

(fffff) " **Statement of Work** " or " **SOW** " means a statement of work or work order signed by both Parties that relates to the Services to be performed by either or both Parties.

(ggggg) " **Sublicensee** " means a Third Party to whom Dicerna has granted a sublicense in a Sublicense Agreement pursuant to the terms of the License Agreement.

(hhhhh) " **Sublicense Agreement** " has the meaning set forth in the License Agreement.

(iiiii) " **Supply Agreement** " means this Development and Supply Agreement and all SOWs generated hereunder, together with all Exhibits attached hereto and to each SOW.

(jjjjj) " **Technical Transfer** " means all or a portion of the transfer by Protiva to Dicerna or a Designated CMO of Protiva Intellectual Property and Protiva's Confidential Information useful or necessary for the Manufacture of Product, including analytical method transfer and qualification, equipment qualification and scale up engineering.

(kkkkk) " **Technical Transfer Plan** " has the meaning set forth in Exhibit D .

(lllll) " **Term** " has the meaning set forth in Section 11.1.

(mmmmm) " **Third Party** " means any Person other than Protiva, Dicerna or any of their respective Affiliates.

(nnnnn) " **Third Party Claim** " has the meaning set forth in Section 9.3.

1.2 Interpretation.

In this Supply Agreement unless otherwise specified:

(a) " **includes** " and " **including** " shall mean respectively includes and including without limitation;

(b) except where the context otherwise requires, the word " **or** " is used in the inclusive sense (and/or);

(c) a Party includes its permitted assignees or their respective permitted successors in title to substantially the whole of its undertaking;

(d) a statute or statutory instrument or any of their provisions is to be construed as a reference to that statute or statutory instrument or such provision as the same may have been or may from time to time hereafter be amended or re-enacted;

(e) words denoting the singular shall include the plural and vice versa and words denoting any gender shall include all genders; and

(f) general words shall not be given a restrictive interpretation by reason of their being preceded or followed by words indicating a particular class of acts, matters or things; and

1.3 Conflict.

(a) In the event of any conflict between this Supply Agreement and the License Agreement, the License Agreement shall prevail.

(b) In the event of any conflict between this Supply Agreement, the Quality Agreement, and any SOW, the following agreements shall govern in the following priority:

(i) this Supply Agreement;

(ii) the Quality Agreement; and

(iii) the applicable SOW;

unless the Quality Agreement or SOW expressly contemplates such conflict, in which case the terms of such Quality Agreement or SOW shall control.

Article 2 DEVELOPMENT COLLABORATION

2.1 Responsibilities of Protiva under the Services.

Subject to the terms and conditions of this Supply Agreement, Dicerna hereby appoints Protiva to provide the following services to Dicerna, its Affiliates and their Sublicensees:

(a) design (i) a formulation of the Product for use in Development by Dicerna, its Affiliates or their Sublicensees, and (ii) the final formulated Product, subject to Dicerna approval, to be used as a clinical development candidate;

(b) Manufacture GMP and Non-GMP Batches of Manufactured Product for Dicerna, its Affiliate or their Sublicensees' pre-clinical testing and development activities;

(c) Manufacture GMP Batches of the Manufactured Product approved by Regulatory Authorities for use by Dicerna, its Affiliate or their Sublicensee in studies required to develop the Product for Regulatory Approval and for all clinical trials up until such time as the completion of Technical Transfer in accordance with Exhibit D ; provided, however, that any obligation of Protiva to continue Manufacture as provided herein will cease if Dicerna fails to perform its obligations related to the Technical Transfer in accordance with the timing set forth in Section 2.1(e);

(d) design stability study protocols, and perform stability studies, for all Batches of the Manufactured Product Manufactured by Protiva;

(e) perform Technical Transfer to Dicerna or any Designated CMO pursuant to the timing mutually agreed by the Parties, provided that it must occur prior to the earlier of (i) initiation of a Phase 3 Trial or (ii) the Manufacture of the Batches for the First Commercial Sale of the Product;

(f) with respect to Regulatory Authorities:

(i) grant (and hereby does grant) to Dicerna permission to provide Regulatory Authorities reference access to Protiva's DMF (s) for the Manufactured Product and to other regulatory documentation of Protiva directed to Lipid Nanoparticles or the Manufactured Product, solely for the purpose of enabling such Regulatory Authorities to examine the suitability of the Manufactured Product for Regulatory Approval;

(ii) to the extent Regulatory Authorities make written demands for more detailed information than is available in Protiva's DMF or other regulatory documentation of Protiva directed to Lipid Nanoparticles or the Manufactured Product, update Protiva's DMF or assist in the preparation of all Chemistry, Manufacturing and Control (CMC)-related regulatory documents necessary for any IND, CTA, NDA, MAA and other submissions to Regulatory Authorities;

(iii) assist Dicerna in responding to requests from Regulatory Authorities; and

(iv) assist Dicerna in relevant filings with respect to the Product, including any IND or CTA, with Regulatory Authorities.

2.2 Technical Transfer.

With respect to Technical Transfer, the Parties have the rights and obligations set forth on Exhibit D .

2.3 Statements of Work.

The Parties acknowledge that the performance of the Services may be implemented through one or more SOWs executed by both Parties, and in accordance with the timelines set forth therein. The Parties agree to negotiate all SOWs and Change Orders in good faith and Protiva may not unreasonably withhold, delay or condition its acceptance or execution of any SOW or Change Order proposed by Dicerna that is necessary for the implementation of the Services as described in Section 2.1. The process for proposal and execution of SOWs is further set forth in Sections 3.2, 3.3, 3.4 and 3.5 Attached hereto as Exhibits A , B and C are drafts of the initial three SOWs. The Parties shall use Commercially Reasonable Efforts to finalize such draft SOWs as promptly as practical after the Effective Date, with a goal of finalizing them within ***** days after the Effective Date.

2.4 Joint Development Committee.

(a) Within ***** days after the Effective Date, the Parties shall appoint a joint development committee (the " **JDC** "), consisting of an equal number of members appointed by each Party, which number of members shall not exceed ***** from each Party, to oversee the performance of the Services and the Development and Manufacturing by Protiva of the Manufactured Product, subject to the terms set forth herein. Each member of the JDC shall have the appropriate expertise to oversee the Parties' performance of their respective obligations under this Supply Agreement. Each Party shall have the right, at any time and from time to time, to designate a replacement, on a permanent or temporary basis, for any or all of its previously designated members of the JDC. After the JDC has been formed, it shall remain in existence until the earlier of the First Commercial Sale of the Manufactured Product or the successful completion of Technical Transfer.

(b) The JDC shall meet at least ***** per ***** on such dates and times as the Parties may agree. The Parties shall agree in advance on a written agenda for each meeting of the JDC. The regularly scheduled JDC meetings shall take place in person or telephonically as determined by the Parties. The members of the JDC may also convene or be polled or consulted from time to time by means of telephone conference, video conference, electronic mail or correspondence and the like, as the Parties deem necessary. The Parties will alternate (every other meeting) responsibility for drafting the minutes of the meeting of the JDC, which shall be promptly (and in any event within ***** days of the meeting) issued to the Parties following each meeting. The Parties shall use Commercially Reasonable Efforts to agree as to the specific text of such minutes within ***** days after receipt.

(c) The principal purposes of the JDC shall be to oversee and provide guidance and direction on the overall strategy for the Development and Manufacturing by Protiva of the Manufactured Product. Subject to the express rights of the Parties as set forth herein, the functions of the JDC shall include:

(i) reviewing the overall strategy regarding clinical and regulatory matters pertaining to the Manufactured Product;

(ii) acting as liaison between the Parties to ensure that they are informed of the ongoing progress of the Development of the Manufactured Product;

(iii) overseeing creation of annual and long-range plans for Development of the Manufactured Product;

(iv) reviewing and approving Specifications and SOPs;

(v) agreeing to non-binding written Batch Forecasts and non-binding written Services Forecasts of anticipated Manufacturing and Service requirements during the applicable *****-month period covered by each such forecast, in accordance with Section 3.1 below; and

(vi) performing such other responsibilities as may be mutually agreed upon by the Parties from time to time.

(d) The Parties shall use Commercially Reasonable Efforts to make all decisions in good faith by unanimous vote or unanimous written consent of both Parties, with each Party having, collectively among its respective designees, one vote in all decisions; provided , however , that if the issue in question requires resolution prior to the date Dicerna could reasonably expect the issue to be resolved pursuant to this Supply Agreement, then subject to the other provisions in, and obligations under, this Agreement (i) Protiva has final decision making authority (including regarding the implementation thereof), on: ***** (ii) the JDC shall continue to discuss the following items in good faith, which may only be resolved by the unanimous vote or unanimous written consent of the JDC: ***** (iii) Dicerna has final decision making authority (including regarding the implementation thereof) on *****.

(e) Each Party shall be responsible for the costs of its representatives on the JDC, including all travel and related costs and expenses for its members and approved invitees to attend meetings of, and otherwise participate on, the JDC.

(f) The JDC shall not have any power to amend, modify or waive compliance with this Supply Agreement.

2.5 On-Site Participation of Dicerna Personnel at the Facilities.

(a) Dicerna has the right to designate at its discretion up to ***** of its or its Designated CMO's personnel to be on site at the applicable Facility, and such additional personnel in such numbers as may be agreed to by the Parties or as otherwise required by Applicable Requirements, during normal business hours to (i) coordinate and observe the Runs and (ii) otherwise assist Dicerna and its Designated CMO to prepare for Technical Transfer and for any future interactions or correspondence with the applicable Regulatory Authorities.

