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UNITED STATES SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

FORM 10-K

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

For the Fiscal Year Ended December 31, 2020

or

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

Commission File Number: 001-31918

IDERA PHARMACEUTICALS, INC.

(Exact name of Registrant as specified in its charter)

Delaware	**04-3072298**
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)
505 Eagleview Blvd., Suite 212 **Exton, Pennsylvania** (Address of principal executive offices)	**19341** (Zip Code)

(484) 348-1600

(Registrant's telephone number, including area code)

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

Title of Each Class:	Trading Symbol	Name of Each Exchange on Which Registered
Common Stock, $.001 par value	**IDRA**	**Nasdaq Capital Market**

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

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

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

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

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§ 232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes ☒ No ☐

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

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

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

Indicate by check mark whether the registrant has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(b)) by the registered public accounting firm that prepared or issued its audit report. ☐

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

The aggregate market value of the voting and non-voting common equity held by non-affiliates of the registrant was $52.7 million based on the last sale price of the registrant's common stock as reported on the Nasdaq Capital Market on June 30, 2020 (the last business day of the registrant's most recently completed second fiscal quarter).

As of February 28, 2021, the registrant had 42,257,456 shares of common stock outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's definitive proxy statement for its 2021 annual meeting of stockholders are incorporated by reference into Part III of this Form 10-K where indicated. Such definitive proxy statement will be filed with the U.S. Securities and Exchange Commission within 120 days after the year ended December 31, 2020.

IDERA PHARMACEUTICALS, INC.
FORM 10-K

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Unless the context otherwise indicates, references in this Annual Report on Form 10-K to "Idera," "the Company," "we," "us" and "our" refer to Idera Pharmaceuticals, Inc.

IMO® and Idera® are our trademarks. All other trademarks and service marks appearing in this Annual Report on Form 10-K are the property of their respective owners.

All share and per share amounts, including the exercise or conversion price of any of our securities, reflect, as applicable, the occurrence of a 1-for-8 reverse split of our common stock that occurred on July 27, 2018.

NOTE REGARDING FORWARD-LOOKING STATEMENTS

This Annual Report on Form 10-K ("Form 10-K") and the documents we incorporate by reference contain forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended (the "Securities Act"), and Section 21E of the Securities Exchange Act of 1934, as amended (the "Exchange Act"). All statements, other than statements of historical fact, included or incorporated in this report regarding our strategy, future operations, clinical trials, collaborations, intellectual property, cash resources, financial position, future revenues, projected costs, prospects, plans and objectives of management are forward-looking statements. The words "believes," "anticipates," "estimates," "plans," "expects," "intends," "may," "could," "should," "potential," "likely," "projects," "continue," "will," "schedule," "would" and similar expressions are intended to identify forward-looking statements, although not all forward-looking statements contain these identifying words. We cannot guarantee that we actually will achieve the plans, intentions or expectations disclosed in our forward-looking statements and you should not place undue reliance on our forward-looking statements. These forward-looking statements involve known and unknown risks, uncertainties, and other factors, which may be beyond our control, and which may cause the actual results, performance, or achievements of the Company to be materially different from future results, performance, or achievements expressed or implied by such forward-looking statements.

There are a number of important factors that could cause our actual results to differ materially from those indicated or implied by forward-looking statements. These important factors include those set forth below under Part I, Item 1A "Risk Factors" and in our other disclosures and filings with the Securities and Exchange Commission ("SEC"). These factors and the other cautionary statements made in this Annual Report on Form 10-K and the documents we incorporate by reference should be read as being applicable to all related forward-looking statements whenever they appear in this Annual Report on Form 10-K and the documents we incorporate by reference.

In addition, any forward-looking statements represent our estimates only as of the date that this Annual Report on Form 10-K is filed with the SEC and should not be relied upon as representing our estimates as of any subsequent date. All forward-looking statements included in this Annual Report on Form 10-K are made as of the date hereof, and are expressly qualified in their entirety by this cautionary notice. We do not assume any obligation to update any forward-looking statements. We disclaim any intention or obligation to update or revise any forward-looking statement, whether as a result of new information, future events or otherwise, except as may be required by law.

PART I.

Item 1. Business.

Overview

We are a clinical-stage biopharmaceutical company with a business strategy focused on the clinical development, and ultimately the commercialization, of drug candidates for both oncology and rare disease indications characterized by small, well-defined patient populations with serious unmet medical needs. Our current focus is on our Toll-like receptor ("TLR") agonist, tilsotolimod (IMO-2125), for oncology. We believe we can develop and commercialize targeted therapies on our own. To the extent we seek to develop drug candidates for broader disease indications, we have entered into and may explore additional collaborative alliances to support development and commercialization.

TLRs are key receptors of the immune system and play a role in innate and adaptive immunity. As a result, we believe TLRs are potential therapeutic targets for the treatment of a broad range of diseases. Using our chemistry-based platform, we designed both TLR agonists and antagonists to act by modulating the activity of targeted TLRs. A TLR agonist is a compound that stimulates an immune response through the targeted TLR. A TLR antagonist is a compound that inhibits an immune response by blocking the targeted TLR.

Our current TLR-targeted clinical-stage drug candidate, tilsotolimod, is an agonist of TLR9. We are currently developing tilsotolimod, via intratumoral injection, for the treatment of anti-PD1 refractory metastatic melanoma in combination with ipilimumab, an anti-CTLA4 antibody marketed as Yervoy® by Bristol Myers Squibb Company ("BMS") in a Phase 3 registration trial. We are also evaluating intratumoral tilsotolimod in combination with nivolumab, an anti-PD1 antibody marketed as Opdivo® by BMS, and ipilimumab for the treatment of multiple solid tumors in a multicohort Phase 2 trial.

Key Business Developments

The following is a summary of key developments affecting our business since the beginning of 2020.

Clinical Development

- In March 2020, completed enrollment in ILLUMINATE-301.
- In April 2020, reported final clinical safety and efficacy data from ILLUMINATE-204.
- In June 2020, announced preliminary data from and planned continuation of ILLUMINATE-206, and reopened enrollment in the fourth quarter of 2020.

Financings and Capital Resources

As further discussed in Note 8 of the Notes to Financial statements in this Annual Report on Form 10-K, during 2020, we:

- Entered into two private placement financing transactions, collectively providing for up to an aggregate of $40.7 million in potential gross proceeds, of which $15.1 million was received during 2020.
- Received $12.3 million and $1.7 million in net proceeds pursuant to the ATM Agreement and LPC Purchase Agreement, respectively.

Intellectual Property

As further discussed under the caption "Patents, Proprietary Rights and Trade Secrets" below:

- In September 2020, we obtained new patent coverage for tilsotolimod through September 2037 directed to methods of treating colorectal cancer.
- In November 2020, we obtained new patent coverage for tilsotolimod through September 2037 directed to methods of treating head and neck squamous cell carcinoma.

Clinical Development

Tilsotolimod (IMO-2125)

Tilsotolimod is a synthetic phosphorothioate oligonucleotide that acts as a direct agonist of TLR9 to stimulate the innate and adaptive immune systems. Tilsotolimod is being developed for administration via intratumoral injection in combination with systemically administered checkpoint inhibitors and costimulation therapies for the treatment of various solid tumors, including (i) anti-PD1 refractory metastatic melanoma in combination with ipilimumab, (ii) microsatellite stable ("MSS") colorectal cancer ("CRC") in combination with nivolumab and ipilimumab, and (iii) squamous cell carcinoma of the head and neck ("HNSCC") in combination with ABBV-368 and other combinations. We refer to our tilsotolimod development program as the ILLUMINATE development program. See additional information under the heading "Collaborative Alliances" for information on the development of tilsotolimod in collaboration with AbbVie Inc. ("AbbVie") for patients with HNSCC.

Advancements in cancer immunotherapy have included the approval of multiple checkpoint inhibitors, which are therapies that target mechanisms by which tumor cells evade detection by the immune system. Despite these advancements, many patients fail to respond to these therapies. Published data suggests the lack of response to checkpoint inhibition is related to a non-immunogenic tumor microenvironment. We believe TLR9 agonists may be useful in melanoma and other solid tumor types that are refractory to anti-PD1 treatment due, in part, to low mutation load and low dendritic cell infiltration. Because TLR9 agonists, such as tilsotolimod, stimulate the immune system, we believe the intratumoral injection of tilsotolimod activates a local immune response in the injected tumor, which may complement the effect of the systemically administered checkpoint inhibitors.

Melanoma

Melanoma is a cancer that begins in a type of skin cell called melanocytes. While melanoma is one of the least common types of skin cancer, it has a poor prognosis when not detected and treated early. As is the case in many forms of cancer, melanoma becomes more difficult to treat once the disease has spread, or metastasized, beyond the skin to other parts of the body. According to the American Cancer Society, approximately 106,000 people in the United States will be diagnosed with invasive melanoma in 2021. Immunotherapies known as checkpoint inhibitors have changed the treatment of advanced melanoma and have become the standard of care, with anti-PD-1 agents being the most commonly used immunotherapy in the first-line setting. These agents work by increasing the ability of the body's immune system to help detect and fight cancer cells. However, due to primary or acquired resistance mechanisms that exclude or inhibit anti-tumor immune cells, as many as 60% of patients do not benefit from this type of therapy, and up to one-third of initial responders develop resistance to the therapy and ultimately experience disease progression. Today, these refractory patients are left with few options for further treatment, paving the way for novel investigational therapies such as tilsotolimod.

We are currently developing tilsotolimod for use in combination with checkpoint inhibitors for the treatment of patients with anti-PD1 refractory metastatic melanoma. Tilsotolimod has received Orphan Drug Designation for the treatment of melanoma Stages IIb to IV and Fast Track designation for the treatment of anti-PD1 refractory metastatic melanoma in combination with ipilimumab therapy from the U.S. Food and Drug Administration ("FDA").

ILLUMINATE-301 - Phase 3 Trial of Tilsotolimod (IMO-2125) in Combination with Ipilimumab in Patients with Anti-PD1 Refractory Metastatic Melanoma

In the first quarter of 2018, we initiated a Phase 3 trial of the tilsotolimod–ipilimumab combination in patients with anti-PD-1 refractory metastatic melanoma, which we refer to as ILLUMINATE-301. This trial, which completed target enrollment of 454 patients in March 2020, will compare the results of the tilsotolimod–ipilimumab combination to those of ipilimumab alone in a 1:1 randomization. The family of primary endpoints of the trial consists of objective response rate ("ORR") by blinded independent central review using Response Evaluation Criteria in Solid Tumors ("RECIST v1.1") and median overall survival ("OS"). We believe positive results in either of the primary endpoints could lead to approval in the United States. Key secondary endpoints include

durable response rate, duration of response, median time to response, median progression free survival ("PFS") and patient-reported outcomes using a validated scale. ILLUMINATE-301 is being monitored by an Independent Data Monitoring Committee.

As further discussed below under the heading "Collaborative Alliances," in May 2018, we entered into a clinical trial collaboration and supply agreement with BMS under which BMS has agreed to supply YERVOY® (ipilimumab), at its cost and for no charge to us, for use in ILLUMINATE-301.

ILLUMINATE-204 - Phase 1/2 Trial of Tilsotolimod (IMO-2125) in Combination with Ipilimumab or Pembrolizumab in Patients with Anti-PD1 Refractory Metastatic Melanoma

In December 2015, we initiated a Phase 1/2 clinical trial to assess the safety and efficacy of intratumoral tilsotolimod in combination with ipilimumab in patients with anti-PD-1 refractory metastatic melanoma, which we refer to as ILLUMINATE-204. We subsequently amended the trial protocol to include an additional treatment arm to study the combination of tilsotolimod with pembrolizumab, an anti-PD1 antibody marketed as Keytruda® by Merck & Co., Inc., in the same patient population.

The primary objectives of the Phase 1 portion of the trial included characterizing the safety of the combinations and determining the recommended Phase 2 dose. A secondary objective of the Phase 1 portion of the trial was to describe the antitumor activity of tilsotolimod when administered intratumorally in combination with ipilimumab or pembrolizumab. Objectives of the Phase 2 portion of the trial included evaluation of the ORR of the tilsotolimod-ipilimumab combination using RECIST v1.1 criteria and immune-related response criteria ("irRC"), median OS, other efficacy measures, and to continue to characterize the safety of the combination.

Final topline data from the trial was reported in April 2020. A total of 52 subjects were treated with the tilsotolimod-ipilimumab combination at the recommended Phase 2 dose of 8 mg tilsotolimod. Of the 49 subjects evaluable for efficacy, 11 had a confirmed response per RECIST v1.1, representing an ORR of 22.4%. Additionally, 35 of the 49 patients achieved stable disease or better, representing a disease control rate of 71.4%. Durable responses (>6 months) were observed in 7 of 11 confirmed responses per RECIST v1.1. Median OS was 21.0 months. The combination regimen was generally well-tolerated among the 62 ILLUMINATE-204 patients receiving tilsotolimod at any dose in combination with ipilimumab.

Other Solid Tumors

Advancements in cancer immunotherapy have included the approval and late-stage development of multiple checkpoint inhibitors, as single agents or in combination, for other solid tumors including, among others, microsatellite instability high/deficient mismatch repair ("MSI-H/dMMR") CRC and HNSCC.

In patients with CRC, nivolumab administered as monotherapy or in combination with ipilimumab has demonstrated benefit and is approved for the treatment of MSI-H/dMMR mCRC. However, in a previously treated microsatellite stable ("MSS") CRC patient population, nivolumab + ipilimumab combination therapy did not produce objective responses. MSS-CRC has been shown to be highly immunosuppressive. Moreover, the tumor microenvironment in MSS-CRC has been shown to keep dendritic cells in an immature state. Given tilsotolimod's mechanism of action of activating dendritic cells, it may serve a complementary function to nivolumab and ipilimumab within the immunosuppressive tumor microenvironment ("TME") of MSS-CRC patients.

In patients with relapsed or metastatic HNSCC ("RM-HNSCC"), results from prospectively conducted trials employing the immune-modulating antibodies nivolumab and pembrolizumab following chemotherapy heralded a new era of treatment for patients with RM-HNSCC. Patients responding to these agents have seen durable responses, and in controlled studies, an overall survival benefit has been demonstrated for the anti-PD-1 antibodies versus standard of care chemotherapy. The challenge remains to increase the percentage of patients responding to these treatments, which currently ranges from 13% to 23%, depending on the line of therapy.

We believe, based on internally conducted commercial research and information published by the American Cancer Society and other references, that annually in the United States, approximately 149,500 people are diagnosed with CRC, of which 85% are MSS, and that approximately 53,000 deaths are attributed to CRC. Additionally, we believe that annually in the United States, approximately 66,000 people are diagnosed with HNSCC and there are approximately 14,500 deaths attributed to HNSCC. We also believe that, in 2018, approximately 212,000 patients in the United States with various tumor types have been treated with an anti-PD-1/anti-PD-L1 therapy. Approximately 87% of these patients may progress after treatment and therefore may benefit from alternative therapies.

ILLUMINATE-206 - Phase 2 Trial of Tilsotolimod (IMO-2125) in Combination with Nivolumab and Ipilimumab for the treatment of Solid Tumors

In September 2019, we initiated a Phase 2, open-label, global, multicohort study to evaluate tilsotolimod administered intratumorally in combination with nivolumab and ipilimumab for the treatment of solid tumors. The basis for this study is supported by data generated from our ILLUMINATE-101 and ILLUMINATE-204 trials, which suggest the mechanism of action for tilsotolimod may be tumor-type agnostic and potentially beneficial in combination with checkpoint modulation in a variety of tumor types. We refer to this study as ILLUMINATE-206.

The objectives of ILLUMINATE-206 are to test the safety and effectiveness of intratumoral tilsotolimod in combination with nivolumab and ipilimumab for the treatment of solid tumors.

Currently, we are evaluating relapsed/refractory MSS-CRC in immunotherapy-naïve patients treated with tilsotolimod in combination with nivolumab and ipilimumab (the “MSS-CRC Study”). An initial group of ten patients was enrolled to evaluate the safety of administering the combination of tilsotolimod, nivolumab and ipilimumab. To investigate the safety profile of this triplet combination, ILLUMINATE-206 was designed with a stepwise approach to Yervoy® dosage. Patients in this initial safety cohort of the MSS-CRC Study, many of whom were heavily pre-treated and rapidly progressing, received 8 mg of intratumoral tilsotolimod and 3 mg/kg of intravenous (IV) Opdivo® every two weeks, along with 1 mg/kg of IV Yervoy® every eight weeks (the “Low-Dose, Low-Frequency Cohort”). This regimen was generally well tolerated; no patients discontinued treatment due to adverse events (AEs) and none experienced Grade 4 or 5 AEs. One patient experienced stable disease per RECIST v1.1 criteria and nine patients progressed as defined by RECIST v1.1. Investigators reported that six of the progressing patients had stability or reduction in size of injected lesions and six had stability or reduction in overall size of uninjected lesions.

Based on these results, we are actively enrolling patients in a second MSS-CRC Study cohort. Changes in the study design intended to improve potential outcomes in the targeted patient population included increasing the frequency of Yervoy® dosing to every three weeks and limiting the number of allowed prior lines of treatment to two. Accordingly, patients in the second group of 10 enrolled in the MSS-CRC Study will receive 8 mg of intratumoral tilsotolimod (total of 9 doses over approximately 28 weeks) and 3 mg/kg of intravenous (IV) Opdivo® every three weeks followed by 480 mg of IV Opdivo® every four weeks, along with 1 mg/kg of IV Yervoy® every three weeks for four doses (the “Low-Dose, High-Frequency Cohort”). Based on data from these patients, the MSS-CRC Study may be expanded further and/or provide rationale to explore additional tumor types.

As further discussed below under the heading “Collaborative Alliances,” in March 2019, we entered into a clinical trial collaboration and supply agreement with BMS, under which BMS has agreed to manufacture and supply YERVOY® (ipilimumab) and OPDIVO® (nivolumab), at its cost and for no charge to us, for use in ILLUMINATE-206.

ILLUMINATE-101 - Phase 1b Trial of Intratumoral Tilsotolimod (IMO-2125) Monotherapy in Patients with Refractory Solid Tumors

In March 2017, we initiated a Phase 1b dose escalation trial of intratumoral tilsotolimod as a single agent in multiple tumor types, which we refer to as ILLUMINATE-101. We completed enrollment of a total of 38 patients in four dose-escalation cohorts at doses of 8mg (cohort 1, n=11), 16mg (cohort 2, n=8), 23mg (cohort 3, n=10) and 32mg (cohort 4, n=9). There were no dose-limiting toxicities observed and tilsotolimod appeared to be generally well-tolerated at each of the dose levels tested. We also completed enrollment of 16 patients in a melanoma expansion cohort, which utilized a Simon's optimal two-stage design, to assess whether tilsotolimod as a single agent (8mg dose) has any statistically relevant clinical activity, as demonstrated for objective response according to RECIST v1.1 criteria, in patients with metastatic melanoma who have progressed on or after treatment with a PD-(L)1 inhibitor. The study was completed in October 2019.

At the American Association for Cancer Research Annual Meeting in April 2020, we provided final results of ILLUMINATE-101, noting that a total of 54 patients had been dosed, including 38 patients in the dose-evaluation portion of the trial and 16 patients in the melanoma dose-expansion cohort. Of the 51 evaluable patients, 29% (n=15) had a best response of stable disease. Duration of stable disease ranged from 1.5 to 12+ months from the start of treatment, with stable disease ongoing beyond 12 months for one patient as of the close of the study. There were no correlations between dose and efficacy observed.

An additional purpose of this study was to obtain tumor biopsies to assess the effect of tilsotolimod on the tumor microenvironment in multiple types of solid tumors and inform the expansion of the development program beyond melanoma. Translational research in ILLUMINATE-101 demonstrated that tilsotolimod increased dendritic cell activation and upregulated MHC class II and IFN-α signaling, which suggests improved antigen presentation, and is similar to that observed and previously reported in the tumor biopsies from the ILLUMINATE-204 melanoma subjects. This observation provided additional rationale to expand the tilsotolimod clinical development program to additional solid tumors.

Discontinued Programs

In July 2018, following an analysis of our gene-silencing technology platform and our research portfolio, we decided to suspend our rare disease and discovery programs as part of our overall strategy to more narrowly focus our capital resources on the development and commercialization of tilsotolimod. Please refer to our Annual Report on Form 10-K for the fiscal year ended December 31, 2019, which was filed with the SEC on March 11, 2020, for further details on our discontinued programs.

Collaborative Alliances

Our current alliances include collaborations with AbbVie and BMS. In addition to our current alliances, we may seek to enter into additional collaborative alliances to support development and commercialization of our TLR agonists and antagonists.

Collaboration with AbbVie

Effective August 27, 2019, we entered into a clinical trial collaboration and supply agreement with AbbVie, a global, research-based biopharmaceutical company, to conduct a clinical study to evaluate the efficacy and safety of combinations of an OX40 agonist (ABBV-368), tilsotolimod, nab-paclitaxel and/or an anti-programmed cell death 1 (PD-1) antagonist (ABBV-181), which we refer to as the AbbVie Agreement. Under the AbbVie Agreement, we will provide a clinical trial supply of tilsotolimod to AbbVie and AbbVie will sponsor, fund and conduct the study entitled "A Phase 1b, Multicenter, Open-Label Study to Determine the Safety, Tolerability, Pharmacokinetics, and Preliminary Efficacy of ABBV-368 plus Tilsotolimod and Other Therapy Combinations in Subjects with Recurrent/Metastatic Head and Neck Squamous Cell Carcinoma" (the, "AbbVie Study"). We have agreed to manufacture and supply tilsotolimod at its cost and for no charge to AbbVie, for use in the AbbVie Study.

Collaboration with Bristol-Meyers Squibb

Effective May 18, 2018, we entered into a clinical trial collaboration and supply agreement with BMS (the "May 2018 BMS Agreement") to clinically evaluate the combination of tilsotolimod with BMS's therapy YERVOY® (ipilimumab). Under the May 2018 BMS Agreement, we will sponsor, fund and conduct our ongoing global, open-label, multicenter Phase 3 clinical trial of tilsotolimod in combination with YERVOY® entitled "A Randomized Phase 3 Comparison of IMO-2125 with Ipilimumab versus Ipilimumab Alone in Patients with Anti-PD-1 Refractory Melanoma" in accordance with an agreed-upon protocol, which we refer to as ILLUMINATE-301. Under the May 2018 BMS Agreement, BMS granted us a non-exclusive, non-transferrable, royalty-free license (with a right to sublicense) under its intellectual property to use YERVOY® in ILLUMINATE-301 and has agreed to manufacture and supply YERVOY®, at its cost and for no charge to us, for use in ILLUMINATE-301.

Effective March 11, 2019, we entered into a second clinical trial collaboration and supply agreement with BMS (the "March 2019 BMS Agreement") to clinically evaluate the combination of tilsotolimod with BMS's therapy YERVOY® (ipilimumab) and OPDIVO® (nivolumab). Under the March 2019 BMS Agreement, we will sponsor, fund and conduct a Phase 2, open-label, global, multicenter, multicohort study of intratumoral tilsotolimod in combination with YERVOY® and OPDIVO® entitled "Study of Tilsotolimod in Combination with Nivolumab and Ipilimumab For the Treatment of Solid Tumors" in accordance with an agreed-upon protocol, which we refer to as ILLUMINATE-206. Under the March 2019 BMS Agreement, BMS granted us a non-exclusive, non-transferrable, royalty-free license (with a right to sublicense) under its intellectual property to use YERVOY® and OPDIVO® in ILLUMINATE-206 and has agreed to manufacture and supply YERVOY® and OPDIVO®, at its cost and for no charge to us, for use in ILLUMINATE-206.

Academic and Research Collaborations

We have entered into research collaborations with scientists at leading academic research institutions. These research collaborations allow us to augment our internal research capabilities and obtain access to specialized knowledge and expertise. In general, our research collaborations may require us to supply compounds and pay various amounts to support the research. Under these research agreements, if a collaborator, solely or jointly with us, creates any invention, we may own exclusively such invention, have an automatic paid-up, royalty-free non-exclusive license or have an option to negotiate an exclusive, worldwide, royalty-bearing license to such invention. Inventions developed solely by our scientists in connection with research collaborations are owned exclusively by us. These collaborative agreements are non-exclusive and may be terminated with limited notice.

Research and Development Expenses

We are committed to redefining the treatment of certain cancers and rare diseases and have historically dedicated a significant portion of our resources to our efforts on the discovery and development of our drug candidates. For the years ended December 31, 2020, 2019 and 2018, we spent approximately $24.8 million, $34.9 million, and $41.8 million, respectively, on research and development activities. We plan to continue to invest in research and development, primarily with respect to our clinical trials of tilsotolimod. Accordingly, we anticipate a significant portion of our operating expenses will continue to be related to clinical development in 2021 and beyond.

Patents, Proprietary Rights and Trade Secrets

Our success depends in part on our ability to obtain and maintain proprietary protection for our drug candidates, technology and know-how, to operate without infringing the proprietary rights of others and to prevent others from infringing our proprietary rights. We use a variety of methods to seek to protect our proprietary position, including filing U.S. and foreign patent applications related to our proprietary technology, inventions and improvements that are important to the development of our business. We also rely on trade secrets, know-how, continuing technological innovation, and in-licensing opportunities to develop and maintain our proprietary position.

We have devoted and continue to devote a substantial amount of our resources into establishing intellectual property protection for:

- Novel chemical entities that function as agonists of TLR3, TLR7, TLR8 or TLR9;
- Novel chemical entities that function as antagonists of TLR7, TLR8 or TLR9; and
- Composition and use of our nucleic acid chemistry compounds to treat and prevent a variety of diseases.

On November 5, 2019, the U.S. Patent and Trademark Office issued to us U.S. Patent No. 10,463,686 entitled "Immune Modulation With TLR9 Agonists For Cancer Treatment," which includes tilsotolimod. The patent includes 24 claims directed to methods of treating melanoma with intratumoral administration of tilsotolimod in combination with certain immune checkpoint inhibitor therapies, including inhibitors of the CTLA-4 and PD-1/PD-L1 pathways. The patent is expected to expire in September 2037.

On September 15, 2020, the U.S. Patent and Trademark Office issued U.S. Patent No. 10,772,907 (the '907 Patent) to us, entitled "Immune Modulation with TLR9 Agonists for Cancer Treatment," which includes our investigational therapy tilsotolimod. The '907 Patent includes 26 claims directed to methods of treating colorectal cancer ("CRC") with intratumoral administration of tilsotolimod in combination with certain immune checkpoint inhibitor therapies, including CTLA-4, PD-1 or PD-L1 proteins.

On November 17, 2020, the U.S. Patent and Trademark Office issued U.S. Patent No. 10,835,550 (the '550 Patent) to us, entitled "immune Modulation with TLR9 Agonists for Cancer Treatment," which includes our investigational therapy tilsotolimod. The '550 Patent includes 26 claims directed to methods of treating head and neck squamous cell carcinoma ("HNSCC") with intratumoral administration of tilsotolimod in combination with certain immune checkpoint inhibitor therapies, including CTLA-4, PD-1 or PD-L1 proteins.

These new patents (the '907 Patent and the '550 Patent) expand protection of the first tilsotolimod method-of-use patent, which was directed to methods of treating metastatic melanoma and was issued in November 2019. The '907 Patent and the '550 Patent provide exclusivity for certain uses of tilsotolimod through September 2037.

As of February 15, 2021, we owned approximately 57 U.S. patents and patent applications and about 184 patents and patent applications throughout the rest of the world for our TLR-targeted immune modulation technologies. These patents and patent applications include claims covering the chemical compositions of matter and methods of use of our IMO compounds, such as IMO-8400, IMO-9200 and tilsotolimod (IMO-2125), as well as other compounds. These patents and patent applications (if granted) expire at various dates ranging from 2020 to 2041. With respect to IMO-8400, we have six issued U.S. patents that cover the chemical composition of matter of IMO-8400 and certain methods of its use, the latest of which expires in 2031. With respect to IMO-9200, we have nine issued U.S. patents that cover the chemical composition for IMO-9200 and methods of its use, the latest of which expires in 2034. With respect to tilsotolimod, we have an issued U.S. patent that covers the chemical composition of matter of tilsotolimod that will expire in 2024 and additional patents that cover methods of its use, the latest of which will expire in 2037. We have pending applications in the United States and outside of the United States that cover methods of treatment or use of tilsotolimod, which, if granted, will expire between 2035 and 2041.

Because patent applications in the United States and many foreign jurisdictions are typically not published until 18 months after filing, or in some cases not at all, and because publications of discoveries in the scientific

literature often lag behind actual discoveries, neither we nor our licensors can be certain that we or they were the first to make the inventions claimed in issued patents or pending patent applications, or that we or they were the first to file for protection of the inventions set forth in these patent applications.

Litigation may be necessary to defend against or assert claims of infringement, to enforce patents issued to us, to protect trade secrets or know-how owned by us, or to determine the scope and validity of the proprietary rights of others or to determine the appropriate term for an issued patent. In addition, the United States Patent and Trademark Office ("USPTO") may declare interference proceedings to determine the priority of inventions with respect to our patent applications or reexamination or reissue proceedings to determine if the scope of a patent should be narrowed. Litigation or any of these other proceedings could result in substantial costs to and diversion of effort by us, even if the eventual outcome is favorable to us, and could have a material adverse effect on our business, financial condition and results of operations. These efforts by us may not be successful.

The term of individual patents depends upon the legal term for patents in the countries in which they are obtained. In most countries, including the United States, the patent term is 20 years from the earliest filing date of a non-provisional patent application. In the United States, a patent's term may be lengthened by patent term adjustment, which compensates a patentee for administrative delays by the USPTO in examining and granting a patent, or may be shortened if a patent is terminally disclaimed over an earlier filed patent. The term of a patent that covers a drug, biological product or medical device approved pursuant to a pre-market approval may also be eligible for patent term extension when FDA approval is granted, provided statutory and regulatory requirements are met. The length of the patent term extension is related to the length of time the drug is under regulatory review while the patent is in force. The Drug Price Competition and Patent Term Restoration Act of 1984, or the Hatch-Waxman Act, permits a patent term extension of up to five years beyond the expiration date set for the patent. Patent extension cannot extend the remaining term of a patent beyond a total of 14 years from the date of product approval, only one patent applicable to each regulatory review period may be granted an extension and only those claims reading on the approved drug are extended. Similar provisions are available in Europe and other foreign jurisdictions to extend the term of a patent that covers an approved drug.