(b) While at the Facilities, Dicerna's representatives will have access to such areas as are reasonably related to the Manufacture of the Manufactured Products, food-service areas, designated office space and public areas, or as otherwise authorized by Protiva, and shall comply (i) as agents of Dicerna with all confidentiality obligations owed by Dicerna hereunder and (ii) with applicable Protiva policies and procedures (including all Protiva security policies and procedures) as provided to Dicerna in writing.

2.6 Acceptance of Final Formulated Product.

Protiva shall submit the final formulated Product developed by Protiva pursuant to this Supply Agreement and as set forth in the applicable SOW to Dicerna for Dicerna's evaluation, testing and approval. Protiva shall provide such assistance as Dicerna may reasonably require to conduct such evaluation and testing. If Dicerna reasonably determines that the final formulated Product does not meet the agreed-upon Finished Product Specifications, then Dicerna shall provide Protiva with notice of the same. ***** Acceptance of the final formulated Product does not waive any representation, warranty or other rights provided in this Supply Agreement.

Article 3 FORECASTING

3.1 Batch Forecasting.

(a) The JDC shall use Commercially Reasonable Efforts to agree on non-binding written Batch Forecasts of anticipated Manufacturing requirements during the applicable *****-month period covered by each such forecast no later than the ***** Business Day of each *****.

(b) Dicerna's JDC members shall initially propose a Batch Forecast to Protiva JDC members, which proposal shall specify the quantity of each GMP Batch and Non-GMP Batch of Manufactured Product, as applicable, and the anticipated Manufacturing date for each Batch, specified as *****. Dicerna shall propose each such Batch Forecast in good faith based on its anticipated requirements for Manufactured Products.

(c) Within ***** days following Protiva's JDC members receipt of each proposed Batch Forecast, the JDC shall agree upon a final forecast, and the JDC shall deliver to Dicerna a

Production Plan covering the forecasted period and notify Dicerna by facsimile or electronic mail addressed to the attention of a JDC member of Dicerna to be designated by Dicerna, if Protiva anticipates difficulties in meeting Dicerna's requirements or timelines during the forecasted period, and the JDC shall thereafter negotiate a mutually achievable Production Plan.

(d) The Parties acknowledge and agree that Protiva may not be able to provide Dicerna with Manufactured Product in excess of what is in a Batch Forecast due to Protiva's use of the applicable Production Plan in scheduling its materials procurement and in allocating its personnel.

3.2 Services Forecasting.

(a) The JDC shall use Commercially Reasonable Efforts to agree on non-binding written Services Forecasts of anticipated Service requirements during the applicable *****-month period covered by each such forecast no later than the ***** Business Day of each *****.

(b) Dicerna's JDC members shall initially propose a Services Forecast to Protiva JDC members, which proposal shall specify the nature of the Service and the anticipated date by which such Services shall be completed, specified as *****.

(c) Within ***** days following Protiva's JDC members receipt of each proposed Services Forecast, the JDC shall agree upon a final forecast, and the JDC shall deliver to Dicerna a plan covering the forecasted period and notify Dicerna by facsimile or electronic mail addressed to the attention of a JDC member of Dicerna to be designated by Dicerna, if Protiva anticipates difficulties in meeting Dicerna's requirements or timelines during the forecasted period, and the JDC shall thereafter negotiate a mutually achievable Services Forecast.

(d) The Parties acknowledge and agree that Protiva may not be able to provide Dicerna with non-Manufacturing Services in excess of what is in the Services Forecast due to Protiva's use of the Services Forecast in allocating its personnel.

3.3 Lead Times for Manufacturing SOWs.

(a) Other than for the initial SOWs attached hereto, Dicerna shall send a draft SOW for any desired Batch to be Manufactured at least: (A) ***** days prior to each Manufacturing date for each GMP Batch; and (B) ***** days prior to each Manufacturing date for each non-GMP Batch (provided that Protiva shall use Commercially Reasonable Efforts to accommodate requests from Dicerna for Manufacturing with a shorter lead time), specifying:

*****

*****

(b) Only one (1) Batch of Manufactured Product shall be ordered in each SOW. Each SOW shall be sent by facsimile or electronic mail to Protiva addressed to the attention of Director of Manufacturing and Supply Chain (or such other Person as Protiva may designate from time to time in writing).

(c) Within ***** Business Days of receipt of each draft SOW, Protiva shall respond by facsimile or electronic mail to Dicerna addressed to the attention of the Vice President of Business Development (or such other Person as Dicerna may designate from time to time) specifying:

*****

Protiva may not reject a SOW for the Manufacture of a Batch if the same is consistent with the then-current Batch Forecast and Production Plan.

3.4 Lead Times for all Other SOWs.

(a) Other than for the initial SOWs attached hereto, Dicerna shall provide Protiva a draft SOW for any desired non-Manufacturing Services at least ***** days prior to the start of each desired Service (provided that Protiva shall use Commercially Reasonable Efforts to accommodate requests from Dicerna for Services with a shorter lead time), specifying:

*****

*****

(b) Within ***** Business Days of receipt of each draft SOW, Protiva shall respond by facsimile or electronic mail to Dicerna addressed to the attention of Vice President of Business Development (or such other Person as Dicerna may designate from time to time) specifying:

*****

Notwithstanding the lead time specified in this Section 3.4, Dicerna is not required to issue a SOW at least ***** days prior to a desired Service if shorter notice is provided by Regulatory Authorities to Dicerna. Provided that Dicerna shall have notified Protiva in writing within ***** Days of Dicerna's receipt of any demand from a Regulatory Authority, Protiva shall assist Dicerna in responding to queries and demands from Regulatory Authorities.

3.5 Binding SOWs and Change Orders.

(a) Except as the Parties shall otherwise agree and without limiting Section 2.3, the Parties shall make Commercially Reasonable Efforts to mutually execute each SOW in sufficient time for all activities contemplated in such SOW to be completed as scheduled in the applicable forecast.

(b) Each SOW shall be governed by the terms of this Supply Agreement, and none of the terms of Dicerna's purchase orders, Protiva's acknowledgment forms, or any other form, shall apply.

(c) If the scope of work of a SOW changes, then the applicable SOW may be amended as provided in this Section 3.5(c) (each a " **Change Order** "). If a required modification to a SOW is identified by either Party, the identifying Party shall notify the other Party in writing as soon as reasonably possible to provide a description of the required modification(s). If Dicerna identifies a change, Protiva shall respond within ***** Days of receiving such notice or within such time as may be required for Protiva to obtain necessary information from its Permitted Contractors, and shall indicate in writing to Dicerna (i) whether such Change Order is necessary or feasible, (ii) to what extent, if any, such Change Order alters the time frame, or any other parameters of Protiva's Manufacture of the applicable Batch or provision of the applicable Service, and (iii) what effect, if any, Protiva believes the implementation of such Change Order would have on the Batch Price or Fees, and both Parties shall use Commercially Reasonable Efforts to timely execute a mutually agreeable Change Order.

(d) When contracting with Permitted Contractors, Protiva shall use Commercially Reasonable Efforts to minimize any rescheduling fees and cancellation fees charged by such Permitted Contractors, it being understood that any Permitted Contractor that is already an existing contractor of Tekmira or Protiva have established rescheduling fees and cancellation fees, which fees shall be the responsibility of and paid by Dicerna in the event of an applicable rescheduling or cancellation.

(e) No Change Order shall be effective unless and until it has been signed by authorized representatives of both Parties.

(f) Unless otherwise requested by Dicerna, Protiva shall continue to work on the existing SOW during any such negotiations, but in no event shall Protiva be obligated to commence work in accordance with the Change Order unless and until it is signed by authorized representatives of both Parties. For clarity, if requested by Dicerna, Protiva will suspend all work under a SOW (and any related SOWs) until such time as a mutually accepted Change Order has been executed.

Article 4 MANUFACTURING

4.1 Dicerna Materials.

(a) Dicerna shall at its sole cost and expense (i) source, purchase and provide such quantities of Dicerna Materials as are set forth in each SOW, and (ii) notify Protiva of any changes to qualification procedures for such vendors or suppliers or to any Raw Material release or Specification procedures applicable to any Dicerna Materials.

(b) Dicerna retains title to and ownership of the Dicerna Materials at each and every stage of Manufacture and has sole responsibility, but not the obligation, to obtain and maintain insurance coverage for any loss or damage to Dicerna Material.

(c) Dicerna shall deliver Dicerna Materials to Protiva in accordance with Dicerna's Shipping and Handling Procedures. Protiva shall receive Dicerna Materials in accordance with Protiva's SOPs and shall visually examine the packaging integrity of Dicerna Materials and ensure that damage has not occurred during transport. If Protiva visually detects any defect or damage in any Dicerna Materials or the packaging thereof, Protiva shall promptly notify Dicerna with detailed information concerning the nature of the damage and seek instructions from Dicerna.

(d) Dicerna will cause all Dicerna Materials to be delivered to Protiva for use in Non-GMP Batches to be released in accordance with the Raw Material Specifications for such Dicerna Materials. Dicerna shall provide all Dicerna Materials and their Associated Documentation to Protiva not less than ***** days prior to the initiation of each Manufacturing campaign to enable Protiva to perform such Raw Material release testing on Dicerna Materials as specified in each applicable SOW.

(e) If, pursuant to any SOW, Protiva is to conduct full release testing of Dicerna Materials in accordance with the Raw Material Specifications, Dicerna shall provide all Dicerna Materials and their Associated Documentation to Protiva not less than ***** days prior to the initiation of each Manufacturing campaign, and supply reasonably sufficient quantities of Dicerna Materials for the purposes of both raw material testing and Manufacturing.

(f) If Protiva is to conduct either a limited release or full release of the Dicerna Materials pursuant to a SOW, Protiva shall conduct such limited release or full release of the Dicerna Materials prior to introducing each lot of Dicerna Materials into the Manufacture of Manufactured Product and shall provide Dicerna with copies of the analytical reports, raw data and any other relevant documentation in respect of each lot of Dicerna Materials tested, and notify Dicerna of any deficiencies in respect of any lot of Dicerna Materials tested.

(g) Dicerna acknowledges that the late delivery of sufficient quantity and quality of any Dicerna Materials or Associated Documentation may be a Delay Event resulting in a delay in Protiva's performance of the applicable SOW requiring such Dicerna Materials or Associated Documentation. In the event of Dicerna's delivery of non-conforming Dicerna Materials or late delivery of any Dicerna Materials or Associated Documentation for which Protiva is not responsible, Protiva shall notify Dicerna of any necessary change to such time line, and if changes to such time line are necessary the Parties shall negotiate in good faith to revise such time line by way of a Change Order.

4.2 Protiva Materials.

(a) Protiva shall (i) source, purchase and provide such quantities of Protiva Materials as are reasonably required for each SOW, and (ii) qualify, monitor and audit the suppliers or vendors of Protiva Materials. Protiva shall procure reasonably sufficient quantities of Protiva Materials for the purposes of both Raw Material testing and Manufacturing.

(b) Protiva shall perform all testing and evaluation of the Protiva Materials to be used in the Manufacture of Batches as required by the Applicable Requirements, and otherwise in accordance with the Quality Agreement. Protiva shall cause all Protiva Materials to be used in the Manufacture of Batches to be released in accordance with the Raw Material Specifications for such Protiva Materials prior to their use, including as set forth in the Quality Agreement, and shall provide Dicerna with copies of the analytical reports, raw data and any other relevant documentation in respect of each lot of Protiva Materials tested.

4.3 Specification Changes.

Except as otherwise expressly set forth to the contrary in the Quality Agreement, if Dicerna is required, or desires, to change the Specifications, Protiva shall: (a) accommodate any request for any changes required by any Regulatory Authority or Applicable Law; and (b) use Commercially Reasonable Efforts to accommodate any other request; provided, however, that Dicerna shall promptly advise Protiva in writing of any such change(s), and provide information reasonably necessary for Protiva to evaluate the effect of such change(s), and Protiva shall promptly advise Dicerna as to scheduling or Batch Price or Fee changes, if any, which may result from such change(s). The notification and approval procedure shall be in accordance with the Quality Agreement and SOPs (*i.e.* , change control procedures) agreed upon by the Parties from time to time. The Parties shall hold a JDC meeting in a timely manner with appropriate advisors invited to discuss such changes as appropriate.

4.4 Responsibility for Safe Use and Safe Keeping.

(a) Protiva shall be responsible in accordance with Applicable Laws for implementing and maintaining health and safety procedures and for the handling of any materials or hazardous waste used in or generated by the Manufacturing. Protiva, in consultation with Dicerna, shall develop safety and handling SOPs for Dicerna Materials and Manufactured Product (other than Additional Formulations). Dicerna shall have no responsibility for Protiva's health and safety program; except that Dicerna must deliver a current MSDS in the form agreed between the Parties from time to time for each of the Dicerna Materials supplied to Protiva.

(b) Protiva shall (i) account for all Dicerna Materials and handle and store all Dicerna Materials in accordance with Applicable Requirements and instructions of Dicerna, (ii) not provide Dicerna Materials to any person other than Protiva's personnel and Permitted Contractors who require access to the Dicerna Materials in the performance of the Services without the express prior written consent of Dicerna, (iii) not use Dicerna Materials for any purpose other than conducting the Services, including, not to analyze (except as necessary to perform Raw Material release testing), characterize, modify or reverse engineer any Dicerna Materials or take any action to determine the structure, sequence or composition of any Dicerna Materials unless required pursuant to a signed SOW, (iv) destroy or return to Dicerna all unused quantities of Dicerna Materials according to Dicerna's written directions, and (v) ensure that all of Protiva's personnel and Permitted Contractors having access to the Dicerna Material are made aware of and comply with the terms of this Supply Agreement, including the obligations of confidentiality respecting same contained herein. Protiva shall return all Dicerna Materials to Dicerna following the completion of the Services contemplated in each SOW, unless otherwise agreed to in writing by both Parties.

(c) Protiva acknowledges and agrees that Dicerna Materials are the property of Dicerna and that Dicerna shall retain all right, title and interest in and to Dicerna Materials, including all proprietary rights thereto.

4.5 Manufacture.

(a) Facilities . To the extent one or more Facilities are expressly identified in a SOW, Protiva shall perform the Manufacture only at the applicable Facilities. Protiva shall be responsible for ensuring that the Facilities meet the Applicable Requirements at all relevant times.

(b) Personnel . Protiva shall furnish all personnel and supervision necessary to perform the Manufacture of the Manufactured Products, and shall take all reasonable steps to ensure that such personnel are properly trained and proficient in the Specifications, analytical methods and the Manufacturing Process and in handling the Equipment, Materials, and Manufactured Product.

(c) Equipment . Protiva shall supply, qualify, validate, calibrate, service and maintain all Equipment necessary for its Manufacture of Manufactured Product, and comply with its own SOPs for the cleaning and maintenance of such Equipment. *****

*****

(d) Licenses and Permits . Protiva shall be responsible for obtaining any licenses or permits and regulatory and government approvals necessary for the operation and use of its Facilities as pharmaceutical manufacturing facilities generally and for Manufacture of the Manufactured Products and performance of the Services specifically. Where any such licenses, permits or approvals are required for the operation and use of the Facilities as pharmaceutical manufacturing facilities generally, all expenses thereof will be at Protiva's sole cost. Where any such licenses, permits or approvals are required specifically for the performance of the Services which would not otherwise be required by Protiva, the expense thereof shall be treated as part of Protiva's Reimbursable Expenses for purposes of determining the applicable Fees or Batch Price.

(e) Production . Protiva shall be responsible for the preparation of the Master Batch Record and Executed Batch Record for all GMP Batches, and Protiva's Quality personnel shall approve each MBR prior to commencement of Manufacture and each Executed Batch Record following completion of Manufacture. Each MBR shall be assigned an identification number and any changes to an MBR shall be documented in sufficient detail for submission to Regulatory Authorities as needed.

(f) Records . In respect of GMP Batches, all MBRs and Executed Batch Records generated by Protiva or its Permitted Contractors for the Manufacture of Manufactured Product under this Agreement shall be made available by Protiva to Dicerna, its Affiliate, their Sublicensee, any Designated CMO and Secondary CMO, as applicable, in accordance with the Quality Agreement but shall remain the property and Confidential Information of Protiva. Protiva shall maintain and retain true and accurate books, records, test and laboratory data, reports and other information related to the Manufacture of the Manufacture Products, including all information required to be maintained under this Supply Agreement, the Quality Agreement or Applicable Laws (including GMPs). Protiva will maintain all such information only in separate forms, notebooks and records to the extent possible (i.e., not commingled with other information) and will maintain all such information for at least the period of time specified in the Quality Agreement or longer if required under Applicable Laws (including GMPs). Protiva shall make all such documentation available to Regulatory Authorities as set forth in the License Agreement.

(g) Audits . Dicerna may conduct audits to verify that Protiva is complying with this Supply Agreement, the Quality Agreement, any SOW and any Applicable Laws, as well as to verify invoices. Dicerna may conduct ***** per ***** and unlimited "for cause" audits. During such audits, personnel of Dicerna or its representatives will have access only to all public areas and those areas that are directly related to the performance of Protiva's obligations under this Supply Agreement. No more than a reasonable number of representatives will be permitted on Protiva's premises for any such audit. Dicerna shall provide reasonable notice of such audit and perform such audit during normal business hours.

4.6 Testing and Release.

(a) Protiva shall perform all Raw Material release testing, in-process testing and Finished Product release testing in accordance with the test parameters set forth in the applicable Specifications. If at any time during the Raw Material release testing of Dicerna Materials, Protiva discovers that the whole or part of a Batch of Dicerna Materials does not meet the acceptance criteria set forth in the applicable Specifications, Protiva shall notify Dicerna in writing by ***** to provide sufficient details to enable Dicerna to order replacement shipments of relevant Dicerna Materials.

(b) All GMP Batches shall be released by Protiva's Quality Assurance representative before shipment to Dicerna.

(c) If Dicerna requests stability studies to be performed on a Manufactured Product by way of an SOW, Protiva shall design and Dicerna shall approve a study protocol and applicable SOPs to be used by Protiva.

4.7 Storage, Packaging and Shipment.

Protiva shall store, package, label and ship the Manufactured Product according to the Applicable Requirements and according to packaging SOPs mutually agreed upon by Dicerna and Protiva in writing. Protiva shall deliver all Batches within the delivery week for such Batches as set forth in the applicable SOW. Protiva shall ensure all shipments of Batches contain Batch numbers and manufacture/expiry dates, are packaged using shipping containers agreed in writing between the Parties and are delivered to Dicerna, or to a location designated in writing by Dicerna. All shipments of Batches by Protiva to Dicerna shall be EXWorks (Incoterms, 2010) Facility, freight collect, by a common carrier designated in writing by Dicerna, at Dicerna's expense. Dicerna shall procure, at its cost, insurance covering damage or loss to all Batches during shipping.