We may rely, in some circumstances, on trade secrets and confidentiality agreements to protect our technology. Although trade secrets are difficult to protect, wherever possible, we use confidential disclosure agreements to protect the proprietary nature of our technology. We regularly implement confidentiality agreements with our employees, consultants, scientific advisors, and other contractors and collaborators. However, there can be no assurance that these agreements will not be breached, that we will have adequate remedies for any breach, or that our trade secrets and/or proprietary information will not otherwise become known or be independently discovered by competitors. To the extent that our employees, consultants or contractors use intellectual property owned by others in their work for us, disputes may also arise as to the rights in related or resulting know-how and inventions.

Manufacturing

We do not currently own or operate manufacturing facilities for the production of clinical or commercial quantities of any of our drug candidates. We currently rely and expect to continue to rely on other companies for the manufacture of our drug candidates for preclinical and clinical development. We source our bulk drug manufacturing requirements from a limited number of contract manufacturers through the issuance of work orders on an as-needed basis. We currently do not have any long-term supply contracts. We depend and will continue to depend on our contract manufacturers to manufacture our drug candidates in accordance with current Good Manufacturing Practices ("cGMP") regulations for use in clinical trials. We will ultimately depend on contract manufacturers for the manufacture of our products for commercial sale, if and when our drug candidates are approved. Contract manufacturers are subject to extensive governmental regulation.

Competition

The biotechnology and pharmaceutical industries are characterized by rapidly advancing technologies, intense competition and a strong emphasis on proprietary products. We are currently developing tilsotolimod (IMO-2125), our TLR agonist drug candidate, for the treatment by intratumoral injection of multiple oncology indications in combination with checkpoint inhibitors. There are many other companies, both public and private, that are actively engaged in discovery, development, and commercializing products and technologies that may compete with our drug candidate, tilsotolimod, including TLR-targeted compounds as well as non-TLR-targeted therapeutics.

Immuno-oncology, which utilizes a patient's own immune system to combat cancer, is currently an active area of research for biotechnology and pharmaceutical companies. Interest in immuno-oncology is driven by efficacy data in cancers with historically bleak outcomes and the potential to achieve a cure or functional cure for some patients. As such, we expect that our efforts in this field will be competitive with a wide variety of different approaches. Any one of these competitive approaches may result in the development of novel technologies that are more effective, safer or less costly than any that we are developing.

We recognize that other companies, including large pharmaceutical companies, may be developing or have plans to develop products and technologies that may compete with ours. Many of our competitors have substantially greater financial, technical, and human resources than we have. In addition, many of our competitors have significantly greater experience than we have in undertaking preclinical studies and human clinical trials of new pharmaceutical products, obtaining FDA and other regulatory approvals of products for use in health care and manufacturing, and marketing and selling approved products. Our competitors may discover, develop or commercialize products or other novel technologies that are more effective, safer or less costly than any that we are developing. Our competitors may also obtain FDA or other regulatory approval for their products more rapidly than we may obtain approval for ours.

We anticipate that the competition with our drug candidate, tilsotolimod, and technologies will be based on a number of factors including product efficacy, safety, availability, and price. The timing of market introduction of tilsotolimod and competitive products will also affect competition among products. We expect the relative speed with which we can develop tilsotolimod, complete the clinical trials and approval processes, and supply commercial quantities of the products to the market to be important competitive factors. Our competitive position will also depend upon our ability to attract and retain qualified personnel, to obtain patent protection or otherwise develop proprietary products or processes, protect our intellectual property, and to secure sufficient capital resources for the period between technological conception and commercial sales.

Risks related to our competitors and our competitive position are discussed in further detail in the section entitled "Risk Factors" of this Annual Report on Form 10-K.

Government Regulation

Government authorities in the United States, at the federal, state and local level, and in other countries and jurisdictions, including the European Union, extensively regulate, among other things, the research, development, testing, manufacture, quality control, approval, packaging, storage, recordkeeping, labeling, advertising, promotion, distribution, marketing, pricing, post-approval monitoring and reporting, and import and export of pharmaceutical products. The processes for obtaining regulatory approvals in the United States and in foreign countries and jurisdictions, along with subsequent compliance with applicable statutes and regulations and other regulatory authorities, require the expenditure of substantial time and financial resources.

Review and Approval of Drugs in the United States

In the United States, the FDA regulates drugs under the Federal Food, Drug, and Cosmetic Act ("FDCA") and associated implementing regulations. The failure to comply with the FDCA and other applicable U.S. requirements at any time during the product development process, approval process or after approval may subject an applicant and/or sponsor to a variety of administrative or judicial sanctions, including refusal by the FDA to approve pending applications, withdrawal of an approval, imposition of a clinical hold, issuance of warning letters and other types of letters, product recalls, product seizures, total or partial suspension of production or distribution, injunctions, fines, refusals of government contracts, restitution, disgorgement of profits, or civil or criminal investigations and penalties brought by the FDA and the Department of Justice, or the DOJ, or other governmental entities, including state agencies.

An applicant seeking approval to market and distribute a new drug product in the United States must typically undertake the following:

- completion of preclinical laboratory tests, animal studies and formulation studies in compliance with the FDA's good laboratory practice ("GLP") regulations;
- submission to the FDA of an IND, which must take effect before human clinical trials may begin in the United States;
- approval by an independent institutional review board ("IRB"), representing each clinical site before each clinical trial may be initiated;
- performance of adequate and well-controlled human clinical trials in accordance with good clinical practices ("GCP") to establish the safety and efficacy of the proposed drug product for each indication;
- preparation and submission to the FDA of a new drug application ("NDA");
- review of the product candidate by an FDA advisory committee, where appropriate or if applicable;
- satisfactory completion of one or more FDA inspections of the manufacturing facility or facilities at which the product, or components thereof, are produced to assess compliance with cGMP requirements and to assure that the facilities, methods and controls are adequate to preserve the product's identity, strength, quality and purity;
- satisfactory completion of FDA audits of clinical trial sites to assure compliance with GCPs and the integrity of the clinical data;
- payment of user fees and securing FDA approval of the NDA; and
- compliance with any post-approval requirements, including Risk Evaluation and Mitigation Strategies ("REMS") where applicable, and post-approval studies required by the FDA.

Preclinical Studies

Before an applicant begins testing a product candidate with potential therapeutic value in humans, the product candidate enters the preclinical testing stage. Preclinical studies include laboratory evaluation of the purity and stability of the manufactured drug substance or active pharmaceutical ingredient and the formulated drug or drug product, as well as in vitro and animal studies to assess the safety and activity of the drug for initial testing in humans and to establish a rationale for therapeutic use. The conduct of preclinical studies is subject to federal regulations and requirements, including GLP regulations. The results of the preclinical tests, together with manufacturing information, analytical data, any available clinical data or literature and plans for clinical studies, among other things, are submitted to the FDA as part of an IND. Additional preclinical testing, such as animal tests of reproductive adverse events and carcinogenicity, may continue after the IND is submitted.

Human Clinical Studies in Support of an NDA

Clinical trials involve the administration of the investigational product to human subjects under the supervision of qualified investigators in accordance with GCP requirements, which include, among other things, the requirement that all research subjects provide their informed consent in writing before their participation in any clinical trial. Clinical trials are conducted under written study protocols detailing, among other things, the objectives of the study, inclusion and exclusion criteria, the parameters to be used in monitoring safety and the effectiveness criteria to be evaluated. A protocol for each clinical trial and any subsequent protocol amendments must be submitted to the FDA as part of the IND. An IND is an exemption from the FDCA that allows an unapproved product candidate to be shipped in interstate commerce for use in an investigational clinical trial and a request for FDA authorization to administer such investigational product to humans. An IND automatically becomes effective 30 days after receipt by the FDA, unless before that time the FDA raises concerns or questions related to a proposed clinical trial and places the trial on clinical hold or partial clinical hold. In such a case, the IND sponsor and the FDA must resolve any outstanding concerns before the clinical trial can begin.

Typically, the FDA will require one IND for early development studies where the sponsor is uncertain of the indication or dosage form of the proposed product, where the drug is being developed for closely related indications within a single review division at FDA, or where there are multiple closely-related routes of administration using the same dosage formulation. On the other hand, multiple INDs may be required where there are two or more unrelated conditions being developed or where multiple dosage forms are being extensively investigated or where multiple routes of administration are being evaluated.

In addition to the foregoing IND requirements, an IRB representing each institution participating in the clinical trial must review and approve the plan for any clinical trial before it commences at that institution, and the IRB must conduct continuing review and reapprove the study at least annually. The IRB must review and approve, among other things, the study protocol and informed consent information to be provided to study subjects. An IRB must operate in compliance with FDA regulations. Information about certain clinical trials must be submitted within specific timeframes to the National Institutes of Health for public dissemination on their ClinicalTrials.gov website.

Additionally, some trials are overseen by an independent group of qualified experts organized by the trial sponsor, known as a data monitoring committee (“DMC”). This group provides recommendations as to whether a trial should move forward at designated check points based on access that only the group maintains to available data from the study. Suspension or termination of development during any phase of clinical trials can occur if it is determined that the participants or patients are being exposed to an unacceptable health risk. Other reasons for suspension or termination may be made by us based on evolving business objectives and/or competitive climate.

Human clinical trials are typically conducted in three sequential phases, which may overlap or be combined:

Phase 1: The drug is initially introduced into healthy human subjects or patients with the target disease (e.g. cancer) or condition and tested for safety, dosage tolerance, absorption, metabolism, distribution, excretion and, if possible, to gain an early indication of its effectiveness and to determine optimal dosage.

Phase 2: The drug is administered to a limited patient population to identify possible adverse effects and safety risks, to preliminarily evaluate the efficacy of the product for specific targeted diseases and to determine dosage tolerance and optimal dosage.

Phase 3: The drug is administered to an expanded patient population, generally at geographically dispersed clinical trial sites, in well-controlled clinical trials to generate enough data to statistically evaluate the efficacy and safety of the product for approval, to establish the overall risk-benefit profile of the product, and to provide adequate information for the labeling of the product.

Progress reports detailing the results of the clinical trials must be submitted at least annually to the FDA and more frequently if serious adverse events occur. In addition, IND safety reports must be submitted to the FDA for any of the following: serious and unexpected suspected adverse reactions; findings from other studies or animal or in vitro testing that suggest a significant risk in humans exposed to the drug; and any clinically important increase in the case of a serious suspected adverse reaction over that listed in the protocol or investigator brochure. Phase 1, Phase 2 and Phase 3 clinical trials may not be completed successfully within any specified period, or at all. Furthermore, the FDA, the sponsor or the data monitoring committee for a clinical trial may suspend or terminate the clinical trial at any time on various grounds, including a finding that the research subjects are being exposed to an unacceptable health risk. Similarly, an IRB can suspend or terminate approval of a clinical trial at its institution, or an institution it represents, if the clinical trial is not being conducted in accordance with the IRB's requirements or if the drug has been associated with unexpected serious harm to patients. The FDA will typically inspect one or more clinical sites to assure compliance with GCP and the integrity of the clinical data submitted.

Section 505(b)(2) NDAs

NDAs for most new drug products are based on two full clinical studies which must contain substantial evidence of the safety and efficacy of the proposed new product. These applications are submitted under Section 505(b)(1) of the FDCA. The FDA is, however, authorized to approve an alternative type of NDA under Section 505(b)(2) of the FDCA. This type of application allows the applicant to rely, in part, on the FDA's previous findings of safety and efficacy for a similar product, or published literature. Specifically, Section 505(b)(2) applies to NDAs for a drug for which the investigations made to show whether or not the drug is safe for use and effective in use and relied upon by the applicant for approval of the application "were not conducted by or for the applicant and for which the applicant has not obtained a right of reference or use from the person by or for whom the investigations were conducted."

Thus, Section 505(b)(2) authorizes the FDA to approve an NDA based on safety and effectiveness data that were not developed by the applicant. NDAs filed under Section 505(b)(2) may provide an alternate and potentially more expeditious pathway to FDA approval for new or improved formulations or new uses of previously approved products. If the Section 505(b)(2) applicant can establish that reliance on the FDA's previous approval is scientifically appropriate, the applicant may eliminate the need to conduct certain preclinical or clinical studies of the new product. The FDA may also require companies to perform additional studies or measurements to support the change from the approved product. The FDA may then approve the new drug candidate for all or some of the label indications for which the referenced product has been approved, as well as for any new indication sought by the Section 505(b)(2) applicant.

Submission of an NDA to the FDA

Assuming successful completion of required clinical testing and other requirements, the results of the preclinical and clinical studies, together with detailed information relating to the product's chemistry, manufacture, controls and proposed labeling, among other things, are submitted to the FDA as part of an NDA requesting approval to market the drug product for one or more indications. Under federal law, the submission of most NDAs is subject to an application user fee, which for federal fiscal year 2021 is $2,875,842 for an application requiring clinical data. The sponsor of an approved NDA is also subject to an annual program fee, which for fiscal year 2021 is $336,432. Exceptions or waivers for these fees exist for a small company (fewer than 500 employees, including employees and affiliates) satisfying certain requirements and products with orphan drug designation for a particular indication are not subject to a fee provided there are no other intended uses in the NDA.

The FDA conducts a preliminary review of an NDA within 60 calendar days of its receipt and strives to inform the sponsor by the 74th day after the FDA's receipt of the submission to determine whether the application is sufficiently complete to permit substantive review. The FDA may request additional information rather than accept an NDA for filing. In this event, the application must be resubmitted with the additional information. The resubmitted application is also subject to review before the FDA accepts it for filing. Once the submission is accepted for filing, the FDA begins an in-depth substantive review.

The FDA has agreed to specified performance goals in the review process of NDAs. Under the agreement, 90% of applications seeking approval of New Molecular Entities ("NMEs"), are meant to be reviewed within ten months from the date on which the FDA accepts the NDA for filing, and 90% of applications for NMEs that have been designated for "priority review" are meant to be reviewed within six months of the filing date. For applications seeking approval of drugs that are not NMEs, the ten-month and six-month review periods run from the date that the FDA receives the application. The review process may be extended by the FDA for three additional months to consider new information or clarification provided by the applicant to address an outstanding deficiency identified by the FDA following the original submission.

Before approving an NDA, the FDA typically will inspect the facility or facilities where the product is or will be manufactured. These pre-approval inspections cover all facilities associated with an NDA submission, including drug component manufacturing (such as active pharmaceutical ingredients), finished drug product manufacturing, and control testing laboratories. The FDA will not approve an application unless it determines that the manufacturing processes and facilities are in compliance with cGMP requirements and adequate to assure consistent production of the product within required specifications. Additionally, before approving an NDA, the FDA will typically inspect one or more clinical sites to assure compliance with GCP.

In addition, as a condition of approval, the FDA may require an applicant to develop a REMS. REMS use risk minimization strategies beyond the professional labeling to ensure that the benefits of the product outweigh the potential risks. To determine whether a REMS is needed, the FDA will consider the size of the population likely to use the product, seriousness of the disease, expected benefit of the product, expected duration of treatment, seriousness of known or potential adverse events, and whether the product is a new molecular entity. REMS can include medication guides, physician communication plans for healthcare professionals, and elements to assure safe use, or ETASU. ETASU may include, but are not limited to, special training or certification for prescribing or dispensing, dispensing only under certain circumstances, special monitoring, and the use of patient registries. The FDA may require a REMS before approval or post-approval if it becomes aware of a serious risk associated with use of the product. The requirement for a REMS can materially affect the potential market and profitability of a product.

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

Fast Track, Breakthrough Therapy and Priority Review Designations

The FDA is authorized to designate certain products for expedited review if they are intended to address an unmet medical need in the treatment of a serious or life-threatening disease or condition. These programs are fast track designation, breakthrough therapy designation and priority review designation.

Specifically, the FDA may designate a product for fast track review if it is intended, whether alone or in combination with one or more other drugs, for the treatment of a serious or life-threatening disease or condition, and it demonstrates the potential to address unmet medical needs for such a disease or condition. For fast track products, sponsors may have greater interactions with the FDA and the FDA may initiate review of sections of a fast track product's NDA before the application is complete. This rolling review may be available if the FDA determines, after preliminary evaluation of clinical data submitted by the sponsor, that a fast track product may be effective. The sponsor must also provide, and the FDA must approve, a schedule for the submission of the remaining information and the sponsor must pay applicable user fees. However, the FDA's time period goal for reviewing a fast track application does not begin until the last section of the NDA is submitted. In addition, the fast track designation may be withdrawn by the FDA if the FDA believes that the designation is no longer supported by data emerging in the clinical trial process.

In 2012, Congress enacted the Food and Drug Administration Safety and Innovation Act ("FDASIA"). This law established a new regulatory scheme allowing for expedited review of products designated as "breakthrough therapies." A product may be designated as a breakthrough therapy if it is intended, either alone or in combination with one or more other drugs, to treat a serious or life-threatening disease or condition and preliminary clinical evidence indicates that the product may demonstrate substantial improvement over existing therapies on one or

more clinically significant endpoints, such as substantial treatment effects observed early in clinical development. The FDA may take certain actions with respect to breakthrough therapies, including holding meetings with the sponsor throughout the development process; providing timely advice to the product sponsor regarding development and approval; involving more senior staff in the review process; assigning a cross-disciplinary project lead for the review team; and taking other steps to design the clinical trials in an efficient manner.

Third, the FDA may designate a product for priority review if it is a drug that treats a serious condition and, if approved, would provide a significant improvement in safety or effectiveness. The FDA determines, on a case-by-case basis, whether the proposed drug represents a significant improvement when compared with other available therapies. Significant improvement may be illustrated by evidence of increased effectiveness in the treatment of a condition, elimination or substantial reduction of a treatment-limiting drug reaction, documented enhancement of patient compliance that may lead to improvement in serious outcomes, and evidence of safety and effectiveness in a new subpopulation. A priority designation is intended to direct overall attention and resources to the evaluation of such applications, and to shorten the FDA's goal for taking action on a marketing application from ten months to six months.

Accelerated Approval Pathway

The FDA may grant accelerated approval to a drug for a serious or life-threatening condition that provides meaningful therapeutic advantage to patients over existing treatments based upon a determination that the drug has an effect on a surrogate endpoint that is reasonably likely to predict clinical benefit. The FDA may also grant accelerated approval for such a condition when the product has an effect on an intermediate clinical endpoint that can be measured earlier than an effect on irreversible morbidity or mortality ("IMM"), and 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. Drugs granted accelerated approval must meet the same statutory standards for safety and effectiveness as those granted traditional approval.

For the purposes of accelerated approval, a surrogate endpoint is a marker, such as a laboratory measurement, radiographic image, physical sign, or other measure that is thought to predict clinical benefit, but is not itself a measure of clinical benefit. Surrogate endpoints can often be measured more easily or more rapidly than clinical endpoints. An intermediate clinical endpoint is a measurement of a therapeutic effect that is considered reasonably likely to predict the clinical benefit of a drug, such as an effect on IMM. The FDA has limited experience with accelerated approvals based on intermediate clinical endpoints, but has indicated that such endpoints generally may support accelerated approval where the therapeutic effect measured by the endpoint is not itself a clinical benefit and basis for traditional approval, if there is a basis for concluding that the therapeutic effect is reasonably likely to predict the ultimate clinical benefit of a drug.

The accelerated approval pathway is most often used in settings in which the course of a disease is long and an extended period of time is required to measure the intended clinical benefit of a drug, even if the effect on the surrogate or intermediate clinical endpoint occurs rapidly. Thus, accelerated approval has been used extensively in the development and approval of drugs for treatment of a variety of cancers in which the goal of therapy is generally to improve survival or decrease morbidity and the duration of the typical disease course requires lengthy and sometimes large trials to demonstrate a clinical or survival benefit.

The accelerated approval pathway is usually contingent on a sponsor's agreement to conduct, in a diligent manner, additional post-approval confirmatory studies to verify and describe the drug's clinical benefit. As a result, a drug candidate approved on this basis is subject to rigorous post-marketing compliance requirements, including the completion of Phase 4 or post-approval clinical trials to confirm the effect on the clinical endpoint. Failure to conduct required post-approval studies, or confirm a clinical benefit during post-marketing studies, would allow the FDA to withdraw the drug from the market on an expedited basis. All promotional materials for drug candidates approved under accelerated regulations are subject to prior review by the FDA.

The FDA's Decision on an NDA

On the basis of the FDA's evaluation of the NDA and accompanying information, including the results of the inspection of the manufacturing facilities, the FDA may issue an approval letter or a complete response letter. An approval letter authorizes commercial marketing of the product with specific prescribing information for specific

indications. A complete response letter generally outlines the deficiencies in the submission and may require substantial additional testing or information in order for the FDA to reconsider the application. If and when those deficiencies have been addressed to the FDA's satisfaction in a resubmission of the NDA, the FDA will issue an approval letter. The FDA has committed to reviewing such resubmissions in two or six months depending on the type of information included. Even with submission of this additional information, the FDA ultimately may decide that the application does not satisfy the regulatory criteria for approval.

If the FDA approves a product, it may limit the approved indications for use for the product, require that contraindications, warnings or precautions be included in the product labeling, require that post-approval studies, including Phase 4 clinical trials, be conducted to further assess the drug's safety after approval, require testing and surveillance programs to monitor the product after commercialization, or impose other conditions, including distribution restrictions or other risk management mechanisms, including REMS, which can materially affect the potential market and profitability of the product. The FDA may prevent or limit further marketing of a product based on the results of post-market studies or surveillance programs. After approval, many types of changes to the approved product, such as adding new indications, manufacturing changes and additional labeling claims, are subject to further testing requirements and FDA review and approval.

Post-Approval Requirements

Drugs manufactured or distributed pursuant to FDA approvals are subject to pervasive and continuing regulation by the FDA, including, among other things, requirements relating to recordkeeping, periodic reporting, product sampling and distribution, advertising and promotion and reporting of adverse experiences with the product. After approval, most changes to the approved product, such as adding new indications or other labeling claims, are subject to prior FDA review and approval. There also are continuing, annual user fee requirements for any marketed products and the establishments at which such products are manufactured, as well as new application fees for supplemental applications with clinical data.

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

Once an approval is granted, the FDA may withdraw the approval if compliance with regulatory requirements and standards is not maintained or if problems occur after the product reaches the market. Later discovery of previously unknown problems with a product, including adverse events of unanticipated severity or frequency, or with manufacturing processes, or failure to comply with regulatory requirements, may result in revisions to the approved labeling to add new safety information; imposition of post-market studies or clinical trials to assess new safety risks; or imposition of distribution or other restrictions under a REMS program. Other potential consequences include, among other things:

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

The FDA strictly regulates the marketing, labeling, advertising and promotion of prescription drug products placed on the market. This regulation includes, among other things, standards and regulations for direct-to-consumer advertising, communications regarding unapproved uses, industry-sponsored scientific and educational activities, and promotional activities involving the Internet and social media. Promotional claims about a drug's safety or effectiveness are prohibited before the drug is approved. After approval, a drug product generally may not be promoted for uses that are not approved by the FDA, as reflected in the product's prescribing information. In the United States, health care professionals are generally permitted to prescribe drugs for such uses not described in the drug's labeling, known as off-label uses, because the FDA does not regulate the practice of medicine. However, FDA regulations impose rigorous restrictions on manufacturers' communications, prohibiting the promotion of off-label uses. It may be permissible, under very specific, narrow conditions, for a manufacturer to engage in nonpromotional, non-misleading communication regarding off-label information, such as distributing scientific or medical journal information.

If a company is found to have promoted off-label uses, it may become subject to adverse public relations and administrative and judicial enforcement by the FDA, the DOJ, or the Office of the Inspector General of the Department of Health and Human Services, as well as state authorities. This could subject a company to a range of penalties that could have a significant commercial impact, including civil and criminal fines and agreements that materially restrict the manner in which a company promotes or distributes drug products. The federal government has levied large civil and criminal fines against companies for alleged improper promotion, and has also requested that companies enter into consent decrees or permanent injunctions under which specified promotional conduct is changed or curtailed.

In addition, the distribution of prescription pharmaceutical products is subject to the Prescription Drug Marketing Act ("PDMA"), and its implementing regulations, as well as the Drug Supply Chain Security Act ("DSCA"), which regulate the distribution and tracing of prescription drug samples at the federal level, and set minimum standards for the regulation of drug distributors by the states. The PDMA, its implementing regulations and state laws limit the distribution of prescription pharmaceutical product samples and the DSCA imposes requirements to ensure accountability in distribution and to identify and remove counterfeit and other illegitimate products from the market.

Abbreviated New Drug Applications for Generic Drugs

In 1984, with passage of the Hatch-Waxman Amendments to the FDCA, Congress authorized the FDA to approve generic drugs that are the same as drugs previously approved by the FDA under the NDA provisions of the statute. To obtain approval of a generic drug, an applicant must submit an abbreviated new drug application, or ANDA, to the agency. In support of such applications, a generic manufacturer may rely on the preclinical and clinical testing previously conducted for a drug product previously approved under an NDA, known as the reference listed drug ("RLD").

Specifically, in order for an ANDA to be approved, the FDA must find that the generic version is identical to the RLD with respect to the active ingredients, the route of administration, the dosage form, and the strength of the drug. At the same time, the FDA must also determine that the generic drug is "bioequivalent" to the innovator drug. Under the statute, a generic drug is bioequivalent to a RLD if "the rate and extent of absorption of the drug do not show a significant difference from the rate and extent of absorption of the listed drug."

Upon approval of an ANDA, the FDA indicates whether the generic product is "therapeutically equivalent" to the RLD in its publication "Approved Drug Products with Therapeutic Equivalence Evaluations," also referred to as the "Orange Book." Physicians and pharmacists consider a therapeutic equivalent generic drug to be fully substitutable for the RLD. In addition, by operation of certain state laws and numerous health insurance programs, the FDA's designation of therapeutic equivalence often results in substitution of the generic drug without the knowledge or consent of either the prescribing physician or patient.

Under the Hatch-Waxman Amendments, the FDA may not approve an ANDA until any applicable period of non-patent exclusivity for the RLD has expired. The FDCA provides a period of five years of non-patent data exclusivity for a new drug containing a new chemical entity. For the purposes of this provision, a new chemical entity ("NCE"), is a drug that contains no active moiety that has previously been approved by the FDA in any other NDA. An active moiety is the molecule or ion responsible for the physiological or pharmacological action of the drug substance. In cases where such exclusivity has been granted, an ANDA may not be filed with the FDA until the

expiration of five years unless the submission is accompanied by a Paragraph IV certification, in which case the applicant may submit its application four years following the original product approval. The FDCA also provides for a period of three years of exclusivity if the NDA includes reports of one or more new clinical investigations, other than bioavailability or bioequivalence studies, that were conducted by or for the applicant and are essential to the approval of the application. This three-year exclusivity period often protects changes to a previously approved drug product, such as a new dosage form, route of administration, combination or indication.

The FDA must establish a priority review track for certain generic drugs, requiring the FDA to review a drug application within eight (8) months for a drug that has three (3) or fewer approved drugs listed in the Orange Book and is no longer protected by any patent or regulatory exclusivities, or is on the FDA's drug shortage list. The new legislation also authorizes FDA to expedite review of ''competitor generic therapies'' or drugs with inadequate generic competition, including holding meetings with or providing advice to the drug sponsor prior to submission of the application.

Hatch-Waxman Patent Certification and the 30-Month Stay

Upon approval of an NDA or a supplement thereto, NDA sponsors are required to list with the FDA each patent with claims that cover the applicant's product or an approved method of using the product. Each of the patents listed by the NDA sponsor is published in the Orange Book. When an Abbreviated New Drug Application ("ANDA"), or 505(b)(2) applicant files its application with the FDA, the applicant is required to certify to the FDA concerning any patents listed for the reference product in the Orange Book, except for patents covering methods of use for which the ANDA applicant is not seeking approval.

Specifically, the applicant must certify with respect to each patent that:

- the required patent information has not been filed;
- the listed patent has expired;
- the listed patent has not expired, but will expire on a particular date and approval is sought after patent expiration; or
- the listed patent is invalid, unenforceable or will not be infringed by the new product.

A certification that the new product will not infringe the already approved product's listed patents or that such patents are invalid or unenforceable is called a Paragraph IV certification. If the applicant does not challenge the listed patents or indicates that it is not seeking approval of a patented method of use, the application will not be approved until all the listed patents claiming the referenced product have expired (other than method of use patents involving indications for which the ANDA applicant is not seeking approval).

If the ANDA or 505(b)(2) applicant has provided a Paragraph IV certification to the FDA, the applicant must also send notice of the Paragraph IV certification to the NDA and patent holders once the ANDA or 505(b)(2) application has been accepted for filing by the FDA. The NDA and patent holders may then initiate a patent infringement lawsuit in response to the notice of the Paragraph IV certification. The filing of a patent infringement lawsuit within 45 days after the receipt of a Paragraph IV certification automatically prevents the FDA from approving the ANDA or 505(b)(2) application until the earlier of 30 months after the receipt of the Paragraph IV notice, expiration of the patent, or a decision in the infringement case that is favorable to the ANDA applicant.

Pediatric Studies and Exclusivity

Under the Pediatric Research Equity Act of 2003, an NDA or supplement thereto must contain data that are adequate to assess the safety and effectiveness of the drug product for the claimed indications in all relevant pediatric subpopulations, and to support dosing and administration for each pediatric subpopulation for which the product is safe and effective. With enactment of the FDASIA in 2012, sponsors must also submit pediatric study plans prior to the assessment data. Those plans must contain an outline of the proposed pediatric study or studies the applicant plans to conduct, including study objectives and design, any deferral or waiver requests, and other information required by regulation. The applicant, the FDA, and the FDA's internal review committee must then

review the information submitted, consult with each other, and agree upon a final plan. The FDA or the applicant may request an amendment to the plan at any time.

For drugs intended to treat a serious or life-threatening disease or condition, the FDA must, upon the request of an applicant, meet to discuss preparation of the initial pediatric study plan or to discuss deferral or waiver of pediatric assessments. In addition, FDA will meet early in the development process to discuss pediatric study plans with sponsors and FDA must meet with sponsors by no later than the end-of-phase 1 meeting for serious or life-threatening diseases and by no later than ninety (90) days after FDA's receipt of the study plan.

The FDA may, on its own initiative or at the request of the applicant, grant deferrals for submission of some or all pediatric data until after approval of the product for use in adults, or full or partial waivers from the pediatric data requirements. Additional requirements and procedures relating to deferral requests and requests for extension of deferrals are contained in the FDASIA. Unless otherwise required by regulation, the pediatric data requirements do not apply to products with orphan designation.

Pediatric exclusivity is another type of non-patent marketing exclusivity in the United States and, if granted, provides for the attachment of an additional six months of marketing protection to the term of any existing regulatory exclusivity, including the non-patent and orphan exclusivity. This six-month exclusivity may be granted if an NDA sponsor submits pediatric data that fairly respond to a written request from the FDA for such data. The data do not need to show the product to be effective in the pediatric population studied; rather, if the clinical trial is deemed to fairly respond to the FDA's request, the additional protection is granted. If reports of requested pediatric studies are submitted to and accepted by the FDA within the statutory time limits, whatever statutory or regulatory periods of exclusivity or patent protection cover the product are extended by six months. This is not a patent term extension, but it effectively extends the regulatory period during which the FDA cannot approve another application.

Orphan Drug Designation and Exclusivity

Under the Orphan Drug Act, the FDA may designate a drug product as an "orphan drug" if it is intended to treat a rare disease or condition (generally meaning that it affects fewer than 200,000 individuals in the United States, or more in cases in which there is no reasonable expectation that the cost of developing and making a drug product available in the United States for treatment of the disease or condition will be recovered from sales of the product). A company must request orphan product designation before submitting an NDA. If the request is granted, the FDA will disclose the identity of the therapeutic agent and its potential use. Orphan product designation does not convey any advantage in or shorten the duration of the regulatory review and approval process, although it does convey certain advantages such as tax benefits and exemption from PDUFA fees.

If a product with orphan status receives the first FDA approval for the disease or condition for which it has such designation or for a select indication or use within the rare disease or condition for which it was designated, the product generally will receive orphan product exclusivity. Orphan product exclusivity means that the FDA may not approve any other applications for the same product for the same indication for seven years, except in certain limited circumstances. Competitors may receive approval of different products for the indication for which the orphan product has exclusivity and may obtain approval for the same product but for a different indication. If a drug or drug product designated as an orphan product ultimately receives marketing approval for an indication broader than what was designated in its orphan product application, it may not be entitled to exclusivity.

Orphan drug exclusivity will not bar approval of another product under certain circumstances, including if a subsequent product with the same drug for the same condition is shown to be clinically superior to the approved product on the basis of greater efficacy or safety, or providing a major contribution to patient care, or if the company with orphan drug exclusivity is not able to meet market demand. This is the case despite an earlier court opinion holding that the Orphan Drug Act unambiguously required the FDA to recognize orphan exclusivity regardless of a showing of clinical superiority.

Patent Term Restoration and Extension

A patent claiming a new drug product may be eligible for a limited patent term extension under the Drug Price Competition and Patent Term Restoration Act of 1984, which permits a patent restoration of up to five years for patent term lost during product development and the FDA regulatory review. The restoration period granted is typically one-half 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 ultimate approval date. Patent term restoration cannot be used to extend the remaining term of a patent past a total of 14 years from the product's approval date. Only one patent applicable to an approved drug product is eligible for the extension, and the application for the extension must be submitted prior to the expiration of the patent in question. A patent that covers multiple drugs for which approval is sought can only be extended in connection with one of the approvals. The USPTO reviews and approves the application for any patent term extension or restoration in consultation with the FDA.

The 21st Century Cures Act

On December 13, 2016, President Obama signed the 21st Century Cures Act (the "Cures Act") into law. The Cures Act is designed to modernize and personalize healthcare, spur innovation and research, and streamline the discovery and development of new therapies through increased federal funding of particular programs. It authorizes increasing funding for FDA to spend on innovation projects. The new law also amends the Public Health Service Act to reauthorize and expand funding for the National Institutes of Health. The Act establishes the NIH Innovation Fund to pay for the cost of development and implementation of a strategic plan, early stage investigators and research. It also charges NIH with leading and coordinating expanded pediatric research. Further, the Cures Act directs the Centers for Disease Control and Prevention to expand surveillance of neurological diseases.

With amendments to the FDCA and the Public Health Service Act, Title III of the Cures Act seeks to accelerate the discovery, development, and delivery of new medicines and medical technologies. To that end, and among other provisions, the Cures Act reauthorizes the priority review voucher program for certain drugs intended to treat rare pediatric diseases; creates a new priority review voucher program for drug applications determined to be material threat medical countermeasure applications; revises the FDCA to streamline review of combination product applications; requires FDA to evaluate the potential use of "real world evidence" to help support approval of new indications for approved drugs; provides a new "limited population" approval pathway for antibiotic and antifungal drugs intended to treat serious or life-threatening infections; and authorizes FDA to designate a drug as a "regenerative advanced therapy," thereby making it eligible for certain expedited review and approval designations.

Review and Approval of Drug Products in the European Union

In order to market any product outside of the United States, a company must also comply with numerous and varying regulatory requirements of other countries and jurisdictions regarding quality, safety and efficacy and governing, among other things, clinical trials, marketing authorization, commercial sales and distribution of drug products. Whether or not it obtains FDA approval for a product, the company would need to obtain the necessary approvals by the comparable foreign regulatory authorities before it can commence clinical trials or marketing of the product in those countries or jurisdictions. The approval process ultimately varies between countries and jurisdictions and can involve additional product testing and additional administrative review periods. The time required to obtain approval in other countries and jurisdictions might differ from and be longer than that required to obtain FDA approval. Regulatory approval in one country or jurisdiction does not ensure regulatory approval in another, but a failure or delay in obtaining regulatory approval in one country or jurisdiction may negatively impact the regulatory process in others.

Clinical Trial Approval in the EU

Pursuant to the European Clinical Trials Directive, a system for the approval of clinical trials in the European Union has been implemented through national legislation of the member states. Under this system, an applicant must obtain approval from the competent national authority of a European Union member state in which the clinical trial is to be conducted. Furthermore, the applicant may only start a clinical trial after a competent ethics committee has issued a favorable opinion. Clinical trial application must be accompanied by an investigational medicinal product dossier with supporting information prescribed by the European Clinical Trials Directive and corresponding national laws of the member states and further detailed in applicable guidance documents. In April 2014, the EU adopted a new Clinical Trials Regulation, which will be directly applicable to and binding without the need for any national implementing legislation. Under the new coordinated procedure for the approval of clinical trials, the sponsor of a clinical trial will be required to submit a single application for approval of a clinical trial to a reporting EU Member State (RMS) through an EU Portal. The submission procedure will be the same irrespective of whether the clinical trial is to be conducted in a single EU Member State or in more than one EU Member State.

The Clinical Trials Regulation also aims to streamline and simplify the rules on safety reporting for clinical trials. The Regulation was published on June 16, 2014 but is not expected to apply until 2020.

Orphan Drug Designation and Exclusivity

Regulation 141/2000 provides that a drug shall be designated as an orphan drug if its sponsor can establish: that the product is intended for the diagnosis, prevention or treatment of a life-threatening or chronically debilitating condition affecting not more than five in ten thousand persons in the European Community when the application is made, or that the product is intended for the diagnosis, prevention or treatment of a life-threatening, seriously debilitating or serious and chronic condition in the European Community and that without incentives it is unlikely that the marketing of the drug in the European Community would generate sufficient return to justify the necessary investment. For either of these conditions, the applicant must demonstrate that there exists no satisfactory method of diagnosis, prevention or treatment of the condition in question that has been authorized in the European Community or, if such method exists, the drug will be of significant benefit to those affected by that condition.

Regulation 847/2000 sets out criteria and procedures governing designation of orphan drugs in the EU. Specifically, an application for designation as an orphan product can be made any time prior to the filing of an application for approval to market the product. Marketing authorization for an orphan drug leads to a ten-year period of market exclusivity. This period may, however, be reduced to six years if, at the end of the fifth year, it is established that the product no longer meets the criteria for orphan drug designation, for example because the product is sufficiently profitable not to justify market exclusivity. Market exclusivity can be revoked only in very selected cases, such as consent from the marketing authorization holder, inability to supply sufficient quantities of the product, demonstration of “clinically relevant superiority” by a similar medicinal product, or, after a review by the Committee for Orphan Medicinal Products, requested by a member state in the fifth year of the marketing exclusivity period (if the designation criteria are believed to no longer apply). Medicinal products designated as orphan drugs pursuant to Regulation 141/2000 shall be eligible for incentives made available by the European Community and by the member states to support research into, and the development and availability of, orphan drugs.

Pharmaceutical Coverage, Pricing and Reimbursement

Significant uncertainty exists as to the coverage and reimbursement status of products approved by the FDA and other government authorities. Sales of products will depend, in part, on the extent to which the costs of the products will be covered by third-party payors, including government health programs in the United States such as Medicare and Medicaid, commercial health insurers and managed care organizations. The process for determining whether a payor will provide coverage for a product may be separate from the process for setting the price or reimbursement rate that the payor will pay for the product once coverage is approved. Third-party payors are increasingly challenging the prices charged, examining the medical necessity, and reviewing the cost-effectiveness of medical products and services and imposing controls to manage costs. Third-party payors may also limit coverage to specific products on an approved list, or formulary, which might not include all of the approved products for a particular indication.

In order to secure coverage and reimbursement for any product that might be approved for sale, a company may need to conduct expensive pharmacoeconomic studies in order to demonstrate the medical necessity and cost-effectiveness of the product, in addition to the costs required to obtain FDA or other comparable regulatory approvals. A payor’s decision to provide coverage for a drug product does not imply that an adequate reimbursement rate will be approved. Third-party reimbursement may not be sufficient to maintain price levels high enough to realize an appropriate return on investment in product development.

The containment of healthcare costs also has become a priority of federal, state and foreign governments and the prices of drugs have been a focus in this effort. 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 a company’s revenue generated from the sale of any approved products. Coverage policies and third-party reimbursement rates may change at any time. Even if favorable coverage and reimbursement status is attained for one or more products for which a company or its collaborators receive marketing approval, less favorable coverage

policies and reimbursement rates may be implemented in the future. In the European Union, pricing and reimbursement schemes vary widely from country to country. Some countries provide that drug products may be marketed only after a reimbursement price has been agreed. Some countries may require the completion of additional studies that compare the cost-effectiveness of a particular drug candidate to currently available therapies, or so-called health technology assessments, in order to obtain reimbursement or pricing approval. For example, the European Union provides options for its member states to restrict the range of drug products for which their national health insurance systems provide reimbursement and to control the prices of medicinal products for human use. European Union member states may approve a specific price for a drug product or may instead adopt a system of direct or indirect controls on the profitability of the company placing the drug product on the market. Other member states allow companies to fix their own prices for drug products, but monitor and control company profits. The downward pressure on health care costs in general, particularly prescription drugs, has become intense. As a result, increasingly high barriers are being erected to the entry of new products. In addition, in some countries, cross-border imports from low-priced markets exert competitive pressure that may reduce pricing within a country. Any country that has price controls or reimbursement limitations for drug products may not allow favorable reimbursement and pricing arrangements.

Healthcare Law and Regulation

Healthcare providers, physicians and third-party payors play a primary role in the recommendation and prescription of drug products that are granted marketing approval. Arrangements with providers, consultants, third-party payors and customers are subject to broadly applicable fraud and abuse and other healthcare laws and regulations. Such restrictions under applicable federal and state healthcare laws and regulations, include the following:

- the federal Anti-Kickback Statute prohibits, among other things, persons from knowingly and willfully soliciting, offering, receiving or providing remuneration, directly or indirectly, in cash or in kind, to induce or reward either the referral of an individual for, or the purchase, order or recommendation of, any good or service, for which payment may be made, in whole or in part, under a federal healthcare program such as Medicare and Medicaid;

- the federal False Claims Act imposes civil penalties, and provides for civil whistleblower or qui tam actions, against individuals or entities for knowingly presenting, or causing to be presented, to the federal government, claims for payment that are false or fraudulent or making a false statement to avoid, decrease or conceal an obligation to pay money to the federal government, with potential liability including mandatory treble damages and significant per-claim penalties, currently set at $5,500 to $11,000 per false claim;

- the federal Health Insurance Portability and Accountability Act of 1996 (“HIPAA”), imposes criminal and civil liability for executing a scheme to defraud any healthcare benefit program or making false statements relating to healthcare matters;

- HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act and their respective implementing regulations, including the Final Omnibus Rule published in January 2013, also imposes obligations, including mandatory contractual terms, with respect to safeguarding the privacy, security and transmission of individually identifiable health information;

- the federal false statements statute prohibits knowingly and willfully falsifying, concealing or covering up a material fact or making any materially false statement in connection with the delivery of or payment for healthcare benefits, items or services;

- the federal transparency requirements under the Health Care Reform Law, known as the federal Physician Payments Sunshine Act, require manufacturers of drugs, devices, biologics and medical supplies to report to the Centers for Medicare & Medicaid Services (“CMS”) within the Department of Health and Human Services information related to payments and other transfers of value to physicians and teaching hospitals and physician ownership and investment interests held by physicians and their immediate family members; and

- analogous state and foreign laws and regulations, such as state anti-kickback and false claims laws, may apply to sales or marketing arrangements and claims involving healthcare items or services reimbursed by non-governmental third-party payors, including private insurers.

Some state laws require pharmaceutical companies to comply with the pharmaceutical industry's voluntary compliance guidelines and the relevant compliance guidance promulgated by the federal government in addition to requiring drug manufacturers to report information related to payments to physicians and other health care providers or marketing expenditures. State and foreign laws also govern the privacy and security of health information in some circumstances, many of which differ from each other in significant ways and often are not preempted by HIPAA, thus complicating compliance efforts.

Healthcare Reform in the United States

A primary trend in the United States healthcare industry and elsewhere is cost containment. There have been a number of federal and state proposals during the last several years regarding the pricing of pharmaceutical and biopharmaceutical products, limiting coverage and reimbursement for drugs and other medical products, government control and other changes to the healthcare system in the United States.

By way of example, the United States and state governments continue to propose and pass legislation designed to reduce the cost of healthcare. In March 2010, the United States Congress enacted the Patient Protection and Affordable Care Act (the "PPACA") which, among other things, includes changes to the coverage and payment for products under government health care programs. Among the provisions of the PPACA of importance to potential drug candidates are:

- an annual, nondeductible fee on any entity that manufactures or imports specified branded prescription drugs and biologic agents, apportioned among these entities according to their market share in certain government healthcare programs, although this fee would not apply to sales of certain products approved exclusively for orphan indications;

- expansion of eligibility criteria for Medicaid programs by, among other things, allowing states to offer Medicaid coverage to certain individuals with income at or below 133% of the federal poverty level, thereby potentially increasing a manufacturer's Medicaid rebate liability;

- expanded manufacturers' rebate liability under the Medicaid Drug Rebate Program by increasing the minimum rebate for both branded and generic drugs and revising the definition of "average manufacturer price" ("AMP") for calculating and reporting Medicaid drug rebates on outpatient prescription drug prices and extending rebate liability to prescriptions for individuals enrolled in Medicare Advantage plans;

- addressed a new methodology by which rebates owed by manufacturers under the Medicaid Drug Rebate Program are calculated for drugs that are inhaled, infused, instilled, implanted or injected;

- expanded the types of entities eligible for the 340B drug discount program;

- established the Medicare Part D coverage gap discount program by requiring manufacturers to provide a point-of-sale-discount off the negotiated price of applicable brand drugs to eligible beneficiaries during their coverage gap period as a condition for the manufacturers' outpatient drugs to be covered under Medicare Part D;

- established a new Patient-Centered Outcomes Research Institute to oversee, identify priorities in, and conduct comparative clinical effectiveness research, along with funding for such research;

- established the Independent Payment Advisory Board ("IPAB") which has authority to recommend certain changes to the Medicare program to reduce expenditures by the program that could result in reduced payments for prescription drugs. However, the IPAB implementation has been not been clearly defined. The PPACA provided that under certain circumstances, IPAB recommendations will become law unless Congress enacts legislation that will achieve the same or greater Medicare cost savings; and

- established the Center for Medicare and Medicaid Innovation within CMS to test innovative payment and service delivery models to lower Medicare and Medicaid spending, potentially including prescription drug spending. Funding has been allocated to support the mission of the Center for Medicare and Medicaid Innovation from 2011 to 2019. Other legislative changes have been proposed and adopted since the PPACA was enacted. These changes include the Budget Control Act of 2011, which, among other things, led to aggregate reductions to Medicare payments to providers of up to 2% per fiscal year that started in 2013 and will stay in effect through 2024 unless additional Congressional action is taken, and the American Taxpayer Relief Act of 2012, which, among other things, reduced Medicare payments to several types of providers and increased the statute of limitations period for the government to recover overpayments to providers from three to five years. These new laws may result in additional reductions in Medicare and other healthcare funding and otherwise affect the prices we may obtain for any of our product candidates for which we may obtain regulatory approval or the frequency with which any such product candidate is prescribed or used. Further, there have been several recent U.S. congressional inquiries and proposed state and federal legislation designed to, among other things, bring more transparency to drug pricing, review the relationship between pricing and manufacturer patient programs, reduce the costs of drugs under Medicare and reform government program reimbursement methodologies for drug products.

These healthcare reforms, as well as other healthcare reform measures that may be adopted in the future, may result in additional reductions in Medicare and other healthcare funding, more rigorous coverage criteria, new payment methodologies and additional downward pressure on the price for any approved product and/or the level of reimbursement physicians receive for administering any approved product. Reductions in reimbursement levels may negatively impact the prices or the frequency with which products are prescribed or administered. Any reduction in reimbursement from Medicare or other government programs may result in a similar reduction in payments from private payors. Since enactment of the PPACA, there have been numerous legal challenges and Congressional actions to repeal and replace provisions of the law.

Further, there have been several recent U.S. congressional inquiries and proposed federal and proposed and enacted state legislation designed to, among other things, bring more transparency to drug pricing, review the relationship between pricing and manufacturer patient programs, reduce the costs of drugs under Medicare and reform government program reimbursement methodologies for drug products. At the federal level, Congress and the Trump administration have each indicated that it will continue to seek new legislative and/or administrative measures to control drug costs. At the state level, individual states are increasingly aggressive in passing legislation and implementing regulations designed to control pharmaceutical and biological product pricing, including price or patient reimbursement constraints, discounts, restrictions on certain product access and marketing cost disclosure and transparency measures, and, in some cases, designed to encourage importation from other countries and bulk purchasing. In addition, regional health care authorities and individual hospitals are increasingly using bidding procedures to determine what pharmaceutical products and which suppliers will be included in their prescription drug and other health care programs. These measures could reduce the ultimate demand for our products, once approved, or put pressure on our product pricing.

Human Capital Resources

Our vision is to translate scientific breakthroughs into important new medicine. We have a culture where patients are at the center of all we do, with core values that connect us to each other and our stakeholders and define who we are, what we stand for, and how we work.

We are focused on effective attraction, development, and retention of, and compensation and benefits to, human resource talent, including workforce and management development, diversity and inclusion initiatives, succession planning, and corporate culture and leadership quality, which are vital to our success. At December 31, 2020, our total workforce consisted of 32 employees. We consider our relations with our employees to be good.

During 2020, as we worked to manage through the effects of the human capital aspects of the pandemic, all employees were provided the option of working remotely or at our Exton office with appropriate safeguards.

Information About Our Executive Officers

See Part III, Item 10 “Directors, Executive Officers and Corporate Governance” for information relating to our executive officers.

Corporate Information

We were incorporated in Delaware in 1989 and our office headquarters is located at 505 Eagleview Boulevard, Suite 212, Exton, Pennsylvania 19341.

Information Available on the Internet

Our internet address is www.iderapharma.com. The contents of our website are not part of this Annual Report on Form 10-K and our internet address is included in this document as an inactive textual reference. We make available free of charge through our web site our Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K and amendments to these reports filed or furnished pursuant to Section 13(a) or 15(d) of the Exchange Act as soon as reasonably practicable after we electronically file or furnish such materials to the SEC. The SEC maintains an internet site at www.sec.gov containing reports, proxies and information statements and other information regarding issuers that file electronically with the SEC.

Item 1A. Risk Factors.

RISK FACTORS

Investing in our securities involves a high degree of risk. You should carefully consider the risks and uncertainties described below in addition to the other information included or incorporated by reference in this Annual Report on Form 10-K before purchasing our common stock. Our business, financial condition and results of operations could be materially and adversely affected by any of these and currently unknown risks or uncertainties. In that case, the market price of our common stock could decline, and you may lose all or part of your investment in our securities.

Risks Relating to Our Financial Position and Need for Additional Capital

We will need additional financing, which may be difficult to obtain on terms attractive to us or at all.

We expect that we will need to raise additional funds in order to complete the development of, seek regulatory approvals for and commercialization of tilsotolimod and to continue to fund our operations. We are seeking and expect to continue to seek additional funding through financings of equity or debt securities, collaborations, or the sale or license of assets. We believe the key factors that will affect our ability to obtain funding are: (i) the results of our clinical development activities in our tilsotolimod program or any other drug candidates we develop on the timelines anticipated; (ii) the time and expense required to submit an NDA for tilsotolimod; (iii) the cost, timing, and outcome of regulatory reviews; (iv) the receptivity of the capital markets to financings by biotechnology companies generally and companies with drug candidates and technologies similar to ours specifically; (v) receptivity of the capital markets to any in-licensing, product acquisition or other transaction we may enter into; and (vi) ability to enter into additional collaborations and the success of such collaborations.

Financing may not be available to us when we need it, or on favorable or acceptable terms, or at all. We could be required to seek funds through collaborative alliances or through other means that may require us to relinquish rights to some of our technologies, drug candidates or drugs that we would otherwise pursue on our own. In addition, if we raise additional funds by issuing equity securities, our existing stockholders may experience dilution, or an equity financing that involves existing stockholders may cause a concentration of ownership. Debt financing, if available, may involve agreements that include covenants limiting or restricting our ability to take specific actions, such as incurring additional debt, making capital expenditures or declaring dividends, and are likely to include rights that are senior to the holders of our common stock. Any additional debt or equity financing may contain terms which are not favorable to us or to our stockholders, such as liquidation and other preferences, or liens or other restrictions on our assets. As discussed in Note 14 to the financial statements appearing elsewhere in this Annual Report on Form 10-K, additional equity financings may also result in cumulative changes in ownership over a three-year period in excess of 50% which would limit the amount of net operating loss and tax credit carryforwards that we may utilize in any one year. If we are unable to obtain adequate funding on a timely basis or at all, we will be required to terminate, modify or delay clinical trials of tilsotolimod, delay the NDA submission of tilsotolimod, or relinquish rights to portions of our technology, drug candidates and/or products.

We expect that we will continue to incur substantial and increasing net losses in the foreseeable future.

From January 1, 2001 to December 31, 2020, we incurred losses of $573.4 million. These losses, among other things, have had and will continue to have an adverse effect on our stockholders' equity, total assets and working capital. Additionally, we have never had any products of our own available for commercial sale and have received no revenues from the sale of drugs. Substantially all of our revenues have been from collaborative and license agreements. We have devoted substantially all of our efforts to research and development, including clinical trials, and have not completed development of any drug candidates. Due to the numerous risks and uncertainties associated with developing drugs, we are unable to predict the extent of any future losses, whether or when any of our drug candidates will become commercially available, or when we will become profitable, if at all. We expect to incur substantial operating losses in future periods.

Even if we succeed in receiving marketing approval for and commercializing tilsotolimod or any other product candidate, we will continue to incur substantial research and development and other expenditures to develop and market additional potential indications or products. The size of our future net losses will depend, in part, on the rate of future growth of our expenses and our ability to generate revenue. Our prior losses and expected future losses have had and will continue to have an adverse effect on our stockholders’ equity and working capital.

Risks Relating to Our Business, Strategy, and Industry

We are depending heavily on the development, regulatory approval and commercialization of our lead TLR-targeted drug candidate, tilsotolimod. If we are unable to successfully develop and commercialize tilsotolimod or any other drug candidate, or experience significant delays in doing so, our business may be materially harmed.

We have made and intend to continue to make a significant investment of our time and financial resources in the development and commercialization of tilsotolimod. Our ability to generate product revenues will depend heavily on our ability to successfully develop, obtain regulatory approval for and commercialize tilsotolimod. If we fail to obtain regulatory approval and successfully commercialize tilsotolimod, our business would be materially and adversely impacted. Even if tilsotolimod receives regulatory approval, we will incur significant expenses to support its commercialization and launch, which investment may never be realized if sales are insufficient.

We are developing tilsotolimod in combination with other immuno-modulatory compounds and chemotherapeutic agents and our efforts may not be successful or result in any approved and marketable products.

Tilsotolimod is being developed for administration via intratumoral injection in combination with systemically administered checkpoint inhibitors for the treatment of various solid tumors, including (i) anti-PD1 refractory metastatic melanoma in combination with ipilimumab, (ii) microsatellite stable colorectal cancer in combination with nivolumab and ipilimumab, and (iii) squamous cell carcinoma of the head and neck in combination with other oncology products. While we have evaluated the safety profile of tilsotolimod as a single agent via intratumoral injection in previous trials, and as marketed products the safety profiles of ipilimumab and nivolumab are each known, the safety profile of the combination of tilsotolimod with ipilimumab and/or nivolumab is still being evaluated. Further, under the AbbVie Agreement, AbbVie is conducting a clinical study to evaluate the efficacy and safety of tilsotolimod with other products. These factors may result in participating subjects experiencing serious adverse events or undesirable side effects or exposure to unacceptable health risks requiring us or AbbVie to suspend or terminate any clinical trials which are being conducted with tilsotolimod and other therapeutic agents.

If we experience delays or difficulties in the enrollment of patients in clinical trials, our receipt of necessary regulatory approvals could be delayed or prevented.

We may not be able to initiate or continue clinical trials for our drug candidates if we are unable to locate and enroll a sufficient number of eligible patients to participate in these trials as required by the FDA or similar regulatory authorities outside the U.S.

In addition, some of our competitors have ongoing clinical trials for drug candidates that treat the same indications as our drug candidates, and patients who would otherwise be eligible for our clinical trials may instead enroll in clinical trials of our competitors' drug candidates. Our inability to enroll a sufficient number of patients for our clinical trials could also require us to abandon one or more clinical trials altogether. Enrollment delays may result in increased development costs for our drug candidates, which would cause the value of our company to decline and limit our ability to obtain additional financing.

If our clinical trials are unsuccessful, delayed or terminated, we may not be able to develop and commercialize our drug candidates.

Clinical trials are lengthy, complex, and expensive processes with uncertain results. We may not be able to complete any clinical trial of an investigational product within any specified time period. Moreover, clinical trials may not show our investigational products to have an acceptable safety and efficacy profile. The FDA or other equivalent foreign regulatory agencies may not allow us to complete these trials or commence and complete any other clinical trials.

Numerous unforeseen events may occur during, or as a result of, preclinical testing, nonclinical testing or the clinical trial process that could delay or inhibit the ability to receive regulatory approval or to commercialize drug products. For example, setbacks in clinical trials may result in enhanced scrutiny by regulators or institutional review boards (“IRBs”) of clinical trials of our drug candidates, including our TLR-targeted drug candidates, which could result in regulators or IRBs prohibiting the commencement of clinical trials, requiring additional nonclinical studies as a precondition to commencing clinical trials or imposing restrictions on the design or scope of clinical trials that could slow enrollment of trials, increase the costs of trials or limit the significance of the results of trials. Such setbacks could also adversely impact the desire of investigators to enroll patients in, and the desire of patients to enroll in, clinical trials of our drug candidates.

Other events that could delay or inhibit conduct of our clinical trials include: (i) nonclinical or clinical data may not be readily interpreted, which may lead to delays and/or misinterpretation; (ii) our nonclinical tests, including toxicology studies, or clinical trials may produce negative or inconclusive results; (iii) we might have to suspend or terminate our clinical trials if the participating subjects experience serious adverse events or undesirable side effects or are exposed to unacceptable health risks; (iv) regulators or IRBs may hold, suspend or terminate clinical research for various reasons, including noncompliance with regulatory requirements, issues identified through inspections of manufacturing or clinical trial operations or clinical trial sites; (v) we, along with our collaborators and subcontractors, may not employ, in any capacity, persons who have been debarred under the FDA's Application Integrity Policy, or similar policy under foreign regulatory authorities; (vi) we or our contract manufacturers may be unable to manufacture sufficient quantities of our drug candidates for use in clinical trials; (vii) the cost of our clinical trials may be greater than we currently anticipate making continuation and/or completion improbable; and (viii) our drug candidates may not cause the desired effects or may cause undesirable side effects or our drug candidates may have other unexpected characteristics.

In conducting clinical trials, we cannot be certain that any planned clinical trial will begin on time, if at all. Delays in commencing clinical trials of potential products could increase our drug candidate development costs, delay any potential revenues, reduce the potential length of patent exclusivity and reduce the probability that a potential product will receive regulatory approval. Significant clinical trial delays also could allow our competitors to bring products to market before we do and impair our ability to commercialize our drug candidates.

Interim, "top-line," and preliminary data from our clinical trials that we announce or publish from time to time may materially differ, including as a result of audit and verification procedures, from final data.