4.8 Inspection Upon Receipt.

Within ***** calendar days from the date of Dicerna's receipt of a Batch of Manufactured Product, Dicerna shall notify Protiva in writing if Dicerna discovers through visual inspection any shortage of or damage to such Batch, or to its packaging or any other obvious defect detectable by the naked eye. Protiva shall not be responsible for any loss or damage to any Manufactured Product during transport provided Protiva has packaged all Manufactured Product in accordance with agreed packing SOPs.

4.9 Disputed Batch.

With each Batch of Manufactured Product, Protiva shall deliver to Dicerna samples for testing in accordance with the Quality Agreement and the Applicable Requirements. Within ***** calendar days after the date of Dicerna's receipt of a Batch of Manufactured Product, the test samples and its applicable Certificate of Analysis and Certificate of Compliance, Dicerna shall determine whether such Batch conforms to the applicable Finished Product Specifications. If Dicerna believes any Batch of Manufactured Product does not meet the applicable Finished Product Specifications (" **Disputed Batch** "), then Dicerna shall give Protiva written notice thereof as soon as practicable but in no event later than ***** days after the date of receipt of the Disputed Batch and shall, unless otherwise directed by Protiva, return a portion of the

Disputed Batch for further testing by Protiva. Failure to provide such written notice within such *****-day period shall constitute an irrevocable acceptance by Dicerna of the Disputed Batch. If, after conducting its own testing, Protiva agrees, or it is determined pursuant to Section 4.10, that the returned Disputed Batch fails to meet the applicable Finished Product Specifications, the provisions of Section 4.11 shall apply. Acceptance of any Batch shall not limit any remedies otherwise available to Dicerna under this Supply Agreement.

4.10 Independent Laboratory.

If there is any dispute concerning whether a Batch of Manufactured Product meets the applicable Finished Product Specifications as a result of Protiva's negligence or breach of this Supply Agreement, the Parties shall designate an independent expert or independent laboratory (acting as an expert and not as an arbitrator) to determine whether or not the Disputed Batch at issue meets the applicable Finished Product Specifications (or fails to meet the Specifications due to a non-conformity of, endotoxin in, impurity of, or adulteration of any Dicerna Materials for which Raw Material release testing was not required by Dicerna as part of the Manufacture). The decision of such independent expert shall be in writing and shall be binding on both Protiva and Dicerna. The costs of such independent expert shall be borne by the Parties equally; provided, however that the Party that is determined to be incorrect in the dispute shall be responsible for all such costs and shall indemnify the prevailing Party for its share of the costs incurred. For clarity, Protiva shall be entitled to retain samples of any Batch of Manufactured Product Manufactured by Protiva for testing by independent experts or independent laboratories.

4.11 Replacement Batches.

(a) In the event a Disputed Batch is determined to have failed the applicable Finished Product Specifications (" **Nonconforming Batch** "), the whole of such Nonconforming Batch shall be either returned to Protiva or destroyed, at Dicerna's option and, if returned pursuant to Section 4.11(b) or 4.11(d), at Protiva's expense.

*****

4.12 Non-GMP Batches.

Notwithstanding anything to the contrary contained herein, Sections 4.9 through 4.11 shall not apply to Non-GMP Batches (i) when such Batches include Dicerna Materials or Dicer Substrates that have not been previously used in a successful Manufacturing run by Protiva and (ii) for which a test Batch run has not been conducted.

Article 5 REGULATORY MATTERS

5.1 Quality Agreement.

Within ***** days of the date hereof, the Parties shall negotiate in good faith and enter into the Quality Agreement to govern the quality and regulatory responsibilities of the Parties in respect of the Manufacture of GMP-grade Product, which shall contain the following provisions (a) Manufacturing audits; (b) reporting of complaints; (c) notification of regulatory correspondence, including warning letters, recalls, market withdrawals and corrections.; (d) responding to regulatory correspondence; (e) inspections; and (f) recalls, including financial responsibility.

Article 6 FINANCIAL PROVISIONS

6.1 Invoicing.

(a) Each SOW shall specify the Batch Price or Fees, as applicable, for the Services under such SOW.

(b) For each Manufacturing SOW, Dicerna shall pay to Protiva in respect of such SOW:

*****

(c) For all non-Manufacturing SOWs, unless otherwise set forth in the SOW, Protiva shall invoice Dicerna for the Fees ***** in arrears.

(d) Protiva will include with each invoice reasonable documentary evidence for the Batch Prices and Fees. Protiva will also provide such additional documentary support or evidence regarding the Batch Prices and Fees as reasonably requested by Dicerna.

6.2 Rescheduling and Cancellation.

(a) Dicerna reserves the right, upon written notice to Protiva, to reschedule or cancel any mutually executed SOW subject to Dicerna's payment of the applicable actual Reimbursable Expenses caused by such rescheduling or cancellation.

(b) Notwithstanding anything in this Supply Agreement to the contrary, (i) Dicerna shall have no obligation to pay any Reimbursable Expenses caused by any rescheduling or cancellation if the need to so reschedule or cancel is due to any act or omission by Protiva, its Affiliates or any Permitted Subcontractor, and (ii) Dicerna shall only be required to pay to Protiva ***** percent ***** of the total amount of any Reimbursable Expenses caused by any rescheduling or cancellation if the need to so reschedule or cancel is due to any Force Majeure Event(other than rescheduling or cancellation when the need to so reschedule or cancel is due to a Force Majeure Event that delays delivery of Dicerna Materials to Protiva).

6.3 Payment and Interest.

(a) With the exception of the invoices for the Initial Deposit and Initiation Deposit, Dicerna shall pay all invoices within ***** days following Dicerna's receipt of Protiva's invoice, by wire transfer of immediately available funds to a bank account designated in advance in writing by Protiva.

(b) Any payments due from one Party to the other Party under this Article VI that are not paid by the date such payments are due shall bear interest from the date such unpaid payments are due until paid in full at the lesser of: (i) ***** percent ***** per *****; or (ii) the highest amount of interest permitted by Applicable Law. The foregoing interest shall be in addition to any other remedies that either Party may have pursuant to this Supply Agreement.

6.4 Payment Procedures and Tax.

(a) Remittance of payments under this Article VI shall be made by means of wire transfer of immediately available funds to a bank account designated in advance in writing by Protiva. All amounts payable to Protiva under this Supply Agreement shall be paid in United States Dollars. In those cases in which the amounts due in United States Dollars is calculated based on one or more currencies other than United States Dollars, such amounts shall be converted into United States Dollars using the spot exchange rate for the relevant currency on the date of the applicable transaction, as such exchange rate is published by Wall Street Journal (or comparable publication if not available).

(b) Protiva is solely responsible for any sales, use, excise, value-added, services, consumption, or other similar tax that is assessed on the provision of the Services, Batch Prices or Fees and shall either pay such payment directly or reimburse Dicerna for the same. Any withholding or other taxes that Dicerna or its Affiliates are required by Applicable Law to withhold or pay on behalf of Protiva may be deducted from such

payments and paid to the appropriate tax authority contemporaneously with the remittance to Protiva, provided that (i) Dicerna promptly furnishes to Protiva proper evidence of the taxes so paid and (ii) Dicerna cooperates with and furnishes to Protiva appropriate documents to secure application of the most favorable rate of withholding tax under Applicable Law (or exemption from such withholding tax payments, as applicable). Dicerna and Protiva shall use Commercially Reasonable Efforts to cooperate to minimize any such taxes, assessments and fees to the extent permitted by Applicable Law.

6.5 Records and Audit.

Until the ***** anniversary of the date any book or record is created or such longer period required by Applicable Law (the " **Record Retention Period** "), Protiva shall maintain and retain complete and accurate books of account and records covering all transactions relating to payment of amounts that may be due under Article VI of this Supply Agreement. Upon the reasonable advance notice of Dicerna (of at least ***** days), Protiva shall make such books and records available for inspection and audit by Dicerna's authorized representative (which shall be a national certified public accounting firm designated by Dicerna), subject to reasonable precautions to protect the confidential information of Protiva. Dicerna may not audit Protiva's books and records more than once in any *****-month period. All audits must be conducted during normal business hours of Protiva and conducted in a manner so as to minimize the impact on the normal operations of Protiva. The accounting firming conducting any such audit must provide the report of its findings of any audit to both Parties, may only identify in such report whether the amount of Batch Prices and Fees paid was correct and the actual amount of the Batch Prices and Fees payable and may not disclose any other Confidential Information of Protiva. The auditor's report and all other information disclosed to the auditor or generated by the auditor in such audit will be the Confidential Information of Protiva. Dicerna shall pay the cost of such audits unless it discovers that Protiva has overcharged for Batch Prices or Fees during any year in the Record Retention Period by an amount of ***** percent ***** or more, in which case the costs of such audit shall be borne by Protiva. If an audit reveals an underpayment or overpayment, the Party responsible for making payment shall promptly pay to the other Party the amount of the underpayment or overpayment discovered unpaid under this Section 6.5, subject to Section 6.3 (b).

Article 7 INTELLECTUAL PROPERTY

7.1 License Agreement.

(a) The terms and conditions regarding Dicerna's use and licensing of certain Patents, Know-How and technology of Protiva and Tekmira are set forth in the License Agreement.

7.2 Ownership.

(a) Protiva is and shall at all times remain the sole and exclusive owner of Protiva's Confidential Information.

(b) Dicerna is and shall at all times remain the sole and exclusive owner of Dicerna's Confidential Information.