From time to time, we may publicly disclose preliminary or top-line data from our preclinical studies and clinical trials, based on a preliminary analysis of then-available data, and the results and related findings and conclusions are subject to change following a more comprehensive review of the data related to the particular study or trial. We also make assumptions, estimations, calculations and conclusions as part of our analyses of data, and we may not have received or had the opportunity to fully and carefully evaluate all data. Top-line or preliminary results that we report may differ from future results of the same studies, or different conclusions or considerations may qualify such results, once additional data have been received and fully evaluated. Top-line data also remain subject to audit and verification procedures that may result in the final data being materially different from the preliminary data we previously published. As a result, top-line data should be viewed with caution until the final data are available.

From time to time, we may also disclose interim data from our preclinical studies and clinical trials. Interim data from clinical trials that we may complete are subject to the risk that one or more of the clinical outcomes may materially change as patient enrollment continues and more patient data become available or as patients from our clinical trials continue other treatments for their disease. Differences between preliminary or interim data and final data could significantly harm our business prospects. Further, disclosure of interim data by us or by our competitors could result in volatility in the price of our common stock. In addition, others, including regulatory agencies, may not accept or agree with our assumptions, estimates, calculations, conclusions or analyses or may interpret or weigh the importance of data differently, which could impact the value of the particular program, the approvability or commercialization of the particular product candidate or product and our company in general. In addition, the information we choose to publicly disclose regarding a particular study or clinical trial is based on what is typically extensive information, and you or others may not agree with what we determine is material or otherwise appropriate information to include in our disclosure.

The technologies on which we rely are unproven and may not result in any approved and marketable products.

Our technologies or therapeutic approaches are relatively new and unproven. We have focused our efforts on the research and development of RNA- and DNA-based compounds, or oligonucleotides, targeted to TLRs. The results of preclinical studies with TLR-targeted compounds may not be indicative of results that may be obtained in clinical trials, and results we have obtained in the clinical trials we have conducted to date may not be predictive of results in subsequent clinical trials. Further, the chemical and pharmacological properties of TLR-targeted compounds may not be fully recognized in preclinical studies and small-scale clinical trials, and such compounds may interact with human biological systems in unforeseen, ineffective or harmful ways that we have not yet identified. As a result of these factors, we may never succeed in obtaining regulatory approval to market any product.

We face substantial competition, which may result in others discovering, developing or commercializing drugs before or more successfully than us.

There are many other companies, public and private, actively engaged in discovery, development, and commercializing products and technologies that may compete with our drug candidate and program, including TLR-targeted compounds as well as non-TLR-targeted therapeutics. Some potentially competitive products have been in development or commercialized for years. Many of the marketed products have been accepted by the medical community, patients, and third-party payors. Our ability to compete may be affected by the previous adoption of such products by the medical community, patients, and third-party payors.

We recognize that other companies, including large pharmaceutical companies, may be developing or have plans to develop products and technologies that may compete with ours. Many of our competitors have substantially greater financial, technical, and human resources than we have and/or may have significantly greater experience than we have in undertaking preclinical studies and human clinical trials of new pharmaceutical products, obtaining FDA and other regulatory approvals of products for use in health care and manufacturing, and marketing and selling approved products. We anticipate that the competition with our drug candidates and technologies will be based on a number of factors including product efficacy, safety, availability, and price. The timing of market introduction of our drug candidates and competitive products will also affect competition among products. We expect the relative speed with which we can develop products, complete the clinical trials and approval processes, and supply commercial quantities of the products to the market to be important competitive factors.

Our business could be adversely affected by the effects of health epidemics, such as the recent COVID-19 global pandemic, including disruptions to our clinical trials or the delay of regulatory approvals.

Our business may be adversely affected by the effects of health epidemics, including the ongoing worldwide COVID-19 pandemic. In December 2019, COVID-19 emerged and in March 2020, the World Health Organization declared the coronavirus outbreak a pandemic. The spread of this pandemic has caused significant volatility and uncertainty globally. This has resulted in an economic downturn and may disrupt our business and delay our clinical trials and regulatory approvals. Quarantines and similar government orders have been enacted in each of the geographies in which we are conducting our clinical trials. The patient populations that are eligible for our clinical trials are immune-compromised and are at higher risk for becoming infected with COVID-19. As COVID-19 affects the parts of the world where we are conducting our clinical trials, and the patients involved with these clinical trials become infected with COVID-19, we may have more adverse events and deaths in our clinical trials as a result. Additionally, if global health concerns continue to prevent the FDA from conducting its regular inspections, reviews, or other regulatory activities, it could significantly impact the ability of the FDA to timely review and process our regulatory submissions, which could have a material adverse effect on our business. Such concerns could also affect the ability of our personnel to perform their normal responsibilities and could result in temporary closures of our facilities.

The global pandemic of COVID-19 continues to evolve. The ultimate impact of the COVID-19 pandemic is highly uncertain and subject to change. We do not yet know the full extent of potential delays or impacts on our business, our clinical trials, healthcare systems or the global economy as a whole. However, any one or a combination of these events could have an adverse effect on the operation of and results from our clinical trials, which could prevent or delay us from obtaining approval for tilsotolimod, or on our employee resources.

As a small biopharmaceutical-focused company with limited resources, we may be unable to attract and retain qualified personnel.

We are a small company with 32 full-time employees as of December 31, 2020. Any future growth will require hiring a number of qualified personnel. Also, because of the specialized scientific nature of our business, we face intense competition for qualified employees and consultants from biopharmaceutical companies, research organizations and academic institutions. Failure to attract and retain qualified personnel would materially harm our ability to compete effectively and grow our business.

If we lose any of our officers or key employees, our management and technical expertise could be weakened significantly.

Our success largely depends on the skills, experience, and efforts of our executive officers, especially our President and Chief Executive Officer, Mr. Vincent Milano. We do not maintain key person life insurance policies covering any

of our employees. The loss of any of our executive officers could weaken our management and technical expertise significantly and harm our business.

Risks Related to Regulatory Approval and Marketing and Other Compliance Matters

Even if we complete the necessary preclinical studies and clinical trials, the marketing approval process is expensive, time-consuming and uncertain and may prevent us from obtaining approvals for the commercialization of some or all of our drug candidates.

We are not permitted to market our drug candidates in the U.S. or in other countries until we, or any future collaborators, receive approval of an NDA from the FDA or marketing approval from applicable regulatory authorities outside of the U.S. The approval process is lengthy, often taking a number of years, is uncertain, and is expensive. Securing marketing approval requires the submission of extensive preclinical and clinical data and supporting information to regulatory authorities for each therapeutic indication to establish the drug candidate's safety and efficacy. Information about the product manufacturing process to, and inspection of manufacturing facilities by, the regulatory authorities is also required. Any delay in obtaining or failure to obtain required approvals could materially adversely affect our ability or that of any collaborators we may have to generate revenue from the particular drug candidate, which likely would result in significant harm to our financial position and adversely impact our stock price.

Our failure to obtain marketing approval in foreign jurisdictions would prevent our drug candidates from being marketed abroad.

We, and any future collaborators, must obtain separate marketing approvals and comply with numerous and varying regulatory requirements in foreign jurisdictions. The approval procedure varies among countries and can involve additional studies. The time required to obtain approval may differ substantially from that required to obtain FDA approval. In addition, in many countries outside of the U.S., it is required that the drug be approved for reimbursement before the drug can be approved for sale in that country. We, and any future collaborators, may not obtain approvals from regulatory authorities outside of the U.S. on a timely basis, if at all. Approval by the FDA does not ensure approval by regulatory authorities in foreign jurisdictions, and approval by one regulatory authority outside of the U.S. does not ensure approval by regulatory authorities in other jurisdictions or by the FDA.

Additionally, on January 31, 2020, the United Kingdom (“U.K.”) withdrew from the E.U. (Brexit), thereby triggering a transition period that ended December 31, 2020. There is currently considerable uncertainty on regulatory processes in Europe and the European Economic Area. The lack of clarity about which E.U. rules and regulations the U.K. would replace or replicate, such as rules and regulations relating to trade (including the importation and exportation of pharmaceuticals), clinical research, and intellectual property, could negatively impact our business, including by restricting our ability to generate revenue in these jurisdictions.

Even if we, or any future collaborators, obtain marketing approvals for our drug candidates, the terms of approvals and ongoing regulation of our drugs may limit how we, or they, manufacture and market our drugs, which could materially impair our ability to generate revenue.

We, and any future collaborators, must comply with requirements concerning advertising and promotion for any of our drug candidates for which we or they obtain marketing approval. Such promotional communications are subject to a variety of legal and regulatory restrictions and must be consistent with the information in the drug’s approved labeling. Thus, we, and any future collaborators, may not be able to promote any drugs we develop for indications or uses for which they are not approved.

In addition, manufacturers of approved drugs and those manufacturers’ facilities are required to comply with extensive FDA requirements, including ensuring that quality control and manufacturing procedures conform to cGMPs, which include requirements relating to quality control and quality assurance as well as the corresponding maintenance of records and documentation and reporting requirements. We, our contract manufacturers, our future collaborators and their contract manufacturers could be subject to periodic unannounced inspections by the FDA, and other regulatory authorities to monitor and ensure compliance with cGMPs.

Accordingly, assuming we, or our future collaborators, receive marketing approval for one or more of our drug candidates, we, and our future collaborators, and our and their contract manufacturers will continue to expend time, money and effort in all areas of regulatory compliance, including manufacturing, production, product surveillance and quality control.

If we, and our future collaborators, are not able to comply with post-approval regulatory requirements, we, and our future collaborators, could have the marketing approvals for our drugs withdrawn by regulatory authorities and our, or our future collaborators', ability to market any future drugs could be limited, which could adversely affect our ability to achieve or sustain profitability. Further, the cost of compliance with post-approval regulations may have a negative effect on our operating results and financial condition.

Moreover, legislative and regulatory proposals have been made to expand post-approval requirements and restrict promotional activities relating to our drugs. We cannot be sure whether additional legislative changes will be enacted, or whether FDA regulations, guidance or interpretations will be changed, or what the impact of such changes on the marketing approvals of our drug candidates, if any, may be. In addition, increased scrutiny by Congress of the FDA's approval process may significantly delay or prevent marketing approval, as well as subject us and any collaborators to more stringent product labeling and post-marketing testing and other requirements.

Any of our drug candidates for which we, or our future collaborators, obtain marketing approval in the future could be subject to post-approval restrictions or withdrawal from the market and we, and our future collaborators, may be subject to substantial penalties if we, or they, fail to comply with regulatory requirements or if we, or they, experience unanticipated problems with our drugs following approval.

Any of our drug candidates for which we, or our future collaborators, obtain marketing approval in the future, as well as the manufacturing processes, post-approval studies and measures, labeling, advertising and promotional activities for such drug, among other things, will be subject to continual requirements of and review by the FDA and other regulatory authorities. These requirements include submissions of safety and other post-marketing information and reports, registration and listing requirements, requirements relating to manufacturing, quality control, quality assurance and corresponding maintenance of records and documents, requirements regarding the distribution of samples to physicians and recordkeeping. Even if marketing approval of a drug candidate is granted, the approval may be subject to limitations on the indicated uses for which the drug may be marketed or to the conditions of approval, including the requirement to implement a Risk Evaluation and Mitigation Strategy, which could include requirements for a restricted distribution system.

The FDA may also impose requirements for costly post-marketing studies or clinical trials and surveillance to monitor the safety or efficacy of a drug. The FDA and other agencies, including the DOJ, closely regulate and monitor the post-approval marketing and promotion of drugs to ensure that they are manufactured, marketed and distributed only for the approved indications and in accordance with the provisions of the approved labeling. The FDA imposes stringent restrictions on manufacturers' communications regarding off-label use and if we, or our future collaborators, do not market any of our drug candidates for which we, or they, receive marketing approval for only their approved indications, we, or they, may be subject to warnings or enforcement action for off-label promotion.

In addition, later discovery of previously unknown adverse events or other problems with our drugs or their manufacturers or manufacturing processes, or failure to comply with regulatory requirements, may yield various results, including: (i) litigation involving patients taking our drug; (ii) restrictions on such drugs, manufacturers or manufacturing processes; (iii) restrictions on the labeling or marketing of a drug; (iv) restrictions on drug distribution or use; (v) requirements to conduct post-marketing studies or clinical trials; (vi) warning letters or untitled letters; (vii) withdrawal of the drugs from the market; (viii) refusal to approve pending applications or supplements to approved applications that we submit; (ix) recall of drugs; (x) fines, restitution or disgorgement of profits or revenues; (xi) suspension or withdrawal of marketing approvals; (xii) damage to relationships with any potential collaborators; (xiii) unfavorable press coverage and damage to our reputation; (xiv) refusal to permit the import or export of drugs; (xv) drug seizure; or (xvi) injunctions or the imposition of civil or criminal penalties.

We may not be able to obtain or maintain orphan drug exclusivity for applications of our TLR drug candidates.

The FDA may designate a product as an orphan drug if it is a drug intended to treat a rare disease or condition, which is generally defined as a patient population of fewer than 200,000 individuals in the U.S. Generally, if a product with an orphan drug designation subsequently receives the first marketing approval for the indication for which it has such designation, the product is entitled to a period of seven years of marketing exclusivity. Orphan drug exclusivity may be lost if the FDA determines that the request for designation was materially defective or if the manufacturer is unable to assure sufficient quantity of the drug to meet the needs of patients with the rare disease or condition.

In June 2017, the FDA granted us orphan drug designation for tilsotolimod for the treatment of melanoma Stages IIb to IV. However, there can be no assurance that we will obtain orphan drug designation or exclusivity for any other

disease indications for which we develop tilsotolimod, or for our other drug candidates. Even if we obtain orphan drug exclusivity for a product, that exclusivity may not effectively protect the product from competition because different drugs can be approved for the same condition. Even after an orphan drug is approved, the FDA can subsequently approve the same drug for the same condition if the FDA concludes that the later drug is clinically superior in that it is shown to be safer, more effective or makes a major contribution to patient care.

A fast track designation by the FDA may not actually lead to a faster development or regulatory review or approval process, and does not increase the likelihood that drug candidates will receive marketing approval.

In November 2017, the FDA granted us fast track designation for tilsotolimod for the treatment of anti-PD1 refractory metastatic melanoma in combination with ipilimumab therapy. However, even with fast track designation, we may not experience a faster development process, review or approval compared to conventional FDA procedures. The FDA may withdraw fast track designation if it believes that the designation is no longer supported by data from our clinical development program. Additionally, we intend to seek fast track designation for other applications of our drug candidates. The FDA has broad discretion whether to grant this designation, so even if we believe a particular drug candidate is eligible for this designation, we cannot assure you that the FDA would decide to grant it.

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

We may seek a breakthrough therapy designation for some applications of our drug candidates. Designation as a breakthrough therapy is within the discretion of the FDA. The receipt of a breakthrough therapy designation for a drug candidate may not result in a faster development process, review or approval compared to drugs considered for approval under conventional FDA procedures and does not assure ultimate approval by the FDA. In addition, even if one or more of our drug candidates qualify as breakthrough therapies, the FDA may later decide that the products no longer meet the conditions for qualification or decide that the time period for FDA review or approval will not be shortened.

We have only limited experience in regulatory affairs and our drug candidates are based on new technologies; these factors may affect our ability or the time we require to obtain necessary regulatory approvals.

We have never obtained regulatory approval for, or commercialized, a drug. It is possible that the FDA may refuse to accept any or all of our planned NDAs for substantive review or may conclude, after review of our data, that our applications are insufficient to obtain regulatory approval of any of our drug candidates. The FDA may also require that we conduct additional clinical or manufacturing validation studies, which may be costly and time-consuming, and submit that data before it will reconsider our applications. Depending on the extent of these or any other FDA required studies, approval of any NDA that we submit may be significantly delayed, possibly for years, or may require us to expend more resources than we have available or can secure.

We are subject to extensive and costly governmental regulation, the violation of which could expose us to criminal sanctions, civil penalties, contractual damages, reputational harm and diminished profits and future earnings.

Our product candidates are subject and any future commercial products will be subject to costly, extensive and rigorous domestic and foreign government regulation, as discussed under the caption “Government Regulation” within Item 1 of this Annual Report on Form 10-K.

In addition, our future arrangements with third party payors, healthcare providers and physicians may expose us to broadly applicable fraud and abuse and other healthcare laws and regulations that may constrain the business or financial arrangements and relationships through which we market, sell and distribute any drugs for which we obtain marketing approval. These include, but are not limited to, the following: the Anti-Kickback Statute; the Foreign Corrupt Practices Act; the False Claims Act; privacy laws such as HIPAA; transparency requirements; and analogous state and foreign laws. Additionally, some state laws require pharmaceutical companies to comply with the pharmaceutical industry’s voluntary compliance guidelines and the relevant compliance guidance promulgated by the federal government and require drug manufacturers to report information related to payments and other transfers of value to physicians and other healthcare providers or marketing expenditures.

Efforts to ensure that our business arrangements with third parties will comply with applicable healthcare laws and regulations will involve substantial costs. It is possible that governmental authorities will conclude that our business

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

We depend on information technology, infrastructure and data to conduct our business. Any significant disruption, or cyber-attacks, could have a material adverse effect on our business.

We are dependent upon information technology, infrastructure and data. Computer systems, including ours and those of our suppliers, partners and service providers, contain sensitive confidential information or intellectual property, and are vulnerable to service interruption or destruction, cyber-attacks (both malicious and random) and other natural or man-made incidents or disasters, which may be prolonged or go undetected. Such events are increasing in their frequency, sophistication and intensity, and have become increasingly difficult to detect. A significant interruption of our information technology could adversely affect our ability to manage and keep our operations running efficiently and effectively. An incident that results in a wider or sustained disruption to our business or products could have a material adverse effect on our business, financial condition and results of operations.

Likewise, data privacy or security breaches by employees or others may pose a risk that sensitive data, including our intellectual property, trade secrets or personal information of our employees, patients or other business partners may be exposed to unauthorized persons or to the public. There can be no assurance that our efforts, or the efforts of our partners and vendors, will prevent service interruptions, or identify breaches in our systems, that could adversely affect our business and operations and/or result in the loss of critical or sensitive information, which could result in financial, legal, business or reputational harm to us. In addition, our liability insurance may not be sufficient in type or amount to cover us against claims related to security breaches, cyberattacks and other related breaches.

Risks Relating to Collaborators

Our existing collaborations and any collaborations we enter into in the future may not be successful.

We rely in part on our collaborative alliances with AbbVie and BMS for the development of tilsotolimod. Our current collaboration agreements, as more fully described within Item 1 of this Annual Report on Form 10-K, or any collaborations we may enter into in the future, may not be successful. The success of our collaborative alliances, if any, will depend heavily on the efforts and activities of our collaborators. Our existing collaborations and any potential future collaborations have risks, including the following: (i) our collaborators may control the development (and timing thereof) of the drug candidates being developed with our technologies and compounds and/or the companion diagnostic to be developed for use in conjunction with our drug candidates; (ii) our collaborators may control the public release of information regarding the developments; (iii) disputes may arise in the future with respect to the ownership of or right to use technology and intellectual property developed with our collaborators; (iv) disagreements with our collaborators could delay or terminate the development of our products, or result in litigation or arbitration; (v) we may have difficulty enforcing the contracts if any of our collaborators fail to perform; (vi) our collaborators may terminate their collaborations with us, which could make it difficult for us to attract new collaborators or adversely affect the perception of us in the business or financial communities; (vii) our collaboration agreements are likely to be for fixed terms and subject to termination by our collaborators in the event of a material breach or lack of scientific progress by us; (viii) our collaborators may challenge our intellectual property rights or utilize our intellectual property rights in such a way as to invite litigation that could jeopardize or invalidate our intellectual property rights or expose us to potential liability; (ix) our collaborators may not comply with all applicable regulatory requirements; (x) our collaborators may under fund or not commit sufficient resources to the testing or development of our drug candidates; and (xi) our collaborators may develop alternative products either on their own or in collaboration with others, or encounter conflicts of interest or changes in business strategy or other business issues. Given these risks, it is possible that any collaborative alliance into which we enter may not be successful.

If we are unable to establish additional collaborative alliances, our business may be materially harmed.

Collaborators provide the necessary resources and drug development experience to advance our compounds in their programs. We have entered into and expect to continue to seek to enter into collaborative alliances with pharmaceutical companies to advance our TLR agonist and antagonist candidates and with respect to additional applications of our nucleic acid chemistry technology research program. Upfront payments and milestone payments received from collaborations help to provide us with the financial resources for our internal research and development programs. Our internal programs are focused on developing TLR-targeted drug candidates for the potential treatment of certain rare diseases and in our immuno-oncology program and on nucleic acid chemistry drug candidates. We believe that additional resources will be required to advance compounds in all of these areas. If we do not reach agreements with additional collaborators in the future or if the terms of such a collaborative alliance on are not favorable to us, we may not be able to obtain the expertise and resources necessary to achieve our business objectives, our ability to advance our compounds will be jeopardized and we may fail to meet our business objectives. Moreover, collaborations are complex and time consuming to negotiate, document, and implement. We may not be successful in our efforts to establish and implement collaborations on a timely basis.

Risks Relating to Intellectual Property

If we are unable to obtain and maintain patent protection for our discoveries, the value of our technology and products will be adversely affected.

Our ability to develop and commercialize drugs depends in significant part on our ability to: (i) obtain and maintain valid and enforceable patents; (ii) obtain licenses to the proprietary rights of others on commercially reasonably terms; (iii) operate without infringing upon the proprietary rights of others; (iv) prevent others from infringing on our proprietary rights; and (v) protect our trade secrets.

We do not know whether any of our currently pending patent applications or those patent applications that we license will result in the issuance of any patents. Our issued patents and those that may be issued in the future, or those licensed to us, may be challenged, invalidated, held unenforceable, narrowed in the course of a post-issuance proceeding or circumvented, and the rights granted thereunder may not provide us proprietary protection or competitive advantages against competitors with similar technology. Moreover, intellectual property laws may change and negatively impact our ability to obtain issued patents covering our technologies or to enforce any patents that issue. Because of the extensive time required for development, testing, and regulatory review of a potential product, it is possible that, before any of our products can be commercialized, any related patent may expire or remain in force for only a short period following commercialization, thus reducing any advantage provided by the patent.

Because patent applications in the U.S. and many foreign jurisdictions are typically not published until 18 months after filing, or in some cases not at all, and because publications of discoveries in the scientific literature often lag behind actual discoveries, neither we nor our licensors can be certain that we or they were the first to make the inventions claimed in issued patents or pending patent applications, or that we or they were the first to file for protection of the inventions set forth in these patent applications.

Third parties may own or control patents or patent applications and require us to seek licenses, which could increase our development and commercialization costs, or prevent us from developing or marketing products.

Although we have many issued patents and pending patent applications in the U.S. and other countries, we may not have rights under certain third-party patents or patent applications related to our compounds under development. Third parties may own or control these patents and patent applications in the U.S. and abroad. In particular, we are aware of certain third-party U.S. patents that contain claims related to immunostimulatory polynucleotides and their use to stimulate an immune response, as well as to antisense technology. Although we do not believe any of our TLR or antisense compounds under development infringe any valid claim of these patents, we cannot be assured that the holder of such patents would not seek to assert such patents against us or, if the holder did, that the courts would not interpret the claims of such patents more broadly than we believe appropriate and determine that we are in infringement of such patents. In addition, there may be other patents and patent applications related to our current or future drug candidates of which we are not aware. Therefore, in some cases, in order to develop, manufacture, sell or import some of our drug candidates, we or our collaborators may choose to seek, or be required to seek, licenses under third-party patents issued in the U.S. and abroad or under third-party patents that might issue from U.S. and foreign patent applications. In such an event, we would be required to pay license fees or royalties or both

to the licensor. If licenses are not available to us on acceptable terms, we or our collaborators may not be able to develop, manufacture, sell or import these products, or may be delayed in doing so. Either of these results could have a material adverse effect on our business.

We may become involved in expensive patent litigation or other proceedings, which could result in our incurring substantial costs and expenses or substantial liability for damages, require us to stop our development and commercialization efforts or result in our patents being invalidated, interpreted narrowly or limited.

There has been substantial litigation and other proceedings regarding patent and other intellectual property rights in the biotechnology industry. We may become a party to various types of patent litigation or other proceedings regarding intellectual property rights from time to time even under circumstances where we are not practicing and do not intend to practice any of the intellectual property involved in the proceedings. In addition to litigation, we may become involved in patent office proceedings, including oppositions, reexaminations, supplemental examinations and *inter partes* reviews involving our patents or the patents of third parties. We may initiate such proceedings or have such proceedings brought against us. An adverse determination in any such proceeding, or in litigation, could reduce the scope of, or invalidate, our patent rights, allow third parties to commercialize our technology or products and compete directly with us, without payment to us, or result in our inability to manufacture or commercialize products without infringing third-party patent rights. In addition, if the breadth or strength of protection provided by our patents and patent applications is threatened, it could dissuade companies from collaborating with us to license, develop or commercialize current or future drug candidates. An adverse determination in a proceeding involving a patent in our portfolio could result in the loss of protection or a narrowing in the scope of protection provided by that patent.

The cost to us of any patent litigation or other proceeding, even if resolved in our favor, could be substantial. Some of our competitors may be able to sustain the cost of such litigation or proceedings more effectively than we can because of their substantially greater financial resources. If any patent litigation or other proceeding is resolved against us, we or our collaborators may be enjoined from developing, manufacturing, selling or importing our drugs without a license from the other party and we may be held liable for significant damages. We may not be able to obtain any required license on commercially acceptable terms or at all. In a patent office proceeding, such as an opposition, reexamination or *inter partes* review, our patents may be narrowed or invalidated. Uncertainties resulting from the initiation and continuation of patent litigation or other proceedings could have a material adverse effect on our ability to compete in the marketplace. Patent litigation and other proceedings may also absorb significant management time.

Our intellectual property may be infringed by a third party.

Third parties may infringe one or more of our issued patents or trademarks. We cannot predict if, when or where a third party may infringe one or more of our issued patents or trademarks. To counter infringement, we may be required to file infringement claims, which can be expensive and time-consuming. Moreover, there is no assurance that we would be successful in proving that a third party is infringing one or more of our issued patents or trademarks. Any claims we assert against perceived infringers could also provoke these parties to assert counterclaims against us, alleging that we infringe their intellectual property. In addition, in a patent infringement proceeding, a court may decide that a patent of ours is invalid or unenforceable, in whole or in part, construe the patent's claims narrowly and/or refuse to stop the other party from using the technology at issue on the grounds that our patents do not cover the technology in question, any of which may adversely affect our business. Even if we are successful in proving in a court of law that a third party is infringing one or more of our issued patents or trademarks there can be no assurance that we would be successful in halting their infringing activities.

Risks Relating to Product Manufacturing, Marketing and Sales, and Reliance on Third Parties

Even if tilsotolimod or other compounds we may develop are successful in clinical trials and receive regulatory approvals, we or our collaboration partners may not be able to successfully commercialize them.

Even if tilsotolimod were successful in clinical development and receive regulatory approvals, it may never reach or remain on the market, be successfully developed into commercial products or gain market acceptance among physicians, patients, healthcare payors or the medical community for a number of reasons including: (i) it may be found ineffective or cause harmful side effects; (ii) it may be difficult to manufacture on a scale necessary for commercialization; (iii) it may experience excessive product loss due to contamination, equipment failure, inadequate transportation or storage, improper installation or operation of equipment, vendor or operator error,

natural disasters or other catastrophic events, inconsistency in yields or variability in product characteristics; (iv) it may be uneconomical to produce; (v) the timing of market introduction of tilsotolimod and other compounds we may develop and competitive products may be inopportune; (vi) political and legislative changes may make the commercialization of tilsotolimod, or any other product candidates we may develop in the future, more difficult; (vii) we may fail to obtain reimbursement approvals or pricing that is cost effective for patients as compared to other available forms of treatment or that covers the cost of production and other expenses; (viii) they may not compete effectively with existing or future alternatives; (ix) we may be unable to develop commercial operations and to sell marketing rights; (x) it may fail to achieve market acceptance; or (xi) we may be precluded from commercialization of a product due to proprietary rights of third parties.

Because we have limited manufacturing experience, and no manufacturing facilities or infrastructure, we are dependent on third-party manufacturers to manufacture drug candidates for us.

We have limited manufacturing experience and no manufacturing facilities, infrastructure or clinical or commercial scale manufacturing capabilities. In order to continue to develop our drug candidates, apply for regulatory approvals, and ultimately commercialize products, we need to develop, contract for or otherwise arrange for the necessary manufacturing capabilities. We currently rely upon third parties to produce material for nonclinical and clinical testing purposes and expect to continue to do so in the future. We also expect to rely upon third parties to produce materials that may be required for the commercial production of our drug candidates, if approved. Our current and anticipated future dependence upon others for the manufacture of our drug candidates may adversely affect our future profit margins and our ability to develop drug candidates and commercialize any drug candidates on a timely and competitive basis. We currently do not have any long-term supply contracts.

There are a limited number of manufacturers that operate under the FDA's cGMP regulations capable of manufacturing our drug candidates. As a result, we may have difficulty finding manufacturers for our drug candidates suitable for our needs. If we are unable to arrange for third-party manufacturing of our drug candidates on a timely basis, or on acceptable terms, we may not be able to complete development of our drug candidates or market them.

Any contract manufacturers with which we enter into manufacturing arrangements will be subject to ongoing periodic, unannounced inspections by the FDA, or foreign equivalent, and corresponding state and foreign agencies or their designees to ensure compliance with cGMP requirements and other governmental regulations and corresponding foreign standards. Any failure by our third-party manufacturers to comply with such requirements, regulations or standards could lead to a delay in the conduct of our clinical trials, or a delay in, or failure to obtain, regulatory approval of any of our drug candidates. Such failure could also result in sanctions being imposed, including fines, injunctions, civil penalties, delays, suspension or withdrawal of approvals, product seizures or recalls, imposition of operating restrictions, total or partial suspension of production or distribution, or criminal prosecution.