*****

(f) All determinations of inventorship and authorship required by this Section 7.12 will be determined in accordance with United States Applicable Laws regarding intellectual property.

(g) Each Party shall, and shall (i) cause its Affiliates and (ii) use Commercially Reasonable Efforts to cause its employees, agents and contractors to, take all further actions (including execution of written documents) reasonably requested by the other Party for purposes of vesting ownership of Inventions with such other Party in accordance with this Section 7.2 and otherwise permit any such other Party to fully enjoy its rights in such Inventions.

7.3 Prosecution and Maintenance of Joint Patents and Product Composition Patents.

*****

7.4 Third-Party Infringement of Joint Patents and Product Composition Patents.

(a) Each Party shall use Commercially Reasonable Efforts to promptly report in writing to the other Party during the Term any known or suspected commercially relevant infringement by a Third Party of any Joint Patents of which such Party becomes aware and provide the other Party with all evidence supporting or relating to such infringement in its possession.

*****

THE COMPANY HAS REQUESTED AN ORDER FROM THE COMMISSION PURSUANT TO RULE 406 UNDER THE SECURITIES ACT OF 1933, AS AMENDED, GRANTING CONFIDENTIAL TREATMENT TO SELECTED PORTIONS. ACCORDINGLY, THE CONFIDENTIAL PORTIONS HAVE BEEN OMITTED FROM THIS EXHIBIT, AND HAVE BEEN FILED SEPARATELY WITH THE COMMISSION. OMITTED PORTIONS ARE INDICATED IN THIS EXHIBIT WITH "*****".

*****

Article 8 CONFIDENTIAL INFORMATION AND PUBLICITY

8.1 Incorporation by Reference.

The provisions of Article VI of the License Agreement are herein incorporated into this Supply Agreement, *mutatis mutandis* .

Article 9 INDEMNIFICATION AND INSURANCE

9.1 Protiva Indemnification.

Protiva agrees to indemnify Dicerna and its Affiliates, and their respective agents, directors, officers, employees, representatives, successors and permitted assigns (the " **Dicerna Indemnitees** ") against and to hold each of them harmless from any and all losses, costs, damages, fees or expenses (" **Losses** ") actually incurred or suffered by a Dicerna Indemnitee to the extent arising out of or in connection with any claim, suit, demand, investigation or proceeding brought by a Third Party based on: (a) any breach of any representation, warranty or covenant by Protiva under this Supply Agreement; (b) Protiva's, its Affiliates' or its Permitted Contractors' gross negligence, willful misconduct or violation of Applicable Law or (c) *****. The foregoing indemnification shall not apply to the extent that any Losses are due to Dicerna's, its Affiliates' or its Sublicensees' gross negligence or willful misconduct, or Dicerna's breach of Section 12.1(d).

9.2 Dicerna Indemnification.

Dicerna agrees to indemnify Protiva and its Affiliates, and their respective agents, directors, officers, employees, representatives, successors and permitted assigns (the " **Protiva Indemnitees** ") against and to hold each of them harmless from any and all Losses actually incurred or suffered by a Protiva Indemnitee to the extent arising out of or in connection with any claim, suit, demand, investigation or proceeding brought by a Third Party based on: (a) any breach of any representation, warranty or covenant by Dicerna under this Supply Agreement; (b) Dicerna's, its Affiliates' or its Sublicensees' gross negligence, willful misconduct or violation of Applicable Law; or (c) *****. The foregoing indemnification obligations shall not apply to the extent that any Losses are due to Protiva's, its Affiliates or its Permitted Contractors' gross negligence or willful misconduct.

9.3 Tender of Defense; Counsel.

Any Person (the " **Indemnified Party** ") seeking indemnification under this Article VII agrees to give prompt notice in writing to the other Party (the " **Indemnifying Party** ") of the assertion of any claim or the commencement of any action by any Third Party (a " **Third Party Claim** ") in respect of which indemnity may be sought under this Article. Such notice shall set forth in reasonable detail such Third Party Claim and the basis for indemnification (taking into account the information then available to the Indemnified Party). The failure to so notify the Indemnifying Party shall not relieve the Indemnifying Party of its indemnification and hold harmless obligations hereunder, except to the extent such failure shall have materially and adversely prejudiced the Indemnifying Party. The Indemnifying Party shall be entitled to participate in the defense of any Third Party Claim and shall be entitled to control and appoint lead counsel reasonably satisfactory to the Indemnified Party for such defense by written notice to the Indemnified Party within ***** calendar days after the Indemnifying Party has received notice of the Third Party Claim, in each case at its own expense; provided, however, that the Indemnifying Party must use Commercially Reasonable Efforts to conduct the defense of the Third Party Claim in a manner designed to protect the rights of the Indemnified Parties, and otherwise conduct such defense actively and diligently, thereafter in order to preserve its rights in this regard. The Indemnifying Party shall not be entitled to assume or maintain control of the defense of any Third Party Claim and shall pay the fees and expenses of one counsel retained by the Indemnified Party if: (a) the Third Party Claim relates to or arises in connection with any criminal proceeding, action, indictment or allegation; (b) the Third Party Claim seeks an injunction or equitable relief against a Indemnified Party or any of its Affiliates; or (c) the Indemnifying Party has failed or is failing to prosecute or defend vigorously the Third Party Claim. Each Indemnified Party shall obtain the prior written consent of the Indemnifying Party, such consent not to be unreasonably withheld, delayed or conditioned, before entering into any settlement of a Third Party Claim. Notwithstanding the foregoing, the Indemnifying Party shall not be entitled to enter into or approve any settlement of a Third Party Claim without the consent of the Indemnified Party (which may be withheld in its sole discretion), if the settlement (i) does not expressly unconditionally release all applicable Indemnified Parties and their Affiliates from all Losses with respect to such Third Party Claim, (ii) imposes injunctive or other equitable relief against the Indemnified Party or any of its Affiliates, (iii) involves any admission of criminal or similar liability, or (iv) involves any monetary damages that may not be fully covered by the Indemnifying Party. In the event that the Indemnifying Party fails to assume the defense of the Third Party Claim in accordance with this Section 9.3, (1) the Indemnified Party may defend against the Third Party Claim in any manner it reasonably may deem appropriate, and (2) the Indemnifying Party shall remain responsible for any Losses of the Indemnified Party as a result of such Third Party Claim. In circumstances where the Indemnifying Party is controlling the defense of a Third Party Claim in accordance with this Section 9.3, the Indemnified Party shall be entitled to participate in the defense of any Third Party Claim and to employ separate counsel of its choice for such purpose, in which case the fees and expenses of such separate counsel shall be borne by such Indemnified Party. Notwithstanding anything herein to the contrary, in circumstances where there is a conflict of interest that would reasonably make it inappropriate under applicable standards of professional conduct to have common counsel for the

Indemnifying Party and the Indemnified Party, the Indemnified Party shall be entitled to employ separate counsel, that is reasonably acceptable to the Indemnifying Party, and the Indemnifying Party shall pay the reasonable fees and expenses of such separate counsel. Each Party shall cooperate, and cause their respective Affiliates to cooperate in all reasonable respects, in the defense or prosecution of any Third Party Claim and shall furnish or cause to be furnished such records, information and testimony, and attend such conferences, discovery proceedings, hearings, trials or appeals, as may be reasonably requested in connection therewith, all at the expense of the Indemnifying Party.

9.4 Insurance.

Each Party shall maintain insurance, including product liability insurance, with respect to its activities under this Supply Agreement regarding the Product in such amount as such Party customarily maintains with respect to similar activities for its other products. Each Party shall maintain such insurance for so long as it continues its activities under this Supply Agreement, the License Agreement or the Quality Agreement, and thereafter for so long as such Party customarily maintains insurance for itself covering similar activities for its other products.

Article 10 EXPORT

10.1 General.

The Parties acknowledge that the exportation from the United States of materials, products and related technical data (and the re-export from elsewhere of United States origin items) may be subject to compliance with United States export laws, including the United States Bureau of Export Administration's Export Administration Regulations, the Act and regulations of the FDA issued thereunder, and the United States Department of State's International Traffic and Arms Regulations which restrict export, re-export, and release of materials, products and their related technical data, and the direct products of such technical data. The Parties agree, under this Supply Agreement, to comply with all export Applicable Laws and to commit no act that, directly or indirectly, would violate any Applicable Laws relating to the export, re-export, or release of any materials, products or their related technical data to which the United States adheres or with which the United States complies.

10.2 Delays and Assistance.

(a) The Parties acknowledge that they cannot be responsible for any delays attributable to export controls which are beyond the reasonable control of either Party.

(b) The Parties agree to provide reasonable assistance to one another in connection with each Party's efforts to fulfill its obligations under this Article.

Article 11 TERM AND TERMINATION

11.1 Term.

The term of this Supply Agreement, shall commence on the Effective Date and, unless earlier terminated as provided herein, shall terminate upon the last to occur of: (a) five (5) years after the Effective Date; (b) the last date of expiry of any GMP Batch of Manufactured Product Manufactured by Protiva hereunder; or (c) the completion of the activities set forth in Exhibits D .

11.2 Termination for Material Breach.

If either Party commits a material breach or material default in the performance or observance of any of its obligations under this Supply Agreement, and such breach or default continues without cure for a period of ***** days after delivery by the other Party of written notice reasonably detailing such breach or default, then the non-breaching or non-defaulting Party shall have the right to terminate this Supply Agreement, with immediate effect, by giving written notice to the breaching or defaulting Party. The Parties shall retain all rights and remedies (at law or in equity) in respect of any breach hereof.