Additionally, contract manufacturers may not be able to manufacture our drug candidates at a cost or in quantities necessary to make them commercially viable. Furthermore, changes in the manufacturing process or procedure, including a change in the location where the drug substance or drug product is manufactured or a change of a third-party manufacturer, may require prior FDA review and approval in accordance with the FDA's cGMP and NDA/BLA regulations. Contract manufacturers may also be subject to comparable foreign requirements. This review may be costly and time-consuming and could delay or prevent the launch of a drug candidate. The FDA or similar foreign regulatory agencies at any time may also implement new standards, or change their interpretation and enforcement of existing standards for manufacture, packaging or testing of products. If we or our contract manufacturers are unable to comply, we or they may be subject to regulatory action, civil actions or penalties.

We have no experience selling, marketing or distributing oncology products and no internal capability to do so.

We currently have no commercialization expertise in oncology, including sales, marketing or distribution capabilities. Advancing tilsotolimod through Phase 3 development and regulatory approval will require us to begin commercialization preparation activities and incur related expenses. These activities will include, among other things, the development of an in-house marketing organization and sales force, a market access and payor reimbursement strategy and a distribution function, which will require significant capital expenditures, management resources and time. If we are unable to adequately prepare the market for the potential future commercialization of tilsotolimod, we may not be able to generate product revenue once marketing authorization is obtained.

If we are unable or decide not to establish internal sales, marketing and distribution capabilities, we will pursue collaborative arrangements regarding the sales and marketing of our products; however, there can be no assurance that we will be able to establish or maintain such collaborative arrangements on commercially reasonable terms, or if we are able to do so, that they will have effective sales forces. Any revenue we receive will depend upon the efforts of such third parties, which may not be successful. We may have little or no control over the marketing and sales efforts of such third parties and our revenue from product sales may be lower than if we had commercialized our product candidates ourselves. We also face competition in our search for third parties to assist us with the sales and marketing efforts of our product candidates.

If third parties on whom we rely for clinical trials do not perform as contractually required or as we expect, we may not be able to obtain regulatory approval for or commercialize our drug candidates and our business may suffer.

We do not have the ability to independently conduct the clinical trials required to obtain regulatory approval for our drug candidates. We depend on independent clinical investigators, contract research organizations (CROs), and other third-party service providers in the conduct of the clinical trials of our drug candidates and expect to continue to do so. We expect to contract with CROs for future clinical trials. We rely heavily on these parties for successful execution of our clinical trials, but do not control many aspects of their activities. We are responsible for ensuring that each of our clinical trials is conducted in accordance with the applicable regulations and protocols for the trial. Third parties may not complete activities on schedule, or at all, or may not conduct our clinical trials in accordance with regulatory requirements or our protocols. If these third parties fail to carry out their obligations, we may need to enter into new arrangements with alternative third parties. This could be difficult, costly or impossible, and our preclinical or clinical trials may need to be extended, delayed, terminated or repeated, and we may not be able to obtain regulatory approval in a timely fashion, or at all, for the applicable drug candidate, or to commercialize such drug candidate being tested in such trials. If we seek to conduct any of these activities ourselves in the future, we will need to recruit appropriately trained personnel and add to our research, clinical, quality and corporate infrastructure.

The commercial success of any drug candidates that we may develop will depend upon the degree of market acceptance by physicians, patients, third-party payors, and others in the medical community.

Any products that we ultimately bring to the market, if they receive marketing approval, may not gain market acceptance by physicians, patients, third-party payors or others in the medical community. For example, current cancer treatments, including chemotherapy and radiation therapy are well-established in the medical community, and doctors may continue to rely on these treatments. If our products do not achieve an adequate level of acceptance, we may not generate product revenue and we may not become profitable. The degree of market acceptance of our products, if approved for commercial sale, will depend on a number of factors, including: (i) the prevalence and severity of any side effects; (ii) the efficacy and potential advantages over alternative treatments; (iii) the ability to offer our drug candidates for sale at competitive prices; (iv) relative convenience and ease of administration; (v) the willingness of the target patient population to try new therapies and of physicians to prescribe these therapies; (vi) the strength of marketing and distribution support and the timing of market introduction of competitive products; and (vii) publicity concerning our products or competing products and treatments.

Even if a potential product displays a favorable efficacy and safety profile, market acceptance of the product will not be known until after it is launched. Our efforts to educate patients, the medical community, and third-party payors about our drug candidates may require significant resources and may never be successful. Such efforts to educate the marketplace may require more resources than are required by conventional methods used by our competitors.

If we are unable to obtain adequate reimbursement from third-party payors for any products that we may develop or acceptable prices for those products, our revenues and prospects for profitability will suffer.

Most patients rely on Medicare, Medicaid, private health insurers, and other third-party payors to pay for their medical needs, including any drugs we may market. If third-party payors do not provide adequate coverage or reimbursement for any products that we may develop, our revenues and prospects for profitability will suffer.

Third-party payors are challenging the prices charged for medical products and services, and many third-party payors limit reimbursement for newly-approved products. These third-party payors may base their coverage and reimbursement on the coverage and reimbursement rate paid by carriers for Medicare beneficiaries. Furthermore, many such payors are investigating or implementing methods for reducing health care costs, such as the establishment of capitated or prospective payment systems. Cost containment pressures have led to an increased emphasis on the use of cost-effective products by health care providers, which could limit the price we might

establish for products that we or our current or future collaborators may develop or sell, which would result in lower product revenues or royalties payable to us. In particular, third-party payors may limit the indications for which they will reimburse patients who use any products that we may develop.

We face a risk of product liability claims and may not be able to obtain insurance.

Our business exposes us to the risk of product liability claims that is inherent in the manufacturing, testing, and marketing of prescription drugs. We face a risk of product liability exposure related to the testing of our drug candidates in clinical trials and will face an even greater risk if we commercially sell any products. Regardless of merit or eventual outcome, liability claims and product recalls may result in: (i) decreased demand for our drug candidates and products; (ii) damage to our reputation; (iii) regulatory investigations that could require costly recalls or product modifications; (iv) withdrawal of clinical trial participants; (v) costs to defend related ligation; (vi) substantial monetary awards to clinical trial participants or patients; (vii) loss of revenue; (viii) the diversion of management's attention away from managing our business; and (ix) the inability to commercialize any products that we may develop.

Although we have product liability and clinical trial liability insurance that we believe is adequate, this insurance is subject to deductibles and coverage limitations. We may not be able to obtain or maintain adequate protection against potential liabilities. If we are unable to obtain insurance at acceptable cost or otherwise protect against potential product liability claims, we will be exposed to significant liabilities, which may materially and adversely affect our business and financial position. These liabilities could also prevent or interfere with our commercialization efforts.

Risks Relating to Ownership of Our Common Stock

Provisions in our certificate of incorporation and by-laws and Delaware law, may prevent a change in control that stockholders may consider desirable.

Section 203 of the General Corporation Law of the State of Delaware (the “DGCL”) and our certificate of incorporation and by-laws contain provisions that might enable our management to resist a takeover of our company or discourage a third party from attempting to take over our company. These provisions include: (i) a classified board of directors; (ii) limitations on the removal of directors; (iii) limitations on stockholder proposals at meetings of stockholders; (iv) the inability of stockholders to act by written consent or to call special meetings; and (v) the ability of our board of directors to designate the terms of and issue new series of preferred stock without stockholder approval. These provisions could: (i) have the effect of delay, defer or prevent a change in control of us or a change in our management that stockholders may consider favorable or beneficial or (ii) discourage proxy contests and make it more difficult for stockholders to elect directors and take other corporate actions.

The Company’s amended and restated bylaws (“Bylaws”) provide, to the fullest extent permitted by law, that the Court of Chancery of the State of Delaware will be the exclusive forum for certain legal actions between the Company and its stockholders, which could increase costs to bring a claim, discourage claims or limit the ability of the Company’s stockholders to bring a claim in a judicial forum viewed by the stockholders as more favorable for disputes with the Company or the Company’s directors, officers or other employees.

Our Bylaws provide to the fullest extent permitted by law that unless the Company consents in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware will be the sole and exclusive forum for any (i) derivative action or proceeding brought on behalf of the Company, (ii) any action asserting a claim of breach of a fiduciary duty owed by any director, officer, other employee or stockholder of the Company to the Company or its stockholders, (iii) any action arising pursuant to any provision of the DGCL, the Company’s Certificate of Incorporation or the Bylaws, (iv) any action to interpret, apply, enforce or determine the validity of the Certificate of Incorporation or the Bylaws, (v) or any action asserting a claim governed by the internal affairs doctrine. The choice of forum provision may increase costs to bring a claim, discourage claims or limit a stockholder’s ability to bring a claim in a judicial forum that it finds favorable for disputes with the Company or its directors, officers or other employees, which may discourage such lawsuits against the Company or its directors, officers and other employees. Alternatively, if a court were to find the choice of forum provision contained in the Company’s amended and restated bylaws to be inapplicable or unenforceable in an action, the Company may incur additional costs associated with resolving such action in other jurisdictions. The exclusive forum provision in our Bylaws would not apply to claims brought under the Securities Exchange Act or the Securities Act, or any other claim for which the federal courts have exclusive jurisdiction. Additionally, such provision will not relieve us of our duty to comply with the federal securities laws and

the rules and regulations thereunder, and stockholders will not be deemed to have waived our compliance with these laws, rules and regulations.

Approximately 35% of our outstanding common stock is held (36% beneficially owned) by three stockholders. If these significant stockholders choose to act together, they could exert substantial influence over our business, and the interests of these stockholders may conflict with those of other stockholders.

There is a concentration of ownership of our outstanding common stock because approximately 35% of our outstanding common stock is owned by three stockholders. As of February 15, 2021: (i) Baker Bros. Advisors LP, and certain of its affiliated funds (collectively, "Baker Brothers") beneficially owned 11.1% of our outstanding common stock, which excludes all convertible securities as a result of certain beneficial ownership limitations as discussed on page F-36 of this Annual Report on Form 10-K; (ii) entities affiliated with Pillar Invest Corporation (the "Pillar Investment Entities") beneficially owned 19.9% of our outstanding common stock; and (iii) Castellina Ventures Ltd. ("Castellina" and, together with Baker Brothers and Pillar Investment Entities, the "Significant Securityholders") beneficially owned 5.3% of our outstanding common stock. If any of our Significant Securityholders acted together, they could be able to exert substantial influence over our business. Additionally, the interests of the Significant Securityholders may be different from or conflict with the interests of our other stockholders. This concentration of voting power with the Significant Securityholders could delay, defer or prevent a change of control, entrench our management and the board of directors or delay or prevent a merger, consolidation, takeover or other business combination involving us on terms that other stockholders may desire. In addition, conflicts of interest could arise in the future between us, on the one hand, and either of our Significant Securityholders on the other hand, concerning potential competitive business activities, business opportunities, the issuance of additional securities and other matters.

Our financial statements, including our balance sheets and statements of operations, are subject to quarterly changes related to the revaluation our warrant and future tranche right liabilities.

In accordance with ASC Topic 480, *Liabilities-Distinguishing from Equity* and/or ASC Topic 815, *Accounting for Derivative Instruments and Hedging Activities*, our outstanding Series B1 convertible preferred shares are accounted for as temporary equity and related warrants and future tranche rights issued in connection with our December 2019 Private Placement are accounted for as liabilities at fair value. Accordingly, the associated warrant and future tranche right liabilities are re-measured at each reporting period with changes in fair value recorded in earnings. The process of determining the fair value of the warrants and future tranche rights requires complex models and the development of significant and subjective estimates that may, and are likely to, change over the duration of the instrument with related changes in internal and external market factors. As a result, our financial statements and results of operations may fluctuate quarterly, based on factors, such as the trading value of our common stock and certain assumptions, which are outside of our control. The liabilities and accounting line items associated with our warrant and future tranche right liabilities on our balance sheet and statement of operations are non-cash items, and the inclusion of such items in our financial statements may materially affect the outcome of our quarterly and annual results, even though such items are non-cash and do not affect the cash we have available for operations. Investors should take such accounting matters and other non-cash items into account when comparing our quarter-to-quarter and year-to-year operating results and financial statements.

If we are required to redeem shares of Series B1 preferred stock, or, if issued, Series B2, Series B3 or Series B4 preferred stock, our cash position will be negatively impacted.

Pursuant to the December 2019 Securities Purchase Agreement, we issued 23,684 shares of Series B1 preferred stock and are contingently obligated to issue 98,685 shares of Series B2 preferred stock, 82,418 shares of Series B3 preferred stock and 82,418 shares of Series B4 preferred stock and accompanying warrants exercisable for either common stock or Series B1 preferred stock, to the extent Baker Brothers exercise its option to purchase these securities. Subject to the terms of the Certificate of Designations, Preferences and Rights of Series B1 Convertible Preferred Stock, Series B2 Convertible Preferred Stock, Series B3 Convertible Preferred Stock and Series B4 Convertible Preferred Stock of the Company, on or after the five-year anniversary of the applicable initial issuance date of each such series of preferred stock, and to the extent that the holder's redemption rights with regard to such series of preferred stock are not lost upon our achievement of certain criteria regarding our stock price and ILLUMINATE-301 on or before the two-year anniversary date of the applicable initial issuance date, some or all of our outstanding shares of such series of preferred stock may be redeemable at the option of the holder at a redemption price of $152.00 per share of Series B1 and Series B2 preferred stock and $182.00 per share of Series B3 and Series B4 preferred stock. If a holder of preferred stock requests redemption, we will be required to redeem such

shares of preferred stock, subject to certain provisions regarding insufficient funds. We may be unable to redeem such preferred stock if restrictions under applicable law or contractual obligations prohibit such redemption. Unless we operate profitably, our ability to redeem the preferred stock would require the availability of adequate "surplus," which is defined as the excess, if any, of our net assets (total assets less total liabilities) over our capital. To date, we have operated at a loss. To the extent a Series B preferred stockholder exercises its redemption rights when it is eligible to do so, and if we do not have sufficient "surplus" under Delaware law at that time, we would be unable to effect such redemption. If we do have sufficient "surplus" to effect such redemption at that time, our available cash will be negatively impacted and our ability to use the net proceeds from this offering could be substantially limited. In addition, such reduction in our available cash could decrease the trading price of our common stock.

The issuance or sale of shares of our common stock, including the issuance of our securities pursuant to the December 2019 Securities Purchase Agreement, could depress the trading price of our common stock.

The December 2019 Securities Purchase Agreement transaction consists of four separate tranches. The terms of the tranches, including the number of shares issued or to be issued, the purchase prices, and the conversion prices and the number of warrants and exercise prices, are set forth beginning on page F-20 of this Annual Report on Form 10-K. If (i) we issue shares of common stock pursuant to the conversion or exercise of the securities issuable under the December 2019 Securities Purchase Agreement, (ii) we issue additional shares of our common stock or rights to acquire shares of our common stock in other future transactions, (iii) any of our existing stockholders sells a substantial amount of our common stock, or (iv) the market perceives that such issuances or sales may occur, then the trading price of our common stock may significantly decrease. In addition, our issuance of additional shares of common stock will dilute the ownership interests of our existing common stockholders.

Certain investors in the December 2019 private placement will have the ability to control or significantly influence certain business decisions.

Pursuant to the terms of the December 2019 Securities Purchase Agreement, subject to certain conditions, Baker Brothers have consent rights over certain significant matters of the Company's business. These include decisions to (i) issue or authorize equity securities that rank equal or senior to the Series B1, Series B2, Series B3 and Series B4 preferred stock with respect to liquidation preference, (ii) incur any indebtedness in excess of $1,000,000, in the aggregate, outside the ordinary course of business (other than the refinancing of the Company's term debt, if any), (iii) sell, transfer or otherwise dispose of tilsotolimod (such approval not to be reasonably withheld), (iv) license tilsotolimod in the U.S. or the E.U. (in each case such approval not to be unreasonably withheld), or (v) pay any dividends. As a result, Baker Brothers will have significant influence over certain matters affecting our business.

Because we do not intend to pay dividends on our common stock, investor returns will be limited to any increase in the value of our stock.

We have never declared or paid any cash dividends on our common stock. We currently intend to retain all available funds and any future earnings to support our operations and finance the growth and development of our business and do not anticipate declaring or paying any cash dividends on our common stock for the foreseeable future. Additionally, the December 2019 Securities Purchase Agreement, more fully described below, contains negative covenants which restricts our ability to pay dividends on our equity securities. Any return to stockholders will therefore be limited to the appreciation of their stock, if any.

Item 1B. Unresolved Staff Comments.

None.

Item 2. Properties.

We lease approximately 11,000 square feet of office space located in Exton, Pennsylvania. The lease expires on May 31, 2025. We may terminate the lease at any point as long as we remain a member of the landlord's group and require a space with more square footage. We have specified rights to sublease this facility.

Item 3. Legal Proceedings.

None.

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

Our common stock is listed under the symbol "IDRA" on the Nasdaq.

Holders of Record

As of February 15, 2021, we had approximately 55 common stockholders of record registered on our books, excluding shares held through banks and brokers.

Dividends

We have never declared or paid cash dividends on our common stock, and we do not expect to pay any cash dividends on our common stock in the foreseeable future. The declaration and payment of dividends in the future, of which there can be no assurance, will be determined by our board of directors in light of conditions then existing, including earnings, financial condition, capital requirements and other factors. In addition, the December 2019 Securities Purchase Agreement, more fully described below, contains negative covenants which restricts our ability to pay dividends on our equity securities.

Securities Authorized for Issuance Under Equity Compensation Plans

The following table provides information as of December 31, 2020 regarding total shares subject to outstanding stock options, warrants and rights and total additional shares available for issuance under our existing equity incentive and employee stock purchase plans. In addition, from time to time, we may grant "inducement grants" pursuant to Nasdaq Listing Rule 5635(c)(4).

Plan Category	Number of Securities 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 Securities Remaining Available for Future Issuance Under Equity Compensation Plans (Excluding Securities Reflected in Column (a)) (c)
Equity compensation plans approved by stockholders (1)	5,158,269	$ 8.38	1,084,142
Equity compensation plans not approved by stockholders (2)	359,375	$ 26.35	—
Total	5,517,644	$ 9.78	1,084,142

(1) Consists of our: 2008 Stock Incentive Plan; 2013 Stock Incentive Plan and 2017 Employee Stock Purchase Plan. Amounts in column (a) include stock options and unvested restricted stock units outstanding. Shares are available for future issuance only under our 2013 Stock Incentive Plan and 2017 Employee Stock Purchase Plan.

(2) Consists of stock options issued as inducement grants (issued prior to 2017) as of December 31, 2020. These stock options are generally subject to the same terms and conditions as those awarded pursuant to the plans approved by our stockholders.

Recent Sales of Unregistered Securities

The following is a summary of transactions by us involving sales of our securities that were not registered under the Securities Act during the year ended December 31, 2020.

April 2020 Private Placement

As reported in our Current Report on Form 8-K filed with the SEC on April 7, 2020, we sold shares of the Company's common stock and warrants to purchase shares of common stock pursuant to the April 2020 Securities Purchase Agreement. These securities were issued in a private placement in reliance on Section 4(a)(2) of the Securities Act. Please refer to Note 8 of the Notes to Financial Statements in this Annual Report on Form 10-K for additional details.

July 2020 Private Placement

As reported in our Current Report on Form 8-K filed with the SEC on July 15, 2020, we sold shares of the Company's common stock, pre-funded warrants and warrants to purchase shares of common stock pursuant to the July 2020 Securities Purchase Agreement. These securities were issued in a private placement in reliance on Section 4(a)(2) of the Securities Act. Please refer to Note 8 of the Notes to Financial Statements in this Annual Report on Form 10-K for additional details.

Issuer Purchases of Equity Securities

We did not repurchase any of our equity securities during the year ended December 31, 2020.

Item 6. Selected Financial Data.

Not applicable.

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

The following discussion and analysis of our financial condition and results of operations should be read in conjunction with our audited financial statements and the related notes appearing elsewhere in this Annual Report on Form 10-K.

Overview

We are a clinical-stage biopharmaceutical company with a business strategy focused on the clinical development, and ultimately the commercialization, of drug candidates for both oncology and rare disease indications characterized by small, well-defined patient populations with serious unmet medical needs. Our current focus is on our Toll-like receptor ("TLR") agonist, tilsotolimod (IMO-2125), for oncology. We believe we can develop and commercialize targeted therapies on our own. To the extent we seek to develop drug candidates for broader disease indications, we have entered into and may explore additional collaborative alliances to support development and commercialization.

TLRs are key receptors of the immune system and play a role in innate and adaptive immunity. As a result, we believe TLRs are potential therapeutic targets for the treatment of a broad range of diseases. Using our chemistry-based platform, we designed both TLR agonists and antagonists to act by modulating the activity of targeted TLRs. A TLR agonist is a compound that stimulates an immune response through the targeted TLR. A TLR antagonist is a compound that inhibits an immune response by blocking the targeted TLR.

Our current TLR-targeted clinical-stage drug candidate, tilsotolimod, is an agonist of TLR9. We are currently developing tilsotolimod, via intratumoral injection, for the treatment of anti-PD1 refractory metastatic melanoma in combination with ipilimumab, an anti-CTLA4 antibody marketed as Yervoy® by Bristol Myers Squibb Company ("BMS") in a Phase 3 registration trial. We are also evaluating intratumoral tilsotolimod in combination with nivolumab, an anti-PD1 antibody marketed as Opdivo® by BMS, and ipilimumab for the treatment of multiple solid tumors in a multicohort Phase 2 trial.

Historically, substantially all of our revenues have been from collaboration and license agreements, although we did not generate any such revenue in 2020, and we have received no revenues from the sale of commercial products. Going forward, we expect ongoing tilsotolimod (IMO-2125) external development expenses to be significant as our focus in 2021 continues to be on the clinical development of tilsotolimod, including preparing for an NDA submission with the FDA. See additional information below under the headings "Results of Operations" regarding research and development expenses to date and "Financial Condition, Liquidity and Capital Resources" regarding our future funding requirements.

Results of Operations

The following is a discussion of results of operations for fiscal 2020 compared to fiscal 2019. For a discussion of results of operations for fiscal 2019 compared to fiscal 2018, please refer to Item 7—Management's Discussion and Analysis of Financial Condition and Results of Operations in the Company's Annual Report on Form 10-K for the year ended December 31, 2019, filed with the SEC on March 12, 2020.

Years ended December 31, 2020 and 2019

Alliance Revenue

Historically, substantially all of our revenues have been from collaboration and license agreements, which we refer to as "alliance revenue." Alliance revenues consist of revenue generated through collaborative research, development and/or commercialization agreements and other out-licensing arrangements. The terms of these agreements may include payment to us of one or more of the following: nonrefundable, up-front license fees; research, development and commercial milestone payments; and other contingent payments due based on the activities of the counterparty or the reimbursement by licensees of costs associated with patent maintenance.

We did not generate any alliance revenue for the fiscal year ended December 31, 2020. Alliance revenue for the year ended December 31, 2019 totaled $1.4 million and primarily related to the out-licensing of certain non-core technology to Licensee during the second quarter of 2019. See Note 9 of the Notes to Financial Statements included elsewhere in this Annual Report on Form 10-K for additional information.

Research and Development Expenses

For each of our research and development programs, we incur both direct and indirect expenses. We track direct research and development expenses by program, which include third party costs such as contract research, consulting and clinical trial and manufacturing costs. We do not allocate indirect research and development expenses, which may include regulatory, laboratory (equipment and supplies), personnel, facility and other overhead costs (including depreciation and amortization), to specific programs.

During the fiscal year ended December 31, 2020, our overall research and development expenses declined by 29% as compared to 2019, primarily due to decreases in external development costs associated with tilsotolimod (IMO-2125). Specifically, this decrease is related to costs incurred with contract research organizations during the fiscal year 2020 to support: (i) our ongoing ILLUMINATE-301 trial, which we initiated in the first quarter of 2018 and completed enrollment in the first quarter of 2020, primarily due to decreased levels of clinical site activity following full enrollment; (ii) our ongoing ILLUMINATE-206 trial, which we initiated in the second quarter of 2019, primarily due to upfront start-up costs incurred during the 2019 period that were not incurred during 2020; (iii) our ILLUMINATE-204 trial, which was substantially completed by the end of the first quarter of 2020; and (iv) our ILLUMINATE-101 trial, which was completed by the end of 2019, all contributed to the decrease in costs incurred during the fiscal year ended December 31, 2020. The decrease in other drug development expenses in 2020, as compared to 2019, was primarily due to decreases in internal employee and facility overhead related costs.

We anticipate that tilsotolimod (IMO-2125) external development expenses will continue to be significant, as we expect to continue the clinical development of tilsotolimod, including preparing for an NDA submission with the FDA.

In the table below, research and development expenses are set forth in the following categories: Tilsotolimod (IMO-2125), IMO-8400 (rare diseases, which has been discontinued), and other drug development expenses.

($ in thousands)	Year Ended December 31, 2020	2019	% Change 2020 vs 2019
Tilsotolimod (IMO-2125) external development expense	$ 16,707	$ 25,494	(34)%
IMO-8400 external development expense	—	45	(100)%
Other drug development expense	8,065	9,314	(13)%
Total research and development expenses	$ 24,772	$ 34,853	(29)%

Tilsotolimod (IMO-2125) External Development Expenses.

These expenses include external expenses that we have incurred in connection with the development of tilsotolimod as part of our immuno-oncology program. These external expenses include payments to independent contractors and vendors for drug development activities conducted after the initiation of tilsotolimod clinical development in immuno-oncology, but exclude internal costs such as payroll and overhead expenses.

We commenced clinical development of tilsotolimod as part of our immuno-oncology program in July 2015, and from July 2015 through December 31, 2020, we incurred approximately $81.9 million in tilsotolimod external development expenses, including costs associated with the preparation for and conduct of ILLUMINATE-204, ILLUMINATE-101, ILLUMINATE-301, ILLUMINATE-206, and the manufacture of additional drug substance for use in our clinical trials and additional nonclinical studies.

IMO-8400 External Development Expenses.

We discontinued development of IMO-8400 in July 2018, and incurred no such expenses during 2020. During the fiscal year ended December 31, 2019, these expenses included payments to independent contractors and vendors for drug development activities conducted after the initiation of IMO-8400 clinical development. Such expenses excluded internal costs such as payroll and overhead expenses.

Other Drug Development Expenses.

These expenses include internal costs, such as payroll and overhead expenses, associated with all of our clinical development programs. In addition, these expenses include external expenses, such as payments to contract vendors, associated with compounds that were previously being developed but are not currently being developed.

General and Administrative Expenses

General and administrative expenses consist primarily of payroll, stock-based compensation expense, consulting fees and professional legal fees associated with our patent applications and maintenance, our corporate regulatory filing requirements, our corporate legal matters, and our business development initiatives. For the years ended December 31, 2020 and 2019, general and administrative expenses totaled $11.9 million and $12.5 million, respectively.

General and administrative expenses decreased by approximately $0.6 million, or 4.5%, in 2020 as compared to 2019, primarily due to lower employee related costs and legal fees, partially offset by increased commercial costs.

Restructuring Costs

Restructuring costs consist primarily of severance and related benefit costs related to workforce reductions, contract termination and wind-down costs and asset impairments.

We did not incur any restructuring costs during the fiscal year ended December 31, 2020. Restructuring costs for the year ended December 31, 2019 totaled $0.2 million and resulted from our decision in July 2018 to wind-down our discovery operations, reduce the workforce in Cambridge, Massachusetts that supported such operations, and close our Cambridge facility.

Interest Income

Interest income for the years ended December 31, 2020 and 2019 totaled $0.2 million and $1.2 million, respectively. The decrease in 2020, as compared to 2019, was primarily due to lower interest rates.

Amounts may fluctuate from period to period due to changes in average investment balances, including money market funds classified as cash equivalents, and composition of investments.

Warrant Revaluation Loss

During the years ended December 31, 2020 and 2019, we recorded a non-cash warrant revaluation loss of approximately $3.7 million and $0.6 million, respectively. The non-cash charges relate to the revaluation of our liability-classified warrants issued in connection with the December 2019 Private Placement, as more fully described in Note 7 of the Notes to Financial Statements appearing elsewhere in this Form 10-K. Due to the nature of and inputs in the model used to assess the fair value of our outstanding warrants, it is not abnormal to experience significant fluctuations during each remeasurement period. These fluctuations may be due to a variety of factors, including changes in our stock price and changes in estimated stock price volatility over the remaining life of the warrants. Warrant revaluation loss for 2020 and 2019 was driven primarily by an increase in our stock price during each period. More specifically, the significant warrant revaluation loss for the 2020 period was primarily due to the approximate 102% increase in our stock price during the period January 1, 2020 to December 31, 2020. Warrant revaluation loss was much more modest during the 2019 period as the change in our stock price from December 22, 2019 (issuance date of securities) to December 31, 2019 was only approximately 19%.

Future Tranche Right Revaluation Loss

During the years ended December 31, 2020 and 2019, we recorded a non-cash future tranche right revaluation loss of approximately $72.4 million and $11.0 million, respectively. The non-cash charges relate to the change in fair value during the respective period of the future tranche right liability (right to purchase preferred stock and warrants to an investor at future dates), associated with the Future Tranche Rights issued in connection with the December 2019 Securities Purchase Agreement, as more fully described in Note 7 of the Notes to Financial Statements appearing elsewhere in this Form 10-K. Due to the nature of and inputs in the model used to assess the fair value of the future tranche rights, it is not abnormal to experience significant fluctuations during each remeasurement period. These fluctuations may be due to a variety of factors, including changes in our stock price and changes in estimated stock price volatility over the remaining estimated lives of the future tranche rights. Changes in the fair value of the future tranche right liability and resulting future tranche right revaluation loss for 2020 and 2019 was driven primarily by an increase in our stock price during the periods. More specifically, the significant future tranche right revaluation loss for the 2020 period was primarily due to the approximate 102% increase in our stock price during the period January 1, 2020 to December 31, 2020. Future tranche right revaluation loss was much more modest during the 2019 period as the change in our stock price from December 22, 2019 (issuance date of securities) to December 31, 2019 was only approximately 19%.

Net Loss and Net Loss Attributable to Common Stockholders

As a result of the factors discussed above, our net loss was $112.7 million and $56.5 million for the years ended December 31, 2020 and 2019, respectively. For the year ended December 31, 2019, net loss attributable to common stockholders was $84.6 million, a difference of $28.0 million compared to net loss for the same period due to a deemed dividend related to the excess fair value provided to Baker Brothers in connection with the December 2019 Private Placement. See Note 7 of the Notes to Financial Statements appearing elsewhere in this Annual Report on Form 10-K for additional details.

Net Operating Loss Carryforwards

We have completed several financings since the effective date of the Tax Reform Act of 1986, which as of December 31, 2020, have resulted in ownership changes that will significantly limit our ability to utilize our net operating loss carryforwards ("NOLs") and tax credit carryforwards. In December 2017, we completed a study which determined that ownership changes had occurred. The federal and state net operating loss and tax credit carryforwards and related deferred tax assets discussed below and included in Note 14 to the financial statements appearing elsewhere in this Annual Report on Form 10-K have been adjusted to reflect the limitations that resulted from this study. The Company continues to monitor equity activity and potential ownership changes.

As of December 31, 2020, the Company had cumulative federal and state NOLs of approximately $328.7 million and $323.2 million available to reduce federal and state taxable income, respectively. As a result of the Tax Cuts and Jobs Act of 2017, federal net operating losses incurred for taxable years beginning after January 1, 2018 have an unlimited carryforward period, but can only be utilized to offset 80% of taxable income in future taxable periods. Of the $328.7 million of federal NOLs, $131.3 million have an unlimited carryforward and the remaining NOLs are still subject to expiration through 2037. State NOLs are still subject to expiration according to the laws of each respective jurisdiction. The Company files state tax returns in Massachusetts and Pennsylvania whereby both jurisdictions impose a 20-year carryforward period. All $323.2 million of state NOLs expire through 2040, with the first year of expiration being 2032 for $23.4 million of Massachusetts NOLs. In addition, at December 31, 2020, the Company had cumulative federal and state tax credit carryforwards of $25.0 million and $1.9 million, respectively, available to reduce federal and state income taxes, respectively, which expire through 2040 and 2033, respectively, for federal and state purposes, other than those that have an unlimited carryforward period.

Financial Condition, Liquidity and Capital Resources

Financial Condition

As of December 31, 2020, we had an accumulated deficit of $833.6 million. To date, substantially all of our revenues have been from collaboration and license agreements and we have received no revenues from the sale of commercial products. We generated no revenue for the fiscal year ended December 31, 2020.

We have devoted substantially all of our efforts to research and development, including clinical trials, and we have not completed development of any commercial products. Our research and development activities, together with our general and administrative expenses, are expected to continue to result in substantial operating losses for the foreseeable future. These losses, among other things, have had and will continue to have an adverse effect on our stockholders' equity, total assets and working capital. Because of the numerous risks and uncertainties associated with developing drug candidates, and if approved, commercial products, we are unable to predict the extent of any future losses, whether or when any of our drug candidates will become commercially available or when we will become profitable, if at all.

Specifically, we have invested and intend to continue to invest a significant portion of our time and financial resources in the development and commercialization of tilsotolimod. Accordingly, our ability to generate product revenues will depend heavily on our ability to successfully develop, obtain regulatory approval for and commercialize tilsotolimod. Developing, obtaining regulatory approval, and commercializing a drug candidate requires substantial time, effort and financial resources and is uncertain. Even if tilsotolimod receives approval from the FDA, European Medicines Agency ("EMA") or other regulatory authorities for one or more indications, we will incur significant expenses to support the commercialization and launch of tilsotolimod, which investment may never be realized if sales are insufficient.

Liquidity and Capital Resources

Overview

We require cash to fund our operating expenses and to make capital expenditures. Historically, we have funded our cash requirements primarily through the following:

(i) sale of common stock, preferred stock and warrants;

(ii) exercise of warrants;

(iii) debt financing, including capital leases;

(iv) license fees, research funding and milestone payments under collaborative and license agreements; and
(v) interest income.

We filed a shelf registration statement on Form S-3 on August 4, 2020, which was declared effective on September 2, 2020, relating to the sale, from time to time, in one or more transactions, up to $150.0 million of common stock, preferred stock, depository shares and warrants. As of February 15, 2021, approximately $73.2 million remained available for issuance under this registration statement, assuming the full contractual amounts provided for under the LPC Purchase Agreement and the ATM Agreement (each as defined below) were to be sold.

LPC Purchase Agreement

On March 4, 2019, the Company entered into a Purchase Agreement with Lincoln Park Capital Fund, LLC ("Lincoln Park"), pursuant to which, upon the terms and subject to the conditions and limitations set forth therein, Lincoln Park has committed to purchase an aggregate of $35.0 million of shares of Company common stock from time to time at the Company's sole discretion (the "LPC Purchase Agreement").

During the years ended December 31, 2020 and 2019, the Company sold 750,000 and 1,535,848 shares, respectively, pursuant to the LPC Purchase Agreement, resulting in net proceeds of $1.7 million and $3.7 million,

respectively. Additionally, during the period January 1, 2021 through February 28, 2021, the Company sold 800,000 shares of its common stock pursuant to the LPC Purchase Agreement, resulting in net proceeds of $4.2 million. As of February 28, 2021, the Company may sell up to an additional $25.3 million of shares under the LPC Purchase Agreement, subject to certain limitations.

ATM Agreement

In November 2018, the Company entered into an Equity Distribution Agreement (the "ATM Agreement") with JMP Securities LLC ("JMP") pursuant to which the Company may issue and sell shares of its common stock having an aggregate offering price of up to $50.0 million through JMP as its agent.

During the years ended December 31, 2020 and 2019, the Company sold 3,608,713 and 532,700 shares, respectively, pursuant to the ATM Agreement, resulting in net proceeds, after deduction of commissions and other offering expenses, of $12.3 million and $1.6 million, respectively. Additionally, during the period January 1, 2021 through February 28, 2021, the Company sold 2,394,956 shares of its common stock pursuant to the ATM Agreement resulting in net proceeds, after deduction of commissions, of $12.1 million. As of February 28, 2021, the Company may sell up to an additional $22.9 million of shares under the ATM Agreement.

The LPC Purchase Agreement and ATM Agreement are more fully described in Note 8 of the notes to our financial statements included elsewhere in this Annual Report on Form 10-K.

Private Placements

As more fully described in Notes 7 and 8 to the financial statements appearing elsewhere in this Annual Report on Form 10-K, between December 2019 and July 2020, the Company entered into three private placement financings with certain investors, which, collectively, may provide the Company with funding of up to $138.4 million, of which $25.2 million has been received through December 31, 2020. This funding is solely at the discretion of the investors and consists of:

(i) the December 2019 Securities Purchase Agreement, under which we received $10.1 million in gross proceeds in December 2019 and provides for up to $87.6 million additional aggregate gross proceeds at the sole discretion of Baker Brothers in connection with additional sales of securities and warrant exercises;

(ii) the April 2020 Securities Purchase Agreement, under which we received $5.0 million gross proceeds in April 2020 and $5.0 million gross proceeds in December 2020 and provides for up to $10.7 million additional aggregate gross proceeds at the sole discretion of entities affiliated with Pillar in connection with the exercise of outstanding warrants; and

(iii) the July 2020 Securities Purchase Agreement, under which we received $5.1 million gross proceeds in July 2020 and provides for up to $14.9 million additional aggregate gross proceeds at the sole discretion of entities affiliated with Pillar in connection with sales of additional securities and warrant exercises.

Funding Requirements

We had cash, cash equivalents and investments of approximately $37.7 million at December 31, 2020. We believe based on our current operating plan, our existing cash, cash equivalents and investments on hand as of December 31, 2020, plus cash received through February 2021 from the ATM Agreement and LPC Purchase Agreement, will enable us to fund our operations into the second quarter of 2022. Specifically, we believe our available funds will be sufficient to enable us to perform the following:

(i) continue to execute on our ongoing Phase 3 clinical trial of tilsotolimod in combination with ipilimumab for the treatment of anti-PD1 refractory metastatic melanoma (ILLUMINATE-301), including announcing key topline data and beginning the filing of a New Drug Application with the FDA;

(ii) continue enrollment in the current Low-Dose, High-Frequency Cohort of our Phase 2 study of tilsotolimod in combination with nivolumab and ipilimumab for the treatment of MSS-CRC (ILLUMINATE-206);

(iii) fund certain investigator initiated clinical trials of tilsotolimod; and

(iv) maintain our current level of general and administrative expenses in order to support the business.

Assuming Baker Brothers and Pillar exercise their rights under their respective securities purchase agreement and no other forms of external funding, we expect the proceeds could fund operations beyond an NDA filing for tilsotolimod and into the second quarter of 2023. In addition, we are seeking and expect to continue to seek additional funding through collaborations, the sale or license of assets or financings of equity or debt securities. We believe that the key factors that will affect our ability to obtain funding are:

(i) the results of our clinical development activities in our tilsotolimod program or any other drug candidates we develop on the timelines anticipated;

(ii) the cost, timing, and outcome of regulatory reviews;

(iii) competitive and potentially competitive products and technologies and investors' receptivity to tilsotolimod or any other drug candidates we develop and the technology underlying them in light of competitive products and technologies;

(iv) the receptivity of the capital markets to financings by biotechnology companies generally and companies with drug candidates and technologies similar to ours specifically;

(v) the receptivity of the capital markets to any in-licensing, product acquisition or other transaction we may enter into;

(vi) our ability to enter into additional collaborations with biotechnology and pharmaceutical companies and the success of such collaborations; and

(vii) the impact of the novel coronavirus disease, COVID-19, to global economy and capital markets, and to our business and our financial results.

In addition, increases in expenses or delays in clinical development may adversely impact our cash position and require additional funds or cost reductions.

Financing may not be available to us when we need it or may not be available to us on favorable or acceptable terms or at all. Additionally, Baker Brothers may not exercise their right to purchase convertible preferred stock or exercise warrants in connection with the December 2019 Securities Purchase Agreement and the Pillar Investment Entities may not exercise their right to purchase shares of common stock (or pre-funded warrants) and common warrants, or exercise common warrants in connection with the April 2020 Securities Purchase Agreement or the July 2020 Securities Purchase Agreement. We could be required to seek funds through collaborative alliances or through other means that may require us to relinquish rights to some of our technologies, drug candidates or drugs that we would otherwise pursue on our own. In addition, if we raise additional funds by issuing equity securities, our then existing stockholders may experience dilution. The terms of any financing may adversely affect the holdings or the rights of existing stockholders. An equity financing that involves existing stockholders may cause a concentration of ownership. Debt financing, if available, may involve agreements that include covenants limiting or restricting our ability to take specific actions, such as incurring additional debt, making capital expenditures or declaring dividends, and are likely to include rights that are senior to the holders of our common stock. Any additional debt or equity financing may contain terms which are not favorable to us or to our stockholders, such as liquidation and other preferences, or liens or other restrictions on our assets. As discussed in Note 14 to the financial statements appearing elsewhere in this Annual Report on Form 10-K, additional equity financings may also result in cumulative changes in ownership over a three-year period in excess of 50% which would limit the amount of net operating loss and tax credit carryforwards that we may utilize in any one year.

If we are unable to obtain adequate funding on a timely basis or at all, we will be required to terminate, modify or delay our clinical trials of tilsotolimod, or relinquish rights to portions of our technology, drug candidates and/or products.

Cash Flows

The following table presents a summary of the primary sources and uses of cash for the years ended December 31, 2020 and 2019:

(in thousands)	Year Ended December 31, 2020	2019
Net cash provided by (used in):		
Operating activities	$ (33,772)	$ (44,498)
Investing activities	(1,687)	(2,402)
Financing activities	28,669	15,488
Decrease in cash and cash equivalents	**$ (6,790)**	**$ (31,412)**

Operating Activities. The net cash used in operating activities for all periods presented consists primarily of our net losses adjusted for non-cash charges and changes in components of working capital. The decrease in cash outflow for the year ended December 31, 2020, as compared to 2019, related to lower costs for our tilsotolimod development program.

Investing Activities. Net cash (used in) provided by investing activities primarily consisted of the following amounts relating to our investments in available-for-sale securities and purchases and disposals of property and equipment:

- for the year ended December 31, 2020, proceeds from the maturity of available-for-sale securities of $10.5 million, substantially offset by the purchase of $12.2 million of available-for-sale securities; and
- for the year ended December 31, 2019, proceeds from the maturity of available-for-sale securities of $42.1 million, substantially offset by the purchase of $44.5 million of available-for-sale securities.

Financing Activities. Net cash provided by financing activities primarily consisted of the following amounts raised in connection with the following transactions:

- for the year ended December 31, 2020, aggregate net proceeds of $28.8 million from financing arrangements consisting of $14.8 million received pursuant to the April 2020 and July 2020 Securities Purchase Agreements, $1.7 million received pursuant to the LPC Purchase Agreement and $12.3 million received under the ATM Agreement, plus an additional $0.1 million in proceeds from employee stock purchases under our 2017 Employee Stock Purchase Plan (“2017 ESPP”), partially offset by $0.2 million in payments related to our short-term insurance premium financing arrangement; and
- for the year ended December 31, 2019, $15.5 million in aggregate net proceeds from financing arrangements consisting of $10.1 million received pursuant to the December 2019 Securities Purchase Agreement, $3.7 million received pursuant to the LPC Purchase Agreement and $1.6 million received under the ATM Agreement, plus an additional $0.1 million in proceeds from employee stock purchases under our 2017 ESPP.

Material Cash Requirements

As of December 31, 2020, we had a material lease commitment in an aggregate amount of $1.1 million relating to our facility in Exton, Pennsylvania. This lease expires on May 31, 2025. See Note 13 of the Notes to Financial Statements in this Annual Report on Form 10-K for additional information.

Critical Accounting Policies and Estimates

This management's discussion and analysis of financial condition and results of operations is based on our financial statements, which have been prepared in accordance with accounting principles generally accepted in the United States. The preparation of these financial statements 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 financial statements and the reported amounts of revenues and expenses during the reporting period. On an ongoing basis, management evaluates its estimates and judgments, including those related to warrant and future tranche right liabilities and related revaluation gains (losses), research and development prepayments, accruals and related expenses, stock-based compensation, and revenue recognition. Management bases its estimates and judgments on historical experience and on various other factors that are believed to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions.

We regard an accounting estimate or assumption underlying our financial statements as a "critical accounting estimate" where:

- the nature of the estimate or assumption is material due to the level of subjectivity and judgment necessary to account for highly uncertain matters or the susceptibility of such matters to change; and
- the impact of the estimates and assumptions on financial condition or operating performance is material.

While our significant accounting policies are described in more detail in Note 2 to our financial statements appearing elsewhere in this Annual Report on Form 10-K, we believe the following accounting policies to be most critical to the judgments and estimates used in the preparation of our financial statements.

Warrant and Future Tranche Right Liabilities and Related Revaluation Gain (Loss)

We entered into the December 2019 Securities Purchase Agreement, as more fully described in Note 7 of the Notes to Financial Statements appearing elsewhere in this Annual Report on Form 10-K, pursuant to which we issued shares of convertible preferred stock with detachable warrants. Additionally, the December 2019 Securities Purchase Agreement contains call options on redeemable preferred shares with warrants (conditionally exercisable for shares that are puttable), which we refer to as future tranche rights.

We determined that these warrants and future tranche rights represent freestanding financial instruments and account for both the warrants and future tranche rights as liabilities, which requires the measurement of the fair value of the liability at the time of issuance and recording changes as a charge to current earnings at each reporting period, which is included in Warrant Liability Revaluation Expense and/or Future Tranche Right Liability Revaluation Expense in the Company's statements of operations.

Warrant Liability. We use an option pricing model to value our liability-classified warrants. Inherent in the valuation model are assumptions related to volatility, risk-free interest rate, expected term, dividend rate, and other scenarios (i.e. probability of complex features of the warrants being triggered). Due to the nature of and inputs in the model used to assess the fair value of the warrants, it is not abnormal to experience significant fluctuations during each remeasurement period.

Future Tranche Right Liability. We use both a lattice model and a Monte Carlo simulation to value the future tranche rights. We selected these models as we believe they are reflective of all significant assumptions that market participants would likely consider in negotiating the transfer of the future tranche rights. Such assumptions include, among other inputs, stock price volatility, risk-free rates, and expected terms inclusive of early exercise and cancellation assumptions. Due to the nature of and inputs in the model used to assess the fair value of the future tranche rights, it is not abnormal to experience significant fluctuations during each remeasurement period.

Research and Development Prepayments, Accruals and Related Expenses

As part of the process of preparing our financial statements, we are required to estimate our accrued and prepaid expenses for research and development activities performed by third parties, including Clinical Research Organizations ("CROs") and clinical investigators. These estimates are made as of the reporting date of the work completed over the life of the individual study in accordance with agreements established with CROs and clinical trial sites. Some CROs invoice us on a monthly basis, while others invoice upon achievement of milestones and the expense is recorded as services are rendered. We determine the estimates of research and development activities incurred at the end of each reporting period through discussion with internal personnel and outside service providers as to the progress or stage of completion of trials or services, as of the end of each reporting period, pursuant to contracts with clinical trial centers and CROs and the agreed upon fee to be paid for such services. We periodically confirm the accuracy of our estimates with the service providers and make adjustments if necessary. Clinical trial site costs related to patient enrollments are recorded as patients are entered into the trial.

Stock-Based Compensation

We recognize all share-based payments to employees and directors as expense in our statements of operations based on their fair values. We record compensation expense over an award's requisite service period, or vesting period, based on the award's fair value at the date of grant. Our policy is to charge the fair value of stock options as an expense, adjusted for forfeitures, on a straight-line basis over the vesting period, which is generally four years for employees and one year for directors.

We use the Black-Scholes option pricing model to estimate the fair value of stock option grants. The Black-Scholes option pricing model relies on a number of key assumptions to calculate estimated fair values, including assumptions as to average risk-free interest rate, expected dividend yield, expected life and expected volatility. For the assumed risk-free interest rate, we use the U.S. Treasury security rate with a term equal to the expected life of the option. Our assumed dividend yield of zero is based on the fact that we have never paid cash dividends to common stockholders and have no present intention to pay cash dividends. We use an expected option life based on actual experience. Our assumption for expected volatility is based on the actual stock-price volatility over a period equal to the expected life of the option.

If factors change and we employ different assumptions for estimating stock-based compensation expense in future periods, or if we decide to use a different valuation model, the stock-based compensation expense we recognize in future periods may differ significantly from what we have recorded in the current period and could materially affect our operating income (loss), net income (loss) and earnings (loss) per share. It may also result in a lack of comparability with other companies that use different models, methods and assumptions. The Black-Scholes option pricing model was developed for use in estimating the fair value of traded options that have no vesting restrictions and are fully transferable. These characteristics are not present in our option grants. Although the Black-Scholes option pricing model is widely used, existing valuation models, including the Black-Scholes option pricing model, may not provide reliable measures of the fair values of our stock-based compensation.

New Accounting Pronouncements

New accounting pronouncements are discussed in Note 2 of the Notes to Financial Statements in this Annual Report on Form 10-K.

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

As of December 31, 2020, all material assets and liabilities are in U.S. dollars, which is our functional currency.

We maintain investments in accordance with our investment policy. The primary objectives of our investment activities are to preserve principal, maintain proper liquidity to meet operating needs and maximize yields. Although our investments are subject to credit risk, our investment policy specifies credit quality standards for our investments and limits the amount of credit exposure from any single issue, issuer or type of investment. We regularly review our investment holdings in light of the then current economic environment. At December 31, 2020, all of our invested funds were invested in (i) money market funds classified in cash and cash equivalents on the accompanying balance sheet and (ii) U.S. treasury bills and commercial paper classified in short-term investments on the accompanying balance sheet.

Based on a hypothetical ten percent adverse movement in interest rates, the potential losses in future earnings, fair value of risk sensitive financial instruments, and cash flows are immaterial to our earnings, although the actual effects may differ materially from the hypothetical analysis.

Item 8. Financial Statements and Supplementary Data.

All financial statements required to be filed hereunder are filed as listed under Item 15(a) of this Annual Report on Form 10-K and are incorporated herein by this reference.

There have been no retrospective changes to our statements of operations for any of the quarters within the two years in the period ended December 31, 2020.

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

None.

Item 9A. Controls and Procedures.

Disclosure Controls and Procedures

Our management, with the participation of our principal executive officer and principal financial officer, evaluated the effectiveness of our disclosure controls and procedures (as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act) as of December 31, 2020. In designing and evaluating our disclosure controls and procedures, management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving their objectives and our management necessarily applied its judgment in evaluating the cost-benefit relationship of possible controls and procedures. Based on this evaluation, our principal executive officer and principal financial officer concluded that as of December 31, 2020, our disclosure controls and procedures were (1) designed to ensure that material information relating to us is made known to our principal executive officer and principal financial officer by others, particularly during the period in which this report was prepared, and (2) effective, in that they provide reasonable assurance that information required to be disclosed by us in the reports we file or submit under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms.

Internal Control over Financial Reporting

a) Management's Annual Report on Internal Control over Financial Reporting

Our management, with the participation of our principal executive officer and principal financial officer, is responsible for establishing and maintaining adequate internal control over financial reporting. Internal control over financial reporting is defined in Rule 13a-15(f) and 15d-15(f) promulgated under the Exchange Act as a process designed by, or under the supervision of, the Company's principal executive and principal financial officers

and effected by the Company's board of directors, management and other personnel, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles and includes those policies and procedures that:

- Pertain to the maintenance of records that in reasonable detail accurately and fairly reflect the transactions and dispositions of the assets of the Company;

- Provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the Company are being made only in accordance with authorizations of management and directors of the Company; and

- Provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of the Company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Therefore, even those systems determined to be effective can provide only reasonable assurance with respect to financial statement preparation and presentation. Projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Management assessed the effectiveness of our internal control over financial reporting as of December 31, 2020. In making this assessment, management used the criteria set forth by the Committee of Sponsoring Organizations of the Treadway Commission in *Internal Control — Integrated Framework* (2013).

Based on its assessment, management believes that, as of December 31, 2020, the Company's internal control over financial reporting is effective based on those criteria.

b) Attestation Report of the Registered Public Accounting Firm

Not Applicable.

c) Changes in Internal Control over Financial Reporting.

No change in our internal control over financial reporting occurred during the fourth quarter of the fiscal year ended December 31, 2020 that has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. Other Information.

None.

PART III.

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

The information required by this item is incorporated by reference to our Proxy Statement for the 2021 Annual Meeting of Stockholders to be filed with the Securities and Exchange Commission within 120 days of the fiscal year ended December 31, 2020.

We have adopted a written code of business conduct and ethics that applies to our principal executive officer, principal financial officer, principal accounting officer or controller, or persons performing similar functions. We have posted a current copy of the Code of Business Conduct and Ethics in the "Investors — Corporate Governance" section of our website, which is located at www.iderapharma.com. We intend to satisfy the disclosure requirements under Item 5.05 of Form 8-K regarding an amendment to, or waiver from, a provision of our code of business conduct and ethics by posting such information on our website at www.iderapharma.com.

Item 11. Executive Compensation.

The information required by this item is incorporated by reference to our Proxy Statement for the 2021 Annual Meeting of Stockholders to be filed with the Securities and Exchange Commission within 120 days of the fiscal year ended December 31, 2020.

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

The information required by this item is incorporated by reference to our Proxy Statement for the 2021 Annual Meeting of Stockholders to be filed with the Securities and Exchange Commission within 120 days of the fiscal year ended December 31, 2020.

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

The information required by this item is incorporated by reference to our Proxy Statement for the 2021 Annual Meeting of Stockholders to be filed with the Securities and Exchange Commission within 120 days of the fiscal year ended December 31, 2020.

Item 14. Principal Accountant Fees and Services.

The information required by this item is incorporated by reference to our Proxy Statement for the 2021 Annual Meeting of Stockholders to be filed with the Securities and Exchange Commission within 120 days of the fiscal year ended December 31, 2020.

PART IV.

Item 15. Exhibits and Financial Statement Schedules.

(a) (1) *Financial Statements.*

(2) We are not filing any financial statement schedules as part of this Annual Report on Form 10-K because they are not applicable or the required information is included in the financial statements or notes thereto.

(3) The list of Exhibits filed as a part of this Annual Report on Form 10-K is set forth on the Exhibit Index below.

(b) The list of Exhibits filed as a part of this Annual Report on Form 10-K is set forth on the Exhibit Index below.

(c) None.

Exhibit Index

Exhibit Number	Description	Incorporated by Reference to			
		Form	SEC File No.	Exhibit(s)	Filing Date
1.1	Equity Distribution Agreement, dated November 26, 2018, by and between Idera Pharmaceuticals, Inc. and JMP Securities LLC	8-K	001-31918	1.1	November 26, 2018
2.1	Agreement and Plan of Merger, dated as January 21, 2018, by and among Idera Pharmaceuticals, Inc., BioCryst Pharmaceuticals, Inc., Nautilus Holdco, Inc., Island Merger Sub, Inc. and Boat Merger Sub, Inc.	8-K	001-31918	2.1	January 22, 2018
3.1	Restated Certificate of Incorporation of Idera Pharmaceuticals, Inc., as amended.	10-Q	001-31918	3.1	August 2, 2018
3.2	Certificate of Amendment to the Restated Certificate of Incorporation of Idera Pharmaceuticals, Inc.	8-K	001-31918	3.1	May 18, 2020
3.3	Amended and Restated Bylaws of Idera Pharmaceuticals, Inc.	10-K	001-31918	3.2	March 7, 2018
3.4	Certificate of Designations, Preferences and Rights of Series B1 Convertible Preferred Stock, Series B2 Convertible Preferred Stock, Series B3 Convertible Preferred Stock and Series B4 Convertible Preferred Stock of the Company	8-K	001-31918	3.1	December 23, 2019
4.1	Specimen Certificate for shares of Common Stock, $.001 par value, of Idera Pharmaceuticals, Inc.	S-1	33-99024	4.1	December 8, 1995
4.2	Unit Purchase Agreement by and among Idera Pharmaceuticals, Inc. and certain persons and entities listed therein, dated April 1, 1998	10-K	000-27352	10.39	April 1, 2002
4.3	Form of Warrant issued in May 2013 to purchasers in Idera Pharmaceuticals, Inc.'s registered public offering on Idera Pharmaceuticals, Inc.'s registration statement on Form S-1 (File No. 333-187155)	10-Q	001-31918	10.5	May 15, 2013
4.4	Form of Warrant issued in September 2013 to purchasers in Idera Pharmaceuticals, Inc.'s registered public offering on Idera Pharmaceuticals, Inc.'s registration statement on Form S-3 (File No. 333-191073)	8-K	001-31918	4.1	September 26, 2013
4.5	Form of Warrant issued in February 2014 to purchasers in Idera Pharmaceuticals, Inc.'s registered public offering on Idera Pharmaceuticals, Inc.'s registration statement on Form S-3 (File No. 333-191073)	8-K	001-31918	4.1	February 5, 2014
4.6	Form of Warrant issued in December 2019 to purchasers in Idera Pharmaceuticals, Inc. private placement transaction	8-K	001-31918	4.1	December 23, 2019

Exhibit Number	Description	Incorporated by Reference to			
		Form	SEC File No.	Exhibit(s)	Filing Date
4.7	Warrant Amendment Agreement, dated as of December 23, 2019, by and among Idera Pharmaceuticals, Inc. and certain holders of warrants named therein	10-K	001-31918	4.13	March 12, 2020
4.8	Form of Pre-Funded Warrant issuable pursuant to the April 2020 Securities Purchase Agreement	8-K	001-31918	4.1	April 7, 2020
4.9	Form of Warrant issuable pursuant to the April 2020 Securities Purchase Agreement	8-K	001-31918	4.2	April 7, 2020
4.10	Form of Pre-Funded Warrant issuable pursuant to the July 2020 Securities Purchase Agreement	8-K	001-31918	4.1	July 15, 2020
4.11	Form of Warrant issuable pursuant to the July 2020 Securities Purchase Agreement	8-K	001-31918	4.2	July 15, 2020
4.12	Registration Rights Agreement, dated March 24, 2006, by and among Idera Pharmaceuticals, Inc. and the Investors named therein	8-K	001-31918	10.2	March 29, 2006
4.13	Registration Rights Agreement, dated February 9, 2015, among Idera Pharmaceuticals, Inc. and the Selling Stockholders named therein	8-K	001-31918	4.1	February 9, 2015
4.14	Amendment to the Registration Rights Agreement, dated January 21, 2018, by and among Idera Pharmaceuticals, Inc., 667, L.P., Baker Brothers Life Sciences, L.P. and 14159, L.P.	8-K	001-31918	10.1	January 22, 2018
4.15	Registration Rights Agreement, dated as of March 4, 2019, by and between Idera Pharmaceuticals, Inc. and Lincoln Park Capital Fund, LLC	10-K	001-31918	4.5	March 6, 2019
4.16	Registration Rights Agreement, dated December 23, 2019, by and among Idera Pharmaceuticals, Inc. and certain investors named therein	10-K	001-31918	4.11	March 12, 2020
4.17	Voting Agreement, dated as of December 23, 2019, by and among Idera Pharmaceuticals, Inc. and certain investors named therein	10-K	001-31918	4.12	March 12, 2020
4.18	Registration Rights Agreement, dated April 7, 2020, by and among Idera Pharmaceuticals, Inc. and Pillar Partners Foundation, L.P.	8-K	001-31918	4.4	April 7, 2020
4.19	Voting Agreement, dated April 7, 2020, by and among Idera Pharmaceuticals, Inc. and Pillar Partners Foundation, L.P.	8-K	001-31918	4.3	April 7, 2020
4.20	Registration Rights Agreement, dated July 13, 2020, by and among Idera Pharmaceuticals, Inc. and Pillar Partners Foundation, L.P.	8-K	001-31918	4.3	July 15, 2020