11.3 Rights in Bankruptcy.

Each Party (the " **Insolvent Party** ") shall promptly notify the other Party (the " **Solvent Party** ") in writing upon the initiation of any proceeding in bankruptcy, reorganization, dissolution, liquidation or arrangement for the appointment of a receiver or trustee to take possession of the assets of the Insolvent Party or similar proceeding under law for release of creditors by or against the Insolvent Party or if the Insolvent Party shall make a general assignment for the benefit of its creditors. To the extent permitted by Applicable Law, if the applicable circumstances described above shall have continued for ***** days undismissed, unstayed, unbonded and undischarged, the Solvent Party may terminate this Supply Agreement upon written notice to the Insolvent Party at any time.

11.4 Termination of License Agreement.

In the event the License Agreement is terminated, this Supply Agreement shall terminate upon the effective date of the termination of the License Agreement.

11.5 Consequences of Termination; Survival.

(a) Termination of this Supply Agreement shall not relieve the Parties of any obligation accruing prior to or upon such expiration or termination, and the provisions of Article 1 (Definitions and Interpretation), Sections 4.5(e) (Records), 6.3 (Payment and Interest), 6.4 (Payment Procedures and Tax), 6.5 (Records and Audit), Article 7 (Intellectual Property), Article 8 (Confidential Information and Publicity), Article 9 (Indemnification and Insurance), Article 11 (Term and Termination), and Article 12 (General Provisions) shall survive any expiration or termination of this Supply Agreement and Exhibit D .

(b) In the event of termination by Dicerna for Protiva's uncured material breach of this Supply Agreement, Protiva, shall *****.

(c) Upon the termination by either Party or both Parties of this Supply Agreement in its entirety, each Party shall promptly return to the other Party all physical manifestations of the other Party's intellectual property and Confidential Information, except to the extent that the Party has a license to such Intellectual Property or Confidential Information pursuant to the License Agreement.

11.6 Remedies.

The Parties acknowledge and agree that, in the event of a breach or a threatened breach by either Party of this Supply Agreement for which it shall have no adequate remedy at law, the other Party may suffer irreparable damage and, accordingly, may be entitled to injunctive and other equitable remedies to prevent or restrain such breach or threatened breach, in addition to any other remedy they might have at law or at equity. In the event of a breach or threatened breach by a Party of any such provision, the other Party shall be authorized and entitled to seek from any court of competent jurisdiction injunctive relief, whether preliminary or permanent, arising from such breach, which rights shall be cumulative and in addition to any other rights or remedies to which the other Party may be entitled in law or equity.

Article 12 GENERAL PROVISIONS

12.1 Representation and Warranties.

(a) Mutual Representations and Warranties by Protiva and Dicerna . Each Party hereby represents and warrants to the other Party as of the Effective Date that:

(i) it is duly organized and validly existing under the laws of the jurisdiction of its incorporation or formation, and has all necessary power and authority to conduct its business in the manner in which it is currently being conducted, to own and use its assets in the manner in which its assets are currently owned and used, and to enter into and perform its obligations under this Supply Agreement;

(ii) the execution, delivery and performance of this Supply Agreement has been duly authorized by all necessary action on the part of such Party and its Board of Directors or other governing body and no consent, approval, order or authorization of, or registration, declaration or filing with any Third Party or Governmental Authority is necessary for the execution, delivery or performance of this Supply Agreement;

(iii) this Supply Agreement constitutes the legal, valid and binding obligation of such Party, enforceable against it in accordance with its terms, subject to (A) Applicable Laws of general application relating to bankruptcy, insolvency and the relief of debtors, and (B) Applicable Laws governing specific performance, injunctive relief and other equitable remedies; and

(iv) neither it nor any of its Affiliates or their employees have ever been (A) convicted of a crime for which a Person can be debarred under Section 306(a) or 306(b) of the Generic Drug Enforcement Act of 1992 or under 42 U.S.C. Section 1320-7 or (B) sanctioned by, suspended, excluded or otherwise ineligible to participate in any federal health care program, including Medicare and Medicaid or in federal procurement or non-procurement programs. If at any time this representation and warranty is no longer accurate, Protiva or Dicerna, as the case may be, shall immediately notify the other of such fact.

(b) Protiva Representations, Warranties, and Covenants . Protiva hereby represents, warrants, and covenants to Dicerna that:

(i) the Manufactured Product, at the time of delivery to Dicerna's designated carrier, shall: (A) conform to the Specifications; (B) be Manufactured in compliance with the requirements of all Applicable Laws (including GMP for GMP Batches); (C) comply with Protiva's SOPs; and (D) be transferred free and clear of any liens, claims or encumbrances of any kind to the extent arising through or as a result of the acts or omissions of Protiva, its Affiliates or their respective agents;

(ii) no Manufactured Product constituting or being part of any shipment or other delivery now or hereafter made to Dicerna will be adulterated or misbranded within the meaning of the FD&C Act or would be an article that could not, under the provisions of the FD&C Act, be introduced into interstate commerce;

(iii) it owns, lawfully controls or has valid rights to use the Facilities and that the Facilities shall be maintained in such condition as will allow Protiva to Manufacture the Manufactured Product in compliance with and conformance to all Applicable Requirements (including GMPs at the Facilities where GMP Batches are Manufactured);

(iv) Protiva shall perform the Services in a diligent, careful, thorough, workmanlike and professional manner, using employees and Permitted Contractors having a level of skill, knowledge, qualifications and experience in the area commensurate with the requirements of the Services;

(v) Protiva shall perform the Services and its other obligations herein in compliance with all Applicable Laws; and

(vi) the Services shall be conducted at and coordinated from the facilities of Protiva under the direction and supervision of a qualified program director employed by Protiva and approved by Dicerna.

(c) Tekmira Representations, Warranties, and Covenants . Tekmira hereby represents, warrants, and covenants to Dicerna that:

(i) as of the Effective Date, it is duly organized and validly existing under the laws of the jurisdiction of its incorporation or formation, and has all necessary power and authority to conduct its business in the manner in which it is currently being conducted, to own and use its assets in the manner in which its assets are currently owned and used, and to enter into and perform its obligations under this Supply Agreement;

(ii) as of the Effective Date, the execution, delivery and performance of this Supply Agreement has been duly authorized by all necessary action on the part of Tekmira and its Board of Directors and no consent, approval, order or authorization of, or registration, declaration or filing with any Third Party or Governmental Authority is necessary for the execution, delivery or performance of this Supply Agreement;

(iii) as of the Effective Date, this Section 12.1(c) constitutes the legal, valid and binding obligation of Tekmira, enforceable against it in accordance with its terms,

subject to (A) Applicable Laws of general application relating to bankruptcy, insolvency and the relief of debtors, and (B) Applicable Law governing specific performance, injunctive relief and other equitable remedies;

(iv) as of the Effective Date, neither it nor any of its Affiliates or their employees have ever been (A) convicted of a crime for which a Person can be debarred under Section 306(a) or 306(b) of the Generic Drug Enforcement Act of 1992 or under 42 U.S.C. Section 1320-7 or (B) sanctioned by, suspended, excluded or otherwise ineligible to participate in any federal health care program, including Medicare and Medicaid or in federal procurement or non-procurement programs. If at any time this representation and warranty is no longer accurate, Tekmira shall immediately notify Dicerna of such fact; and

(v) Tekmira shall cause Protiva to perform and to comply with the provisions of this Supply Agreement, and shall remain responsible for and guarantee the performance of Protiva under this Supply Agreement, and is liable to Dicerna for any breach of this Supply Agreement by Protiva and for the actions and omissions of Protiva undertaken pursuant to this Supply Agreement as if taken by Tekmira itself.

(d) Dicerna Representations, Warranties, and Covenants . Dicerna hereby represents, warrants, and covenants to Protiva that the Dicerna Materials, at the time of delivery to Protiva, shall (i) conform to all applicable Raw Material Specifications; (ii) be Manufactured in compliance with the requirements of all Applicable Laws (including GMPs for Dicerna Materials to be used in GMP Batches); and (iii) comply with Dicerna's SOPs.

(e) Warranty Disclaimer . EXCEPT AS OTHERWISE EXPRESSLY PROVIDED IN THIS SUPPLY AGREEMENT, NEITHER PARTY MAKES ANY REPRESENTATION OR EXTENDS ANY WARRANTY OR CONDITIONS OF ANY KIND, EITHER EXPRESS OR IMPLIED, TO THE OTHER PARTY WITH RESPECT TO ANY INTELLECTUAL PROPERTY, PRODUCTS, GOODS, RIGHTS OR OTHER SUBJECT MATTER OF THIS SUPPLY AGREEMENT AND HEREBY DISCLAIMS ALL IMPLIED CONDITIONS, REPRESENTATIONS, AND WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OR VALIDITY OF PATENT RIGHTS WITH RESPECT TO ANY AND ALL OF THE FOREGOING. EACH PARTY HEREBY DISCLAIMS ANY REPRESENTATION OR WARRANTY THAT THE DEVELOPMENT, MANUFACTURE OR COMMERCIALIZATION OF ANY PRODUCT PURSUANT TO THIS SUPPLY AGREEMENT SHALL BE SUCCESSFUL OR THAT ANY PARTICULAR SALES LEVEL WITH RESPECT TO ANY SUCH PRODUCT SHALL BE ACHIEVED.

12.2 Force Majeure and Delay Events.

(a) Except with respect to payment obligations, a Party shall neither be held liable or responsible to any other Party, nor be deemed to have defaulted under or breached this Supply Agreement, for failure or delay in fulfilling or performing any term of this Supply Agreement to the extent, and for so long as, such failure or delay is caused by or results

from causes beyond the reasonable control of the affected Party, including fire, floods, embargoes, power shortage or failure, acts of war (whether war be declared or not), insurrections, riots, terrorism, civil commotions, strikes, lockouts or other labor disturbances, acts of God or any acts, omissions or delays in acting by any Governmental Authority or any other Party (each a "**Force Majeure Event**"), and such affected Party promptly begins performing under this Supply Agreement once such causes have been removed; provided that if Protiva experiences any such event that hinders its ability to Manufacture and supply Manufactured Product to Dicerna, Protiva shall allocate resources and capacity to Manufacturing and supplying the Manufactured Products to Dicerna on a basis no less favorable to Dicerna than Protiva provides to its other customers or itself.

(b) In the case of a Delay Event, Protiva shall be excused from performance hereunder for the period of time attributable to such delay, but only to the extent: (i) Protiva gives Dicerna notice of such Delay Event promptly after Protiva becomes aware of the Delay Event; (ii) Protiva uses Commercially Reasonable Efforts to perform the applicable Service or other obligation given due regard equally to Protiva's obligations to Dicerna, to Protiva's then-existing obligations to Third Parties and to Protiva's own internal project timelines; (iii) the occurrence of such Delay Event is not due to an earlier or contemporaneous failure or delay by Protiva, its Affiliates or Permitted Contractors; and (iv) such Delay Event actually prevents Protiva from the timely performance of the applicable Service or other obligation.

12.3 Consequential Damages.

UNDER NO CIRCUMSTANCES WILL ANY PARTY BE LIABLE TO ANY OTHER PARTY WITH RESPECT TO THIS SUPPLY AGREEMENT, AND THE ACTIVITIES CONTEMPLATED HEREBY, FOR ANY CONSEQUENTIAL, INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL OR SIMILAR DAMAGES, WHETHER FORESEEABLE OR UNFORESEEABLE AND REGARDLESS OF THE CAUSE OF ACTION FROM WHICH THEY ARISE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES OCCURRING. NOTWITHSTANDING THE FOREGOING, NOTHING IN THIS SECTION 12.3 IS INTENDED TO OR SHALL LIMIT OR RESTRICT THE INDEMNIFICATION RIGHTS OF A PARTY OR DAMAGES AVAILABLE FOR A PARTY'S BREACH OF CONFIDENTIALITY OBLIGATIONS IN ARTICLE 8.

12.4 Assignment.

Neither Party shall assign any of its rights and obligations hereunder without the prior written consent of the other Party, except (a) to a purchaser of all or substantially all of the assets or business of such Party to which this Supply Agreement relates, or to the successor resulting from any merger, acquisition, consolidation or similar transaction with such Party and (b) to an Affiliate; provided , however , that (i) such assignment to an Affiliate shall not relieve such Party of its obligations herein, and (ii) in each case, the assigning Party shall provide the other Party with written notice of such assignment. Any purported transfer or assignment in contravention of this Section 12.4 shall, at the option of the non-assigning Party, be null and void and of no effect. This Supply Agreement shall be binding upon and inure to the benefit of the Parties and their permitted successors and assigns.

12.5 Notices.

Notices to Dicerna shall be addressed to:

Dicerna Pharmaceuticals, Inc.
480 Arsenal St., #120
Watertown, MA 02472
United States
Attention: CEO and President

With a copy to:

Dicerna Pharmaceuticals, Inc.
480 Arsenal St., #120
Watertown, MA 02472
United States
Attention: Chief Financial Officer

Notices to Protiva shall be addressed to:

Protiva Pharmaceuticals Corporation
100-8900 Glenlyon Parkway
Burnaby, B.C.
Canada V5J 5J8
Attention: President & CEO
Facsimile No.: (604) 630-5103

Notices to Tekmira shall be addressed to:

Tekmira Pharmaceuticals Corporation
100-8900 Glenlyon Parkway
Burnaby, B.C.
Canada V5J 5J8
Attention: President & CEO
Facsimile No.: (604) 630-5103

In each case with copy to:

Orrick, Herrington & Sutcliffe LLP
51 West 52 nd Street
New York, NY 10019
Attention: R. King Milling
Facsimile No.: (212) 506-5151

Any party hereto may change their address by giving notice to the other parties in the manner provided in this Section 12.5. Any notice required or provided for by the terms of this Supply Agreement shall be in writing and shall be (a) sent by certified mail, return receipt requested, postage prepaid, (b) sent via a reputable international express courier service, or (c) sent by facsimile transmission, with a copy by regular mail. The effective date of the notice shall be the actual date of receipt by the receiving party.

12.6 Independent Contractors.

It is understood and agreed that the relationship between the Parties is that of independent contractors and that nothing in this Supply Agreement shall be construed as authorization for either Party to act as the agent for the other Party.

12.7 Governing Law; Dispute Resolution Arbitration.

This Supply Agreement shall be governed and interpreted in accordance with the substantive laws of the State of New York, excluding its conflicts of laws principles.

(a) The Parties and Tekmira recognize that a bona fide dispute as to certain matters may from time to time arise during the Term that relate to a Party or Tekmira's rights or obligations hereunder. In the event of the occurrence of any Dispute, the Parties and Tekmira shall first have such Dispute referred to their respective executives designated below for attempted resolution by good faith negotiations within ***** calendar days after such notice is received. If either Party or Tekmira desires to pursue arbitration under Section 12.7(b) below to resolve any such Dispute, unless expressly provided for otherwise herein, a referral to such executives under this Section 12.7(a) shall be a mandatory condition precedent. Said designated executives as of the Effective Date are as follows.

For Dicerna: Douglas Fambrough, Ph.D., President and CEO

For Protiva: Mark Murray, President and CEO

For Tekmira: Mark Murray, President and CEO

In the event that they shall be unable to resolve the Dispute by consensus within such *****-day period, the Dispute shall be finally settled by binding arbitration as provided below.

(b) Except as expressly otherwise provided in this Supply Agreement, in the event of any dispute arising out of or relating to the interpretation of any provision of this Supply Agreement or the failure of either Party or Tekmira to perform or comply with any obligation of such party pursuant to this Supply Agreement or the breach, termination or validity hereof (a " **Dispute** "), such Dispute will be finally settled by arbitration in accordance with the commercial arbitration rules of the American Arbitration Association, then in force and the Federal Arbitration Act, 9 U.S.C. § 1 et seq., by three (3) arbitrators (the " **Arbitrators** "); provided that the appointed arbitrators shall have appropriate experience in the pharmaceutical industry. Dicerna shall appoint one Arbitrator and Protiva and Tekmira, collectively, shall appoint one Arbitrator, and such two Arbitrators shall jointly appoint the third Arbitrator. If any party is not able to appoint its Arbitrator or the two initial Arbitrators are not able to appoint the third Arbitrator within a reasonable amount of time after the initiation of such process, the applicable Arbitrator or Arbitrators will be appointed in accordance with the above identified commercial arbitration rules. The place of arbitration will be New York, New

York, and the Arbitrators must decide the Dispute in accordance with the substantive laws of the State of New York. The Arbitrators, by accepting their appointment, undertake to conduct the process such that the award is rendered within ***** months of their appointment and is final and binding upon all parties participating in such arbitration. The judgment rendered by the Arbitrators may, at the Arbitrator's discretion, include costs of arbitration, reasonable attorneys' fees and reasonable costs for any expert and other witnesses. Judgment upon the award may be entered in any court having jurisdiction, or application may be made to such court for judicial acceptance of the award or an order of enforcement as the case may be. Any period of limitations or survival period that would otherwise expire between the initiation of the procedures described in this Section 12.7 and the conclusion of such procedures will be extended until ***** days following the conclusion of such procedures. This Section 12.7 does not prohibit a Party or Tekmira from seeking preliminary injunctive relief in aid of arbitration from a court of competent jurisdiction.

(c) The Parties and Tekmira consent to (i) the exclusive jurisdiction of the Federal courts and the State courts of the State of New York, in each case, located in the borough of Manhattan, City of New York (the " **New York Courts** ") for (A) any action referenced in Section 12.7(d) and (B) any action in aid of arbitration, for provisional relief of the status quo or to prevent irreparable harm prior to the appointment of the Arbitrators in Section 12.7(d) above, and (ii) the non-exclusive jurisdiction of the New York Courts for any action to enter or enforce any arbitral award entered in connection with this Supply Agreement. THE PARTIES AND TEKMIRA HEREBY IRREVOCABLY WAIVE, AND AGREE TO CAUSE THEIR RESPECTIVE AFFILIATES TO WAIVE, THE RIGHT TO TRIAL BY JURY IN SUCH ACTIONS.

(d) Unless agreed by the Parties, the foregoing alternative dispute resolution procedures shall not be used with respect to any claim by one Party against another regarding the validity, infringement, misappropriation or violation of a Patent, copyright, trade secret or trademark.

12.8 Severability.

In the event that any provision of this Supply Agreement is held by a court of competent jurisdiction to be unenforceable because it is invalid or in conflict with any law of the relevant jurisdiction, the validity of the remaining provisions shall not be affected and the rights and obligations of the Parties and Tekmira shall be construed and enforced as if this Supply Agreement did not contain the particular provisions held to be unenforceable, provided that the Parties and Tekmira, shall negotiate in good faith a modification of this Supply Agreement with a view to revising this Supply Agreement in a manner which reflects, as closely as is reasonably practicable, the commercial terms of this Supply Agreement as originally signed.