Exhibit Number	Description	Incorporated by Reference to			
		Form	SEC File No.	Exhibit(s)	Filing Date
4.21*	Description of the Idera Pharmaceuticals, Inc. Securities Registered Under Section 12 of the Securities Exchange Act of 1934				
10.1†	2008 Stock Incentive Plan, as amended	8-K	001-31918	99.2	June 17, 2011
10.2†	2013 Stock Incentive Plan, as amended	8-K	001-31918	10.1	June 13, 2014
10.3†	Amendment to 2013 Stock Incentive Plan, as amended	8-K	001-31918	10.1	June 11, 2015
10.4†	Amendment to 2013 Stock Incentive Plan, as amended	8-K	001-31918	10.1	June 9, 2017
10.5†	Amendment to 2013 Stock Incentive Plan, as amended	DEF14A	001-31918	Appendix A	April 25, 2019
10.6†	2017 Employee Stock Purchase Plan	8-K	001-31918	10.2	June 9, 2017
10.7†	Amendment to 2017 Employee Stock Purchase Plan	DEF14A	001-31918	Appendix C	April 25, 2019
10.8	Policy on Treatment of Stock Options in the Event of Retirement, approved April 28, 2014	10-Q	001-31918	10.1	August 12, 2014
10.9†	Form of Incentive Stock Option Agreement Granted Under the 2008 Stock Incentive Plan	8-K	001-31918	10.2	June 10, 2008
10.10†	Form of Nonstatutory Stock Option Agreement Granted Under the 2008 Stock Incentive Plan	8-K	001-31918	10.3	June 10, 2008
10.11†	Form of Nonstatutory Stock Option Agreement (Non-Employee Directors) Granted Under the 2008 Stock Incentive Plan	8-K	001-31918	10.4	June 10, 2008
10.12†	Form of Restricted Stock Agreement Under the 2008 Stock Incentive Plan	8-K	001-31918	10.5	June 10, 2008
10.13†	Form of Incentive Stock Option Agreement granted under the 2013 Stock Incentive Plan	8-K	001-31918	10.2	July 29, 2013
10.14†	Form of Nonstatutory Stock Option Agreement granted under the 2013 Stock Incentive Plan	8-K	001-31918	10.3	July 29, 2013
10.15†	Form of Nonstatutory Stock Option Agreement (Non-Employee Directors) granted under the 2013 Stock Incentive Plan	8-K	001-31918	10.4	July 29, 2013
10.16†	Form of Inducement Stock Option Award – Nonstatutory Stock Option Agreement	10-Q	001-31918	10.1	November 6, 2015
10.17†	Form of Restricted Stock Agreement under the 2013 Stock Incentive Plan	10-Q	001-31918	10.3	August 8, 2019
10.18†	Form of Performance-Based Restricted Stock Agreement under the 2013 Stock Incentive Plan	10-Q	001-31918	10.3	October 29, 2020
10.19†	Employment Letter Agreement, dated December 1, 2014, by and between Idera Pharmaceuticals, Inc. and Vincent Milano	10-K	001-31918	10.24	March 12, 2015
10.20†	Amendment to Employment Agreement, dated January 10, 2020, by and between the Company and Vincent J. Milano	8-K	001-31918	10.1	January 15, 2020

Exhibit Number	Description	Incorporated by Reference to			
		Form	SEC File No.	Exhibit(s)	Filing Date
10.21†	Form of Vincent J. Milano Restricted Stock Unit Agreement	8-K	001-31918	10.2	January 15, 2020
10.22†	Employment Letter, dated January 26, 2015, by and between Idera Pharmaceuticals, Inc. and Clayton Fletcher	10-Q	001-31918	10.1	May 11, 2015
10.23†	Consulting Agreement, dated December 29, 2020, between the Company and R. Clayton Fletcher	8-K	001-31918	10.1	January 5, 2021
10.24†	Employment Offer Letter, dated October 15, 2015, by and between Idera Pharmaceuticals, Inc. and John J. Kirby	10-K	001-31918	10.26	March 6, 2019
10.25†*	Employment Offer Letter, dated November 16, 2020, by and between Idera Pharmaceuticals, Inc. and Daniel Soland				
10.26†*	Severance and Change of Control Agreement, dated February 19, 2021, by and between the Company and Daniel Soland				
10.27†	Employment Offer Letter, dated August 20, 2018, by and between Idera Pharmaceuticals, Inc. and Bryant D. Lim	10-Q	001-31918	10.1	November 6, 2018
10.28†	Employment Offer Letter, dated June 26, 2019, by and between Idera Pharmaceuticals, Inc. and Elizabeth Tarka	10-Q	001-31918	10.4	August 8, 2019
10.29†	Form of Director and Officer Indemnification Agreement	10-Q	001-31918	10.1	May 4, 2017
10.30†	Form of Executive Severance and Change of Control Agreement	10-Q	001-31918	10.2	May 4, 2017
10.31††	Development and Commercialization Agreement, dated May 1, 2014, by and between Abbott Molecular Inc. and Idera Pharmaceuticals, Inc.	10-Q	001-31918	10.3	August 12, 2014
10.32††	License Agreement, dated November 28, 2016, by and between Idera Pharmaceuticals, Inc. and Vivelix Pharmaceuticals, Ltd.	10-K	001-31918	10.56	March 15, 2017
10.33††	Clinical Trial Collaboration and Supply Agreement, by and between Idera Pharmaceuticals, Inc. and Bristol-Myers Squibb Company, dated May 18, 2018	10-Q	001-31918	10.1	August 2, 2018
10.34††	Clinical Trial Collaboration and Supply Agreement, by and between Idera Pharmaceuticals, Inc. and Bristol-Myers Squibb Company, dated March 11, 2019	10-Q	001-31918	10.1	May 2, 2019
10.35††	Clinical Trial Collaboration and Supply Agreement, effective August 27, 2019, by and between AbbVie Inc. and Idera Pharmaceuticals, Inc.	10-Q	001-31918	10.1	November 6, 2019
10.36	Lease Agreement dated March 31, 2015, between Idera Pharmaceuticals, Inc. and 505 Eagleview Boulevard Associates, L.P.	10-K	001-31918	10.45	March 7, 2018

Exhibit Number	Description	Incorporated by Reference to			
		Form	SEC File No.	Exhibit(s)	Filing Date
10.37	First Amendment dated September 23, 2015 to Lease Agreement dated March 31, 2015 between Idera Pharmaceuticals, Inc. and 505 Eagleview Boulevard Associates, L.P.	10-K	001-31918	10.46	March 7, 2018
10.38	Second Amendment dated January 13, 2020 to Lease Agreement dated March 31, 2015 between Idera Pharmaceuticals, Inc. and 505 Eagleview Boulevard Associates, L.P.	10-K	001-31918	10.42	March 12, 2020
10.39	Purchase Agreement, dated as of March 4, 2019, by and between Idera Pharmaceuticals, Inc. and Lincoln Park Capital Fund, LLC	10-K	001-31918	10.37	March 6, 2019
10.40	First Amendment to Purchase Agreement, dated as of September 2, 2020, by and between Idera Pharmaceuticals, Inc. and Lincoln Park Capital Fund, LLC	8-K	001-31918	10.1	September 3, 2020
10.41	Securities Purchase Agreement, dated December 23, 2019, by and among the institutional investors named therein	8-K	001-31918	10.1	December 23, 2019
10.42	Securities Purchase Agreement, dated April 7, 2020, by and among Idera Pharmaceuticals, Inc. and Pillar Partners Foundation, L.P.	8-K	001-31918	10.1	April 7, 2020
10.43	Securities Purchase Agreement, dated July 13, 2020, by and among Idera Pharmaceuticals, Inc. and Pillar Partners Foundation, L.P.	8-K	001-31918	10.1	July 15, 2020
10.44	Amendment to the Securities Purchase Agreement and Registration Rights Agreement, dated December 11, 2020, by and among Idera Pharmaceuticals, Inc., Pillar Partners Foundation, L.P. and Pillar Pharmaceuticals 6, L.P.	8-K	001-31918	10.2	December 15, 2020
23.1*	Consent of Independent Registered Public Accounting Firm				
31.1*	Certification of Chief Executive Officer pursuant to Exchange Act Rules 13a-14 and 15d-14, as adopted pursuant to Section 302 of Sarbanes-Oxley Act of 2002				
31.2*	Certification of Chief Financial Officer pursuant to Exchange Act Rules 13a-14 and 15d-14, as adopted pursuant to Section 302 of Sarbanes-Oxley Act of 2002				
32.1*	Certification of Chief Executive Officer pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002				
32.2*	Certification of Chief Financial Officer pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002				

Exhibit Number	Description	Incorporated by Reference to			
		Form	SEC File No.	Exhibit(s)	Filing Date
101.INS	Inline XBRL Instance Document				
101.SCH	Inline XBRL Taxonomy Extension Schema Document				
101.CAL	Inline XBRL Taxonomy Extension Calculation Linkbase Document				
101.DEF	Inline XBRL Taxonomy Extension Definition Linkbase Document				
101.LAB	Inline XBRL Taxonomy Extension Label Linkbase Document				
101.PRE	Inline XBRL Taxonomy Extension Presentation Linkbase Document				
104	Cover Page Interactive Data File (formatted as inline XBRL with applicable taxonomy extension information contained in Exhibits 101)				

* Filed or furnished, as applicable, herewith.

† Management contract or compensatory plan or arrangement required to be filed as an Exhibit to the Annual Report on Form 10-K.

†† In accordance with Item 601(b)(10) of Regulation S-K, portions of this exhibit have been omitted in order for them to remain confidential.

Item 16. Form 10-K Summary.

Not applicable.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, as amended, the Registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized, on this 1st day of March 2021.

Idera Pharmaceuticals, Inc.

By: /S/ VINCENT J. MILANO
Vincent J. Milano
President and
Chief Executive Officer

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

Signature	Title	Date
/S/ VINCENT J. MILANO Vincent J. Milano	President, Chief Executive Officer and Director (Principal Executive Officer)	March 1, 2021
/S/ JOHN J. KIRBY John J. Kirby	Chief Financial Officer (Principal Financial and Accounting Officer)	March 1, 2021
/S/ JAMES A. GERAGHTY James A. Geraghty	Chairman of the Board of Directors	March 1, 2021
/S/ CRISTINA CSIMMA Cristina Csimma, Pharm. D., M.H.P.	Director	March 1, 2021
/S/ MICHAEL DOUGHERTY Michael Dougherty	Director	March 1, 2021
/S/ MARK GOLDBERG Mark Goldberg, M.D.	Director	March 1, 2021
/S/ MAXINE GOWEN Maxine Gowen, Ph.D.	Director	March 1, 2021
/S/ CAROL A. SCHAFER Carol A. Schafer	Director	March 1, 2021

IDERA PHARMACEUTICALS, INC.

INDEX TO FINANCIAL STATEMENTS
December 31, 2020

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Stockholders and the Board of Directors of Idera Pharmaceuticals, Inc.

Opinion on the Financial Statements

We have audited the accompanying balance sheets of Idera Pharmaceuticals, Inc. (the Company) as of December 31, 2020 and 2019, and the related statements of operations, redeemable preferred stock and stockholders' equity (deficit) and cash flows for each of the three years in the period ended December 31, 2020, and the related notes (collectively referred to as the "financial statements"). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company at December 31, 2020 and 2019, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2020, in conformity with U.S. generally accepted accounting principles.

Basis for Opinion

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

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

Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

Critical Audit Matter

The critical audit matter communicated below is a matter arising from the current period audit of the financial statements that was communicated or required to be communicated to the audit committee and that: (1) relates to accounts or disclosures that are material to the financial statements and (2) involved our especially challenging, subjective or complex judgments. The communication of the critical audit matter does not alter in any way our opinion on the financial statements, taken as a whole, and we are not, by communicating the critical audit matter below, providing a separate opinion on the critical audit matter or on the accounts or disclosures to which it relates.

Valuation of Future Tranche Right Liability

Description of the Matter

As discussed in Notes 2, 3, and 7 to the financial statements, the Company entered into a Securities Purchase Agreement in December of 2019 that contains call options on redeemable preferred shares with warrants that represent freestanding financial instruments that are required to be accounted for as liabilities (Future Tranche Right Liability) and measured at fair value each period. Subsequent changes in the fair value of the Future Tranche Right Liability are recorded as a component of net loss. As of December 31, 2020, the fair value of the Future Tranche Right Liability was $118.8 million and the Company recorded a total of $72.4 million of future tranche right revaluation loss during the year.

Auditing the Company's valuations of the Future Tranche Right Liability was complex and required the involvement of specialists due to the nature of the estimation process and assumptions used by management. The valuation models used by management to measure the fair value of the Future Tranche Right Liability are complex and the respective fair values are sensitive to the significant underlying assumptions. The Company used a binomial lattice model to value the Series B2 and Series B3 components of the Future Tranche Right Liability and a Monte Carlo simulation to value the Series B4 component of the Future Tranche Right Liability. The significant assumptions used in the valuation models included stock price volatility and the expected term of the call options on the preferred shares, which includes both cancellation and early exercise assumptions. These significant assumptions are forward looking and could be affected by future economic and market conditions as well as the outcome of ongoing clinical development activities.

How We Addressed the Matter in Our Audit

To test the estimated fair value of the Future Tranche Right Liability, our audit procedures included, among others, understanding the contractual terms of the Securities Purchase Agreement, and evaluating the completeness and accuracy of the underlying data supporting the significant assumptions and estimates. We also involved our valuation specialists to assist us in evaluating the use of the binomial lattice model and Monte Carlo simulation, as well as testing the significant assumptions used in these models. We evaluated the stock price volatility by independently developing a range of volatilities based on historical, implied and peer group share price volatility information. We also evaluated the expected term estimates used within the models by agreeing the assumptions to the contractual terms and analyzing the effects of forecasted cancellation and early exercise assumptions in the models.

/s/ ERNST & YOUNG LLP

We have served as the Company’s auditor since 2002.

Philadelphia, Pennsylvania
March 1, 2021

IDERA PHARMACEUTICALS, INC.
BALANCE SHEETS

(In thousands)	December 31, 2020	December 31, 2019
ASSETS		
Current assets:		
Cash and cash equivalents	$ 33,229	$ 40,019
Short-term investments	4,499	2,774
Prepaid expenses and other current assets	3,627	3,475
Total current assets	41,355	46,268
Property and equipment, net	44	97
Operating lease right-of-use assets	930	1,054
Other assets	70	70
Total assets	$ 42,399	$ 47,489
LIABILITIES AND STOCKHOLDERS' EQUITY (DEFICIT)		
Current liabilities:		
Accounts payable	$ 329	$ 457
Accrued expenses	6,072	7,461
Operating lease liability	191	163
Future tranche right liability	—	46,436
Other current liability	435	—
Total current liabilities	7,027	54,517
Warrant liability, long-term	6,983	3,241
Future tranche right liability, long-term	118,803	—
Operating lease liability, net of current portion	758	899
Total liabilities	133,571	58,657
Commitments and contingencies (Note 13)		
Preferred stock, $0.01 par value, Authorized — 5,000 shares:		
Series B1 redeemable convertible preferred stock (Note 7); Designated — 278 shares, Issued and outstanding — 24 shares at December 31, 2020 and December 31, 2019	—	—
Stockholders' equity (deficit):		
Preferred stock, $0.01 par value, Authorized — 5,000 shares:		
Series A convertible preferred stock; Designated — 1,500 shares, Issued and outstanding — 1 share	—	—
Common stock, $0.001 par value, Authorized — 140,000 shares; Issued and outstanding — 38,291 and 29,672 at December 31, 2020 and December 31, 2019, respectively	38	30
Additional paid-in capital	742,342	709,692
Accumulated deficit	(833,552)	(720,890)
Total stockholders' deficit	(91,172)	(11,168)
Total liabilities and stockholders' deficit	$ 42,399	$ 47,489

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

IDERA PHARMACEUTICALS, INC.
STATEMENTS OF OPERATIONS

(In thousands, except per share amounts)	Year Ended December 31, 2020	2019	2018
Alliance revenue	$ —	$ 1,448	$ 662
Operating expenses:			
Research and development	24,772	34,853	41,841
General and administrative	11,915	12,481	15,420
Merger-related costs, net	—	—	1,245
Restructuring costs	—	181	3,112
Total operating expenses	36,687	47,515	61,618
Loss from operations	(36,687)	(46,067)	(60,956)
Other income (expense):			
Interest income	165	1,150	1,089
Interest expense	(3)	—	(11)
Warrant revaluation loss	(3,742)	(598)	—
Future tranche right revaluation loss	(72,367)	(10,964)	—
Foreign currency exchange loss	(28)	(36)	(3)
Net loss	$ (112,662)	$ (56,515)	$ (59,881)
Deemed dividend related to December 2019 Private Placement (see Note 7)	—	(28,043)	—
Net loss applicable to common stockholders	$ (112,662)	$ (84,558)	$ (59,881)
Net loss per share applicable to common stockholders - basic and diluted (Note 17)	$ (3.33)	$ (2.96)	$ (2.25)
Weighted-average number of common shares used in computing net loss per share applicable to common stockholders - basic and diluted	33,821	28,545	26,601

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

IDERA PHARMACEUTICALS, INC.
STATEMENTS OF REDEEMABLE PREFERRED STOCK AND STOCKHOLDERS' EQUITY (DEFICIT)

(In thousands)	Series B1 Preferred Number of Shares	Series B1 Preferred $0.01 Par Value	Common Stock Number of Shares	Common Stock $0.001 Par Value	Additional Paid-In Capital	Accumulated Deficit	Total Stockholders' Equity (Deficit)
Balance, December 31, 2017	—	$ —	24,453	$ 24	$ 712,165	$ (604,494)	$ 107,695
Issuance of common stock under employee stock purchase plan	—	—	25	—	243	—	243
Issuance of common stock upon exercise of common stock options and warrants	—	—	2,702	3	10,163	—	10,166
Issuance of common stock for services rendered	—	—	8	—	97	—	97
Stock-based compensation	—	—	—	—	5,674	—	5,674
Net loss	—	—	—	—	—	(59,881)	(59,881)
Balance, December 31, 2018	—	$ —	27,188	$ 27	$ 728,342	$ (664,375)	$ 63,994
Sale of common stock, net of issuance costs	—	—	2,068	3	5,295	—	5,298
Sale of redeemable convertible preferred stock	24	—	—	—	—	—	—
Deemed dividend related to December 2019 Private Placement (Note 7)	—	—	—	—	(28,043)	—	(28,043)
Issuance of commitment shares	—	—	270	—	—	—	—
Issuance of common stock under employee stock purchase plan	—	—	61	—	121	—	121
Issuance of common stock upon exercise of common stock options and warrants	—	—	38	—	3	—	3
Issuance of common stock for services rendered	—	—	47	—	129	—	129
Stock-based compensation	—	—	—	—	3,845	—	3,845
Net loss	—	—	—	—	—	(56,515)	(56,515)
Balance, December 31, 2019	24	$ —	29,672	$ 30	$ 709,692	$ (720,890)	$ (11,168)
Sale of common stock, net of issuance costs	—	—	8,218	8	28,638	—	28,646
Issuance of common stock under employee stock purchase plan (vesting of restricted stock units)	—	—	177	—	—	—	—
Issuance of common stock under employee stock purchase plan	—	—	76	—	113	—	113
Issuance of common stock upon exercise of stock options	—	—	5	—	15	—	15
Issuance of common stock for services rendered	—	—	143	—	243	—	243
Stock-based compensation	—	—	—	—	3,641	—	3,641
Net loss	—	—	—	—	—	(112,662)	(112,662)
Balance, December 31, 2020	24	$ —	38,291	$ 38	$ 742,342	$ (833,552)	$ (91,172)

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

IDERA PHARMACEUTICALS, INC.
STATEMENTS OF CASH FLOWS

(In thousands)	Year Ended December 31, 2020	2019	2018
Cash Flows from Operating Activities:			
Net loss	$ (112,662)	$ (56,515)	$ (59,881)
Adjustments to reconcile net loss to net cash used in operating activities:			
Stock-based compensation	3,641	3,845	5,674
Warrant liability revaluation loss	3,742	598	—
Future tranche right liability revaluation loss	72,367	10,964	—
Issuance of common stock for services rendered	243	129	97
Accretion of discounts on short-term investments	(46)	(372)	—
Depreciation and amortization expense	61	120	432
(Gain) loss on disposal of property and equipment	—	(10)	477
Changes in operating assets and liabilities:			
Prepaid expenses and other assets	500	(2,160)	2,717
Accounts payable, accrued expenses, and other liabilities	(1,629)	(1,105)	(866)
Deferred revenue	—	—	(566)
Other	11	8	—
Net cash used in operating activities	(33,772)	(44,498)	(51,916)
Cash Flows from Investing Activities:			
Purchases of available-for-sale securities	(12,178)	(44,502)	—
Proceeds from maturity of available-for-sale securities	10,499	42,100	—
Proceeds from the sale of property and equipment	—	11	290
Purchases of property and equipment	(8)	(11)	(75)
Net cash (used in) provided by investing activities	(1,687)	(2,402)	215
Cash Flows from Financing Activities:			
Proceeds from private placement	—	10,072	—
Proceeds from common stock financings, net	28,758	5,298	—
Proceeds from employee stock purchases	113	121	243
Proceeds from exercise of common stock options and warrants	15	3	10,166
Payments on note payable and seller-financed purchases	(217)	—	(209)
Other	—	(6)	(8)
Net cash provided by financing activities	28,669	15,488	10,192
Net decrease in cash and cash equivalents	(6,790)	(31,412)	(41,509)
Cash and cash equivalent, beginning of period	40,019	71,431	112,940
Cash and cash equivalents, end of period	$ 33,229	$ 40,019	$ 71,431
Supplemental disclosure of cash flow information:			
Cash paid for interest	$ 3	$ —	$ 9
Increase to operating lease right-of-use asset upon adoption of ASC 842	$ —	$ 1,236	$ —
Increase to operating lease right-of-use assets upon acquisition	$ 54	$ —	$ —
Increase to operating lease liability upon adoption of ASC 842	$ —	$ 1,236	$ —
Increase to operating lease liability upon acquisition	$ 54	$ —	$ —
Supplemental disclosure of non-cash financing and investing activities:			
Offering costs in accounts payable and accrued expenses	$ 112	$ 165	$ 101
Non-cash seller-financed purchases	$ 652	$ —	$ —

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

IDERA PHARMACEUTICALS, INC.

NOTES TO FINANCIAL STATEMENTS
December 31, 2020

Note 1. Business and Organization

Business Overview

Idera Pharmaceuticals, Inc. ("Idera" or the "Company"), a Delaware corporation, is a clinical-stage biopharmaceutical company with a business strategy focused on the clinical development, and ultimately the commercialization, of drug candidates for both oncology and rare disease indications characterized by small, well-defined patient populations with serious unmet medical needs. The Company's current focus is on its Toll-like receptor ("TLR") agonist, tilsotolimod (IMO-2125), for oncology. The Company believes it can develop and commercialize targeted therapies on its own. To the extent the Company seeks to develop drug candidates for broader disease indications, it has entered into and may explore additional collaborative alliances to support development and commercialization.

Liquidity and Financial Condition

As of December 31, 2020, the Company had an accumulated deficit of $833.6 million and a cash, cash equivalents and short-term investments balance of $37.7 million. The Company expects to incur substantial operating losses in future periods and will require additional capital as it seeks to advance tilsotolimod and any future drug candidates through development to commercialization. The Company does not expect to generate product revenue, sales-based milestones or royalties until the Company successfully completes development of and obtains marketing approval for tilsotolimod or other future drug candidates, either alone or in collaboration with third parties, which the Company expects will take a number of years. In order to commercialize tilsotolimod and any future drug candidates, the Company needs to complete clinical development and comply with comprehensive regulatory requirements. The Company is subject to a number of risks and uncertainties similar to those of other companies of the same size within the biotechnology industry, such as uncertainty of clinical trial outcomes, uncertainty of additional funding and history of operating losses.

The Company follows the provisions of Financial Accounting Standards Board ("FASB") Accounting Standards Codification ("ASC") Topic 205-40, *Presentation of Financial Statements—Going Concern*, which requires management to assess the Company's ability to continue as a going concern within one year after the date the financial statements are issued. Management currently anticipates that the Company's balance of cash, cash equivalents, and short-term investments on hand as of December 31, 2020, plus a total of $16.3 million of cash received in January and February 2021 from the ATM Agreement (Note 8) and the LPC Purchase Agreement (Note 8), is sufficient to enable the Company to continue as a going concern through the one-year period subsequent to the filing date of this Annual Report on Form 10-K and fund operations into the second quarter of 2022. The Company has and will continue to evaluate available alternatives to extend its operations beyond this date, which include raising additional capital through the Company's December 2019 Securities Purchase Agreement (Note 7), LPC Agreement (Note 8), ATM Agreement (Note 8), April 2020 Securities Purchase Agreement (Note 8), July 2020 Securities Purchase Agreement (Note 8), or additional financing or strategic transactions. Additionally, management's plans may also include the possible deferral of certain operating expenses unless additional capital is received. Management's operating plan, which underlies the analysis of the Company's ability to continue as a going concern, involves the estimation of the amount and timing of future cash inflows and outflows. Actual results could vary from the operating plan.

Note 2. Summary of Significant Accounting Policies

Basis of Presentation

The accompanying financial statements have been prepared in accordance with U.S. generally accepted accounting principles ("GAAP").

Use of Estimates

The preparation of financial statements in conformity with GAAP requires management to make estimates, judgements, and assumptions that affect the reported amounts of assets, liabilities, equity, revenues and expenses, and related disclosure of contingencies in the accompanying financial statements and these notes. In addition, management's assessment of the Company's ability to continue as a going concern involves the estimation of the amount and timing of future cash inflows and outflows. On an ongoing basis, the Company evaluates its estimates, judgments and methodologies. The Company bases its estimates on historical experience and on various other assumptions that are believed to be reasonable. Actual results could differ materially from those estimates.

Segment Information

Operating segments are defined as components of an enterprise in which separate discrete information is available for evaluation by the chief operating decision maker, or decision-making group, in deciding how to allocate resources and assessing performance. The Company views its operations and manages its business as one operating segment, which is the business of developing novel therapeutics for oncology and rare diseases.

Financial Instruments

The fair value of the Company's financial instruments is determined and disclosed in accordance with the three-tier fair value hierarchy specified in Note 3. The Company is required to disclose the estimated fair values of its financial instruments. As of December 31, 2020 and 2019, the Company's financial instruments consisted of cash, cash equivalents, short-term investments, receivables, and warrant and future tranche right liabilities. The estimated fair values of these financial instruments approximate their carrying values as of December 31, 2020 and 2019. As of December 31, 2020, the Company did not have any other derivatives, hedging instruments or other similar financial instruments.

Concentration of Credit Risk

Financial instruments that subject the Company to credit risk primarily consist of cash, cash equivalents and short-term investments. The Company's credit risk is managed by investing in highly rated money market instruments, U.S. treasury bills, corporate bonds, commercial paper and/or other debt securities. Due to these factors, no significant additional credit risk is believed by management to be inherent in the Company's assets. As of December 31, 2020, all of the Company's cash and cash equivalents were held at two financial institutions.

Cash and Cash Equivalents

The Company considers all highly liquid investments with maturities of 90 days or less when purchased to be "cash equivalents." Cash and cash equivalents at December 31, 2020 and 2019 consisted of cash and money market funds.

Note 2. Summary of Significant Accounting Policies (Continued)

Property and Equipment

Property and equipment is carried at acquisition cost less accumulated depreciation, subject to review for impairment whenever events or changes in circumstances indicate that the carrying amount of the asset may not be recoverable as described further under the heading "Impairment of Long-Lived Assets" below. The cost of normal, recurring, or periodic repairs and maintenance activities related to property and equipment are expensed as incurred. The cost for planned major maintenance activities, including the related acquisition or construction of assets, is capitalized if the repair will result in future economic benefits.

Depreciation and amortization are computed using the straight-line method based on the estimated useful lives of the related assets. Leasehold improvements are amortized over the remaining lease term or the related useful life, if shorter. Equipment and other long-lived assets are depreciated over three to five years.

When an asset is disposed of, the associated cost and accumulated depreciation is removed from the related accounts on the Company's balance sheet with any resulting gain or loss included in the Company's statement of operations.

Operating Lease Right-of-use Asset and Lease Liability

The Company accounts for leases under ASC Topic 842, *Leases*. Operating leases are included in “Operating lease right-of-use assets” within the Company’s balance sheets and represent the Company’s right to use an underlying asset for the lease term. The Company’s related obligation to make lease payments are included in “Operating lease liability” and “Operating lease liability, net of current portion” within the Company’s balance sheets. Operating lease right-of-use (“ROU”) assets and liabilities are recognized at commencement date based on the present value of lease payments over the lease term. As most of the Company’s leases do not provide an implicit rate, the Company uses its incremental borrowing rates, which are the rates incurred to borrow on a collateralized basis over a similar term, an amount equal to the lease payments in a similar economic environment. Lease expense for lease payments is recognized on a straight-line basis over the lease term. The ROU assets are tested for impairment according to ASC Topic 360, *Property, Plant, and Equipment* (“ASC 360”). Leases with an initial term of 12 months or less are not recorded on the balance sheet and are recognized as lease expense on a straight-line basis over the lease term.

As of December 31, 2020 and 2019, the Company’s operating lease ROU assets and corresponding short-term and long-term lease liabilities primarily relate to its existing Exton, PA facility operating lease which expires on May 31, 2025.

Impairment of Long-Lived Assets

In accordance with ASC 360-10-35, *Impairment or Disposal of Long-Lived Assets*, the Company reviews its long-lived assets for impairment whenever events or changes in circumstances indicate that the carrying amount of an asset may not be recoverable (i.e. impaired). Once an impairment is determined, the actual impairment recognized is the difference between the carrying amount and the fair value (less costs to sell for assets to be disposed of) as estimated using one of the following approaches: income, cost and/or market. Fair value using the income approach is determined primarily using a discounted cash flow model that uses the estimated cash flows associated with the asset or asset group under review, discounted at a rate commensurate with the risk involved. Fair value utilizing the cost approach is determined based on the replacement cost of the asset reduced for, among other things, depreciation and obsolescence. Fair value, utilizing the market approach, benchmarks the fair value against the carrying amount.