12.9 No Implied Waivers.

The waiver by either Party or Tekmira of a breach or default of any provision of this Supply Agreement by the other Party or Tekmira shall not be construed as a waiver of any succeeding breach of the same or any other provision, nor shall any delay or omission on the part of either Party or Tekmira to exercise or avail itself of any right, power or privilege that it has or may have hereunder operate as a waiver of any right, power or privilege by such Party or Tekmira.

12.10 Headings.

The headings of articles and sections contained this Supply Agreement are intended solely for convenience and ease of reference and do not constitute any part of this Supply Agreement, or have any effect on its interpretation or construction.

12.11 Entire Agreement; Amendment.

This Supply Agreement, the License Agreement and the Quality Agreement contain the entire understanding of the Parties with respect to the subject matter hereof and thereof and supersede and replace any and all previous arrangements and understandings, whether oral or written, between the Parties with respect to the subject matter hereof and thereof. This Supply Agreement may be amended only by a writing signed by each of the Parties.

12.12 Time of the Essence.

Protiva acknowledges that time is of the essence with respect to Protiva's obligations in each SOW for which any specified performance period, delivery date or other temporal requirement is identified, including all timetables and milestones, and is strictly required for Dicerna in light of its schedules and commitments; provided , however , that this Section 12.12 shall not apply to any SOW that is not consistent with the current Batch Forecast.

12.13 Waiver of Rule of Construction.

Each Party and Tekmira has had the opportunity to consult with counsel in connection with the review, drafting and negotiation of this Supply Agreement. Accordingly, the rule of construction that any ambiguity in this Supply Agreement shall be construed against the drafting party shall not apply.

12.14 No Third Party Beneficiaries.

Except as expressly contemplated herein, no Third Party, including any employee of either Party or Tekmira, shall have or acquire any rights by reason of this Supply Agreement.

12.15 Further Assurances.

Each Party and Tekmira shall provide such further documents or instruments required by the other Party or Tekmira as may be reasonably necessary or desirable to give effect to the purpose of this Supply Agreement and carry out its provisions.

12.16 Performance by Affiliates.

Either Party may use one or more of its Affiliates to perform its obligations and duties hereunder, and Affiliates of a Party are expressly granted certain rights herein; provided that each such Affiliate shall be bound by the corresponding obligations of such Party and the relevant Party shall remain liable hereunder for the prompt payment and performance of all their respective obligations hereunder.

12.17 Counterparts.

This Supply Agreement may be executed in any number of counterparts in original or by facsimile or PDF copy, each of which shall be deemed an original, and all of which together shall constitute one and the same instrument.

12.18 Non-Solicitation of Employees.

Each Party agrees that from the Effective Date until the expiration of ***** after the expiration of the Term of this Supply Agreement, it shall not, except upon the express prior written consent of the other Party in each instance, directly or indirectly employ in any capacity (whether as a full or part time employee or as a consultant or contractor) any individual who is then employed by such other Party and has worked in any capacity related to this Supply Agreement, the License Agreement or the Quality Agreement. This provision shall not apply to or prohibit general solicitations, such as job postings though public media, not focused on or directed specifically to the personnel of the other Party or hiring or employing any individual who is hired by a Party in response to those general solicitations.

IN WITNESS WHEREOF , authorized representatives of the Parties have executed and delivered this Supply Agreement effective as of the Effective Date.

PROTIVA BIOTHERAPEUTICS INC.

By: /s/ B. Cousins

Name: B. Cousins

Title: EVP & CFO

By: /s/ Paul Brennan

Name: Paul Brennan

Title: SVP Business Development

DICERNA PHARMACEUTICALS INC.

By: /s/ Douglas Fambrough

Name: Douglas Fambrough

Title: CEO & President

TEKMIRA PHARMACEUTICALS CORPORATION

By: /s/ B. Cousins

Name: B. Cousins

Title: EVP & CFO

By: /s/ Paul Brennan

Name: Paul Brennan

Title: SVP Business Development

DICERNA PHARMACEUTICALS INC.

By: /s/ James E. Dentzer

Name: James E. Dentzer

Title: Chief Financial Officer

Exhibit A

SOW #1

See attached.

*****

THE COMPANY HAS REQUESTED AN ORDER FROM THE COMMISSION PURSUANT TO RULE 406 UNDER THE SECURITIES ACT OF 1933, AS AMENDED, GRANTING CONFIDENTIAL TREATMENT TO SELECTED PORTIONS. ACCORDINGLY, THE CONFIDENTIAL PORTIONS HAVE BEEN OMITTED FROM THIS EXHIBIT, AND HAVE BEEN FILED SEPARATELY WITH THE COMMISSION. OMITTED PORTIONS ARE INDICATED IN THIS EXHIBIT WITH "*****".

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Exhibit B

SOW #2

See attached.

*****

THE COMPANY HAS REQUESTED AN ORDER FROM THE COMMISSION PURSUANT TO RULE 406 UNDER THE SECURITIES ACT OF 1933, AS AMENDED, GRANTING CONFIDENTIAL TREATMENT TO SELECTED PORTIONS. ACCORDINGLY, THE CONFIDENTIAL PORTIONS HAVE BEEN OMITTED FROM THIS EXHIBIT, AND HAVE BEEN FILED SEPARATELY WITH THE COMMISSION. OMITTED PORTIONS ARE INDICATED IN THIS EXHIBIT WITH "*****".

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Exhibit C

SOW #3

See attached.

*****

THE COMPANY HAS REQUESTED AN ORDER FROM THE COMMISSION PURSUANT TO RULE 406 UNDER THE SECURITIES ACT OF 1933, AS AMENDED, GRANTING CONFIDENTIAL TREATMENT TO SELECTED PORTIONS. ACCORDINGLY, THE CONFIDENTIAL PORTIONS HAVE BEEN OMITTED FROM THIS EXHIBIT, AND HAVE BEEN FILED SEPARATELY WITH THE COMMISSION. OMITTED PORTIONS ARE INDICATED IN THIS EXHIBIT WITH "*****".

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Exhibit D

Technical Transfer

*****

THE COMPANY HAS REQUESTED AN ORDER FROM THE COMMISSION PURSUANT TO RULE 406 UNDER THE SECURITIES ACT OF 1933, AS AMENDED, GRANTING CONFIDENTIAL TREATMENT TO SELECTED PORTIONS. ACCORDINGLY, THE CONFIDENTIAL PORTIONS HAVE BEEN OMITTED FROM THIS EXHIBIT, AND HAVE BEEN FILED SEPARATELY WITH THE COMMISSION. OMITTED PORTIONS ARE INDICATED IN THIS EXHIBIT WITH “*****”.

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Exhibit 21.1

Subsidiaries of Dicerna Pharmaceuticals, Inc.

Name	Jurisdiction of Incorporation
Dicerna Security Corporation	Delaware
Dicerna Cayman	Cayman
Dicerna EU Limited	England

Exhibit 23.1

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We consent to the incorporation by reference in Registration Statement No. 333-193795 on Form S-8 of our report dated March 12, 2015, relating to the consolidated financial statements of Dicerna Pharmaceuticals, Inc. and its subsidiaries appearing in this Annual Report on Form 10-K of Dicerna Pharmaceuticals, Inc. for the year ended December 31, 2014.

/s/ Deloitte & Touche LLP

Boston, Massachusetts
March 12, 2015

Exhibit 31.1

CERTIFICATIONS

I, Douglas M. Fambrough, III, Ph.D., certify that:

1. I have reviewed this Annual Report on Form 10-K of Dicerna Pharmaceuticals, Inc. for the year ended December 31, 2014;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15 (f) and 15d-15(f)) for the registrant and have:

a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: March 12, 2015

/s/ Douglas M. Fambrough, III, Ph.D.
Douglas M. Fambrough, III, Ph.D.
Chief Executive Officer and Director

Exhibit 31.2

CERTIFICATIONS

I, James E. Dentzer, certify that:

1. I have reviewed this Annual Report on Form 10-K of Dicerna Pharmaceuticals, Inc. for the year ended December 31, 2014;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15 (f) and 15d-15(f)) for the registrant and have:

a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: March 12, 2015

/s/ James E. Dentzer

James E. Dentzer
Chief Financial Officer

Exhibit 32.1

SECTION 1350 CERTIFICATIONS*

Pursuant to the requirement set forth in Rule 13a-14(b) of the Securities Exchange Act of 1934, as amended (the "Exchange Act"), and Section 1350 of Chapter 63 of Title 18 of the United States Code (18 U.S.C. § 1350), Douglas M. Fambrough, III, Ph.D., Chief Executive Officer and Director of Dicerna Pharmaceuticals, Inc. (the "Company"), and James E. Dentzer, Chief Financial Officer of the Company, each hereby certifies that, to the best of his knowledge:

1. The Company's Annual Report on Form 10-K, for the year ended December 31, 2014, to which this Certification is attached as Exhibit 32.1 (the "Annual Report"), fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended; and

2. The information contained in the Annual Report fairly presents, in all material respects, the financial condition and results of operations of the Company for the period covered by the Annual Report.

Dated: March 12, 2015

/s/ Douglas M. Fambrough, III, Ph.D.	/s/ James E. Dentzer
Douglas M. Fambrough, III, Ph.D.	**James E. Dentzer**
Chief Executive Officer and Director	**Chief Financial Officer**

* This certification accompanies the Annual Report on Form 10-K, to which it relates, is not deemed filed with the Securities and Exchange Commission and is not to be incorporated by reference into any filing of the Company under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended (whether made before or after the date of the Form 10-K), irrespective of any general incorporation language contained in such filing.