Other Current Liability

In October 2020, the Company entered into a short-term financing arrangement with a third-party vendor to finance insurance premiums. The aggregate amount financed under this agreement was $0.6 million. As of December 31, 2020, the balance of $0.4 million, which is included in “Other current liability’ in the Company’s balance sheets, is scheduled to be paid in monthly installments through June 2021.

Note 2. Summary of Significant Accounting Policies (Continued)

Warrant Liability

The Company accounts for stock warrants as either equity instruments, liabilities or derivative liabilities in accordance with ASC 480, *Distinguishing Liabilities from Equity* ("ASC 480") and/or ASC 815, *Derivatives and Hedging* ("ASC 815"), depending on the specific terms of the warrant agreement. Freestanding warrants for shares that are potentially redeemable, whereby the Company may be required to transfer assets (e.g. cash or other assets) outside of its control, are classified as liabilities. Liability-classified warrants are recorded at their estimated fair values at each reporting period until they are exercised, terminated, reclassified or otherwise settled. Changes in the estimated fair value of liability-classified warrants are recorded in Warrant Revaluation (Loss) Gain in the Company's statements of operations. Equity classified warrants are recorded within additional paid-in capital at the time of issuance and not subject to remeasurement. For additional discussion on warrants, see Note 8.

Future Tranche Right Liability

On December 23, 2019, the Company entered into a Securities Purchase Agreement (the "December 2019 Securities Purchase Agreement") with institutional investors affiliated with Baker Brothers (the "Purchasers"), an existing stockholder and related party (see Note 16). As more fully described in Note 7, the December 2019 Securities Purchase Agreement contains call options on redeemable preferred shares with warrants (conditionally exercisable for shares that are puttable). The Company determined that these call options represent freestanding financial instruments and accounts for the options as liabilities ("Future Tranche Right Liability") under ASC 480, which requires the measurement and recognition of the fair value of the liability at the time of issuance and at each reporting period. Any change in fair value is recognized in Future Tranche Right Liability Revaluation (Loss) Gain in the Company's statements of operations.

As of December 31, 2020, the Future Tranche Right Liability is classified as a long-term liability in the Company's balance sheet as settlement is in the form of the applicable Series B convertible preferred stock and warrants exercisable for shares of either Series B1 Preferred Stock or the Company's common stock. As of December 31, 2019, the Future Tranche Right Liability was classified as a current liability because the Future Tranche Rights and related Option Fee, each defined in Note 7, were subject to the Company obtaining required shareholder approval, which was obtained in May 2020.

Preferred Stock

The Company applies ASC 480 when determining the classification and measurement of its preferred stock. Preferred shares subject to mandatory redemption are classified as liability instruments and are measured at fair value. Conditionally redeemable preferred shares (including preferred shares that feature redemption rights that are either within the control of the holder or subject to redemption upon the occurrence of uncertain events not solely within the Company's control) are classified as temporary equity. At all other times, preferred shares are classified as stockholders' equity.

Accretion of redeemable convertible preferred stock includes the accretion of the Company's Series B redeemable convertible preferred stock to its stated value. The carrying value of the Series B redeemable convertible preferred stock is being accreted to redemption value using the effective interest method, from the date of issuance to the earliest date the holders can demand redemption.

Redeemable Preferred Stock Issued with Other Freestanding Instruments

The Company considers guidance within ASC 470-20, *Debt* (ASC 470), ASC 480, and ASC 815 when accounting for a redeemable equity instrument issued with other freestanding instruments (e.g. detachable warrants and future tranche right liabilities), such as in the December 2019 Private Placement (Note 7). In circumstances in which redeemable convertible preferred stock is issued with freestanding liability-classified instruments, the proceeds from the issuance of the convertible preferred stock are first allocated to those instruments at their full estimated fair value. The remaining proceeds, as further reduced by discounts created by the bifurcation of embedded derivatives and/or beneficial conversion features, if any, are allocated to the redeemable equity instrument.

Note 2. Summary of Significant Accounting Policies (Continued)

Revenue Recognition

The Company recognizes revenue in accordance with ASC Topic 606, *Revenue from Contracts with Customers* ("ASC 606'), which applies to all contracts with customers, except for contracts that are within the scope of other standards, such as leases, insurance, collaboration arrangements and financial instruments. In accordance with ASC 606, the Company recognizes revenue when its customer obtains control of promised goods or services, in an amount that reflects the consideration which the entity expects to receive in exchange for those goods or services. To determine revenue recognition for arrangements that the Company determines are within the scope of ASC Topic 606, it performs the following five steps:

(i) identify the contract(s) with a customer;

(ii) identify the performance obligations in the contract;

(iii) determine the transaction price;

(iv) allocate the transaction price to the performance obligations in the contract; and

(v) recognize revenue when (or as) the entity satisfies a performance obligation.

The Company only applies the five-step model to contracts when it determines that it is probable it will collect the consideration to which it is entitled in exchange for the goods or services it transfers to the customer. At contract inception, once the contract is determined to be within the scope of ASC 606, the Company assesses the goods or services promised within each contract and determines those that are performance obligations, and assesses whether each promised good or service is distinct. The Company then recognizes as revenue the amount of the transaction price that is allocated to the respective performance obligation when (or as) the performance obligation is satisfied.

Amounts received prior to satisfying the revenue recognition criteria are recognized as deferred revenue in the Company's balance sheet. Amounts expected to be recognized as revenue within the 12 months following the balance sheet date are classified as current portion of deferred revenue. Amounts not expected to be recognized as revenue within the 12 months following the balance sheet date are classified as deferred revenue, net of current portion.

Alliance Revenues

The Company's revenues have primarily been generated through collaborative research, development and/or commercialization agreements. The terms of these agreements may include payment to the Company of one or more of the following: nonrefundable, up-front license fees; research, development and commercial milestone payments; and other contingent payments due based on the activities of the counterparty or the reimbursement by licensees of costs associated with patent maintenance. Each of these types of revenue are recorded as Alliance revenues in the Company's statements of operations.

In determining the appropriate amount of revenue to be recognized as it fulfills its obligations under each of its agreements, the Company performs the following steps:

(i) identification of the promised goods or services in the contract;

(ii) determination of whether the promised goods or services are performance obligations including whether they are distinct in the context of the contract;

(iii) measurement of the transaction price, including the constraint on variable consideration;

(iv) allocation of the transaction price to the performance obligations; and

(v) recognition of revenue when (or as) the Company satisfies each performance obligation.

Note 2. Summary of Significant Accounting Policies (Continued)

See Note 10, “Collaboration and License Agreements” for additional details regarding the Company’s collaboration and out-licensing arrangements.

As part of the accounting for these arrangements, the Company allocates the transaction price to each performance obligation on a relative stand-alone selling price basis. The stand-alone selling price may be, but is not presumed to be, the contract price. In determining the allocation, the Company maximizes the use of observable inputs. When the stand-alone selling price of a good or service is not directly observable, the Company estimates the stand-alone selling price for each performance obligation using assumptions that require judgment. Acceptable estimation methods include, but are not limited to: (i) the adjusted market assessment approach, (ii) the expected cost plus margin approach, and (iii) the residual approach (when the stand-alone selling price is not directly observable and is either highly variable or uncertain). In order for the residual approach to be used, the Company must demonstrate that (a) there are observable stand-alone selling prices for one or more of the performance obligations and (b) one of the two criteria in ASC 606-10-32-34(c)(1) and (2) is met. The residual approach cannot be used if it would result in a stand-alone selling price of zero for a performance obligation as a performance obligation, by definition, has value on a stand-alone basis.

An option in a contract to acquire additional goods or services gives rise to a performance obligation only if the option provides a material right to the customer that it would not receive without entering into that contract. Factors that the Company considers in evaluating whether an option represents a material right include, but are not limited to: (i) the overall objective of the arrangement, (ii) the benefit the collaborator might obtain from the arrangement without exercising the option, (iii) the cost to exercise the option (e.g. priced at a significant and incremental discount) and (iv) the likelihood that the option will be exercised. With respect to options determined to be performance obligations, the Company recognizes revenue when those future goods or services are transferred or when the options expire.

The Company’s revenue arrangements may include the following:

Up-front License Fees: If a license is determined to be distinct from the other performance obligations identified in the arrangement, the Company recognizes revenues from nonrefundable, up-front fees allocated to the license when the license is transferred to the licensee and the licensee is able to use and benefit from the license. For licenses that are bundled with other promises, the Company utilizes judgment to assess the nature of the combined performance obligation to determine whether the combined performance obligation is satisfied over time or at a point in time and, if over time, the appropriate method of measuring progress for purposes of recognizing revenue from non-refundable, up-front fees. The Company evaluates the measure of progress each reporting period and, if necessary, adjusts the measure of performance and related revenue recognition.

Milestone Payments: At the inception of an agreement that includes research and development milestone payments, the Company evaluates whether each milestone is considered probable of being achieved and estimates the amount to be included in the transaction price using the most likely amount method. If it is probable that a significant revenue reversal would not occur, the associated milestone value is included in the transaction price. Milestone payments that are not within the control of the Company or the licensee, such as regulatory approvals, are not considered probable of being achieved until those approvals are received. The transaction price is then allocated to each performance obligation on a relative stand-alone selling price basis, for which the Company recognizes revenue as or when the performance obligations under the contract are satisfied. At the end of each subsequent reporting period, the Company re-evaluates the probability of achievement of such milestones and any related constraint, and if necessary, adjusts its estimate of the overall transaction price. Any such adjustments are recorded on a cumulative catch-up basis, which would affect Alliance revenues and earnings in the period of adjustment.

Research and Development Activities: If the Company is entitled to reimbursement from its collaborators for specified research and development activities or the reimbursement of costs associated with patent maintenance, the Company determines whether such funding would result in Alliance revenues or an offset to research and development expenses. Reimbursement of patent maintenance costs are recognized during the period in which the related expenses are incurred as Alliance revenues in the Company’s statements of operations.

Note 2. Summary of Significant Accounting Policies (Continued)

Royalties: If the Company is entitled to receive sales-based royalties from its collaborator, including milestone payments based on the level of sales, and the license is deemed to be the predominant item to which the royalties relate, the Company recognizes revenue at the later of (i) when the related sales occur, provided the reported sales are reliably measurable, or (ii) when the performance obligation to which some or all of the royalty has been allocated has been satisfied (or partially satisfied). To date, the Company has not recognized any royalty revenue resulting from any of its collaboration and license arrangements.

Manufacturing Supply and Research Services: Arrangements that include a promise for future supply of drug substance, drug product or research services at the licensee's discretion are generally considered as options. The Company assesses if these options provide a material right to the licensee and if so, they are accounted for as separate performance obligations. If the Company is entitled to additional payments when the licensee exercises these options, any additional payments are recorded in Alliance revenues when the licensee obtains control of the goods, which is upon delivery, or as the services are performed.

The Company receives payments from its licensees based on schedules established in each contract. Upfront payments and fees are recorded as deferred revenue upon receipt, and may require deferral of revenue recognition to a future period until the Company performs its obligations under these arrangements. Amounts are recorded as accounts receivable when the Company's right to consideration is unconditional. The Company does not assess whether a contract has a significant financing component if the expectation at contract inception is such that the period between payment by the licensees and the transfer of the promised goods or services to the licensees will be one year or less.

Research and Development Expenses

All research and development expenses are expensed as incurred. Research and development expenses are comprised of costs incurred in performing research and development activities, including drug development trials and studies, drug manufacturing, laboratory supplies, external research, payroll including stock-based compensation and overhead. Nonrefundable advance payments for goods or services to be received in the future for use in research and development activities are deferred and capitalized. The capitalized amounts are expensed as the related goods are accepted by the Company or the services are performed. As of December 31, 2020 and 2019, the Company recorded approximately $2.5 million and $2.8 million as prepaid research and development, respectively, which is included within prepaid expenses and other current assets in the accompanying balance sheets.

Stock-Based Compensation

The Company accounts for stock-based compensation using ASC 718, *Compensation – Stock Compensation* ("ASC 718"), or ASC 505-50, *Equity – Equity Based Payments to Non-Employees*, as applicable. The Company accounts for stock-based awards to employees and non-employee directors using the fair value based method to determine compensation expense for all arrangements where shares of stock or equity instruments are issued for compensation. In addition, the Company accounts for stock-based compensation to other non-employees in accordance with the accounting guidance for equity instruments that are issued to entities or persons other than employees.

The Company recognizes all share-based payments to employees and directors as expense in the statements of operations based on their fair values. The Company records compensation expense on a straight-line basis over an award's requisite service period, or vesting period, based on the award's fair value at the date of grant. Vesting for time-based options and restricted stock units is generally four years for employees and one year for directors. The Company uses a Black-Scholes option-pricing model to determine the fair value of each option grant as of the date of grant for expense incurred. The Black-Scholes option pricing model requires inputs for risk-free interest rate, dividend yield, expected stock price volatility and expected term of the options. Forfeitures are accounted for as they occur. See Note 12, "Stock-based Compensation" for additional details.

Note 2. Summary of Significant Accounting Policies (Continued)

Merger-related Costs, net

On January 21, 2018, the Company, BioCryst Pharmaceuticals, Inc., a Delaware corporation ("BioCryst"), Nautilus Holdco, Inc., a Delaware corporation and a direct, wholly owned subsidiary of BioCryst ("Holdco"), Island Merger Sub, Inc., a Delaware corporation and a direct, wholly owned subsidiary of Holdco, and Boat Merger Sub, Inc., a Delaware corporation and a direct, wholly owned subsidiary of Holdco, entered into an Agreement and Plan of Merger (the "Merger Agreement"). The board of directors of each of Idera and BioCryst unanimously approved the Merger Agreement and the transactions contemplated thereby and the required regulatory approvals were received. However, the proposed merger was subject to approval by the stockholders of Idera and BioCryst, and satisfaction of other customary closing conditions, as specified in the Merger Agreement. At a special meeting of BioCryst stockholders held on July 10, 2018, BioCryst's stockholders voted against the adoption of the Merger Agreement. Following such vote and in accordance with the terms of the Merger Agreement, BioCryst terminated the Merger Agreement. In accordance with the Merger Agreement, BioCryst paid the Company a fixed expense reimbursement amount of $6 million in July 2018 in connection with the termination of the Merger Agreement. The fixed expense reimbursement amount is included in "Merger-related costs, net" in the accompanying statements of operations.

Merger-related costs, net includes amounts related to the transactions contemplated under the Merger Agreement, including charges incurred for transaction and integration-related professional fees, employee retention costs, and other incremental costs directly related to the potential merger; less the $6 million fixed expense reimbursement termination fee, which was received by the Company in July 2018.

Restructuring Costs

Restructuring charges are primarily comprised of severance costs related to workforce reductions, contract termination and wind-down costs and asset impairments. In accordance with ASC 420, *Exit or Disposal Cost Obligations*, the Company recognizes restructuring charges when the liability has been incurred, except for one-time employee termination benefits that are incurred over time. Generally, one-time employee termination benefits (i.e. severance costs) are accrued at the date management has committed to a plan of termination and employees have been notified of their termination dates and expected severance payments. Other costs will be recorded as incurred. Asset impairment charges have been, and will be, recognized when management has concluded that the assets have been impaired in accordance with ASC 360-10-35, *Impairment or Disposal of Long-Lived Assets*, or other applicable authoritative guidance. See Note 11 for additional details.

Income Taxes

An asset and liability approach is used for financial accounting and reporting for income taxes. Deferred income taxes arise from temporary differences between income tax and financial reporting and principally relate to recognition of revenue and expenses in different periods for financial and tax accounting purposes and are measured using currently enacted tax rates and laws. In addition, a deferred tax asset can be generated by a net operating loss carryover. If it is more likely than not that some portion or all of a deferred tax asset will not be realized, a valuation allowance is recognized.

In the event the Company is charged interest or penalties related to income tax matters, the Company would record such interest as interest expense and would record such penalties as other expense in the Statements of Operations. No such charges have been incurred by the Company. For each of the years ended December 31, 2020, 2019 and 2018, the Company had no uncertain tax positions. See Note 14, "Income Taxes" for additional details.

Note 2. Summary of Significant Accounting Policies (Continued)

Net Loss per Common Share applicable to Common Stockholders

Basic and diluted net loss per common share applicable to common stockholders is computed using the weighted average number of shares of common stock outstanding during the period. The diluted loss per share calculation gives effect to dilutive stock options, restricted stock units, warrants, convertible preferred stock and other potentially dilutive common stock equivalents outstanding during the period. Diluted loss per share is based on the if-converted method or the treasury stock method, as applicable, and includes the effect from the potential issuance of common stock, such as shares issuable pursuant to the conversion of convertible preferred stock and the exercise of stock options and warrants, assuming the exercise of all “in-the-money” common stock equivalents based on the average market price during the period. Common stock equivalents have been excluded where their inclusion would be anti-dilutive. Diluted net loss per common share applicable to common stockholders is the same as basic net loss per common share applicable to common stockholders for each of the three years in the period ended December 31, 2020 as the effects of the Company’s potential common stock equivalents are antidilutive (see Note 17).

New Accounting Pronouncements

From time to time, new accounting pronouncements are issued by the FASB and rules are issued by the SEC that the Company has or will adopt as of a specified date. Unless otherwise noted, management does not believe that any other recently issued accounting pronouncements issued by the FASB or guidance issued by the SEC had, or is expected to have, a material impact on the Company’s present or future financial statements.

Recently Adopted Accounting Pronouncements

In June 2016, the FASB issued Accounting Standard Update (“ASU”) No. 2016-13, *Financial Instruments— Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments* (“ASU 2016-13”). This standard requires that credit losses be reported using an expected losses model rather than the incurred losses model that is currently used, and establishes additional disclosures related to credit risks. For available-for-sale debt securities with unrealized losses, this standard now requires allowances to be recorded instead of reducing the amortized cost of the investment. The Company adopted ASU 2016-13 in the first quarter of 2020. The adoption of this ASU did not have a material effect on the Company’s financial statements.

In August 2018, the FASB issued ASU No. 2018-13, *Disclosure Framework—Changes to the Disclosure Requirements for Fair Value Measurement* (“ASU 2018-13”), which amends ASC 820, *Fair Value Measurement*. ASU 2018-13 modifies the disclosure requirements for fair value measurements by removing, modifying, or adding certain disclosures. The Company adopted ASU 2018-13 in the first quarter of 2020. The adoption of this ASU did not have a material effect on the Company’s financial statements.

Recently Issued (Not Yet Adopted) Accounting Pronouncements

In August 2020, the FASB issued ASU No. 2020-06, *Debt—Debt with Conversion and Other Options (Subtopic 470-20) and Derivatives and Hedging—Contracts in Entity’s Own Equity (Subtopic 815-40): Accounting for Convertible Instruments and Contracts in an Entity’s Own Equity* (“ASU 2020-06”), which simplifies the guidance on an issuer’s accounting for convertible instruments and contracts in its own equity. The provisions of ASU 2020-06 are applicable for fiscal years beginning after December 15, 2021, with early adoption permitted no earlier than fiscal years beginning after December 15, 2020. The Company is currently evaluating the impact of ASU 2020-06 on its financial statements.

COVID-19

While the Company is not aware of a material impact from the novel coronavirus disease ("COVID-19") pandemic through December 31, 2020, the full extent to which COVID-19 will directly or indirectly impact the Company’s business, results of operations and financial condition, including expenses and manufacturing, clinical trials and research and development costs, depends on future developments that are highly uncertain at this time.

Note 3. Fair Value Measurements

Assets and Liabilities Measured at Fair Value on a Recurring Basis

The Company applies the guidance in ASC 820, *Fair Value Measurement*, to account for financial assets and liabilities measured on a recurring basis. Fair value is measured at the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. As such, fair value is a market-based measurement that is determined based on assumptions that market participants would use in pricing an asset or liability.

The Company uses a fair value hierarchy, which distinguishes between assumptions based on market data (observable inputs) and an entity's own assumptions (unobservable inputs). The guidance requires that fair value measurements be classified and disclosed in one of the following three categories:

- Level 1: Unadjusted quoted prices in active markets that are accessible at the measurement date for identical, unrestricted assets or liabilities;
- Level 2: Quoted prices in markets that are not active or inputs which are observable, either directly or indirectly, for substantially the full term of the asset or liability;
- Level 3: Prices or valuation techniques that require inputs that are both significant to the fair value measurement and unobservable (i.e., supported by little or no market activity).

Determining which category an asset or liability falls within the hierarchy requires significant judgment. The Company evaluates its hierarchy disclosures each reporting period. There were no transfers between Level 1, 2 and 3 during the year ended December 31, 2020.

The table below presents the assets and liabilities measured and recorded in the financial statements at fair value on a recurring basis at December 31, 2020 and 2019 categorized by the level of inputs used in the valuation of each asset and liability.

	December 31, 2020			
(In thousands)	**Total**	**Level 1**	**Level 2**	**Level 3**
Assets				
Cash	$ 250	$ 250	$ —	$ —
Cash equivalents – money market funds	32,979	32,979	—	—
Short-term investments – commercial paper	3,499	—	3,499	—
Short-term investments – US treasury bills	1,000	—	1,000	—
Total assets	$ 37,728	$ 33,229	$ 4,499	$ —
Liabilities				
Warrant liability	$ 6,983	$ —	$ —	$ 6,983
Future tranche right liability	118,803	—	—	118,803
Total liabilities	$ 125,786	$ —	$ —	$ 125,786

	December 31, 2019			
(In thousands)	**Total**	**Level 1**	**Level 2**	**Level 3**
Assets				
Cash	$ 250	$ 250	$ —	$ —
Cash equivalents – money market funds	39,769	39,769	—	—
Short-term investments – commercial paper	2,774	—	2,774	—
Total assets	$ 42,793	$ 40,019	$ 2,774	$ —
Liabilities				
Warrant liability	$ 3,241	$ —	$ —	$ 3,241
Future tranche right liability	46,436	—	—	46,436
Total liabilities	$ 49,677	$ —	$ —	$ 49,677

Note 3. Fair Value Measurements (Continued)

The Level 1 assets consist of money market funds, which are actively traded daily. The Level 2 assets consist of commercial paper and US treasury bills whose fair value may not represent actual transactions of identical securities. The fair value of commercial paper is generally determined based on the relationship between the investment's discount rate and the discount rates of the same issuer's commercial paper available in the market which may not be actively traded daily. Since these fair values may not be based upon actual transactions of identical securities, they are classified as Level 2.

Changes in Level 3 Liabilities Measured at Fair Value on a Recurring Basis

Warrant Liability and Future Tranche Right Liability

The reconciliation of the Company's warrant and future tranche right liability measured at fair value on a recurring basis using unobservable inputs (Level 3) is as follows:

(In thousands)	Warrant Liability	Future Tranche Right Liability
Balance, December 31, 2019	$ 3,241	$ 46,436
Change in the fair value of liability	3,742	72,367
Balance, December 31, 2020	$ 6,983	$ 118,803

Assumptions Used in Determining Fair Value of Liability-Classified Warrants

The Company utilizes an option pricing model to value its liability-classified warrants. Inherent in the valuation model are assumptions related to volatility, risk-free interest rate, expected term, dividend rate, and other scenarios (i.e. probability of complex features of the warrants being triggered).

The fair value of the warrants has been estimated with the following weighted-average assumptions:

	December 31, 2020	December 31, 2019
Risk-free interest rate	0.50%	1.79%
Expected dividend yield	—	—
Expected term (years)	5.98	6.98
Expected volatility	80%	80%
Exercise price (per share)	$ 1.52	$ 1.52

Assumptions Used in Determining Fair Value of Future Tranche Rights

The Company utilizes a lattice model to value the Series B2 and B3 future tranche rights and a Monte Carlo simulation to value the Series B4 future tranche rights. The Company selected these models as it believes they are reflective of all significant assumptions that market participants would likely consider in negotiating the transfer of the Future Tranche Rights (as defined in Note 7). Such assumptions include, among other inputs, stock price volatility, risk-free rates, and expected terms inclusive of early exercise and cancellation assumptions.

The estimated fair value of the Future Tranche Rights is determined using Level 2 and Level 3 inputs. Significant inputs and assumptions used in the valuation models are as follows:

	December 31, 2020	December 31, 2019
Risk-free interest rate	0.64% - 0.73%	1.84% - 1.88%
Expected dividend yield	—	—
Expected term (years) of call options on preferred stock	0.25 - 1.12	1.16 - 2.16
Expected term (years) of warrants	7.25 - 8.12	8.16 - 9.16
Expected volatility	80%	80%
Exercise price (per share) for common stock equivalent for preferred stock and warrant	$ 1.52 - 1.82	$ 1.52 - 1.82

Note 4. Investments

The Company's available-for-sale investments at fair value consisted of the following at December 31, 2020 and 2019:

	December 31, 2020			
(In thousands)	Cost	Gross Unrealized (Losses)	Gross Unrealized Gains	Estimated Fair Value
Short-term investments – commercial paper	$ 3,499	$ —	$ —	$ 3,499
Short-term investments – US treasury bills	1,000	—	—	1,000
Total short-term investments	$ 4,499	$ —	$ —	$ 4,499

	December 31, 2019			
(In thousands)	Cost	Gross Unrealized (Losses)	Gross Unrealized Gains	Estimated Fair Value
Short-term investments – commercial paper	$ 2,774	$ —	$ —	$ 2,774
Total short-term investments	$ 2,774	$ —	$ —	$ 2,774

The Company had no realized gains or losses from the sale of investments in available-for-sale securities during each of the years ended December 31, 2020 and 2019. In accordance with ASU 2016-13, if the fair value of the Company's investments in available-for-sale debt securities is less than the amortized cost, the Company records (i) an allowance for credit losses with a corresponding charge to net income (loss) for any credit-related impairment, with subsequent improvements in expected credit losses recognized as a reversal of the allowance, and/or (ii) any non-credit impairment loss to other comprehensive income (loss).

As of December 31, 2020 and 2019, the Company had no allowance for credit losses pertaining to the Company's investments in available-for-sale debt securities. Additionally, there were no impairment charges or recoveries recorded during each of the years ended December 31, 2020 and 2019.

Note 5. Property and Equipment

At December 31, 2020 and 2019, net property and equipment at cost consisted of the following:

(In thousands)	December 31, 2020	December 31, 2019
Leasehold improvements	$ 107	$ 107
Equipment and other	770	764
Total property and equipment, at cost	$ 877	$ 871
Less: Accumulated depreciation and amortization	833	774
Property and equipment, net	$ 44	$ 97

Depreciation and amortization expense on property and equipment was approximately $0.1 million, $0.1 million, and $0.4 million in 2020, 2019 and 2018, respectively.

No impairment charges were recognized during the years ended December 31, 2020 or 2019. During the year ended December 31, 2018, the Company recorded asset impairments related to its property equipment in the amount of $0.5 million in connection with restructuring activities more fully described in Note 11.

Note 6. Accrued Expenses

At December 31, 2020 and 2019, accrued expenses consisted of the following:

(In thousands)	December 31, 2020	December 31, 2019
Payroll and related costs	$ 2,133	$ 2,179
Clinical and nonclinical trial expenses	3,229	4,199
Professional and consulting fees	584	859
Restructuring expenses	—	113
Other	126	111
Total accrued expenses	$ 6,072	$ 7,461

Note 7. Redeemable Convertible Preferred Stock

December 2019 Private Placement

On December 23, 2019, the Company entered into the December 2019 Securities Purchase Agreement, under which the Company sold 23,684 shares of Series B1 convertible preferred stock ("Series B1 Preferred Stock") and warrants to purchase 2,368,400 shares of the Company's common stock at an exercise price of $1.52 per share (or, if the holder elects to exercise the warrants for shares of Series B1 Preferred Stock, 23,684 shares of Series B1 Preferred Stock at an exercise price of $152 per share) for aggregate gross proceeds of $3.9 million (the "Initial Closing").

In addition, the Company has agreed to sell to the Purchasers, at their option and subject to certain conditions, shares of Series B2 convertible preferred stock ("Series B2 Preferred Stock"), Series B3 convertible preferred stock ("Series B3 Preferred Stock") and Series B4 convertible preferred stock ("Series B4 Preferred Stock) and accompanying warrants to purchase common stock (or preferred stock at the election of the holder) over a 21-month period following stockholder approval for the Charter Amendment, as defined below (the "Future Tranche Rights"). As of December 31, 2020, the Company's outstanding Future Tranche Rights are as follows:

Future Tranche Rights	Preferred Shares	Price Per Share	Aggregate Purchase Price
Tranche 2 (Series B2) (1)	98,685	$ 152	$ 15,000,120
Tranche 3 (Series B3) (2)	82,418	$ 182	15,000,076
Tranche 4 (Series B4) (2)	82,418	$ 182	15,000,076
Total	263,521		$ 45,000,272

(1) Accompanied by related warrants to purchase up to 9,868,500 shares of the Company's common stock (or, if the holder elects to exercise the warrants for shares of Series B1 Preferred Stock, 98,685 shares of Series B1 Preferred Stock), at an exercise price of $1.52 per share (or, if the holder elects to exercise the warrants for Series B1 Preferred Stock, $152 per share of Series B1 Preferred Stock).

(2) Accompanied by related warrants to purchase up to 6,593,440 shares of the Company's common stock (or, if the holder elects to exercise the warrants for shares of Series B1 Preferred Stock, 65,934 shares of Series B1 Preferred Stock), at an exercise price of $1.82 per share (or, if the holder elects to exercise the warrants for Series B1 Preferred Stock, $182 per share of Series B1 Preferred Stock).

As consideration for the Future Tranche Rights, the Company received aggregate gross proceeds of $6.2 million (the "Option Fee") in December 2019. Following the Company's 2020 Annual Meeting of Stockholders held on May 12, 2020, where stockholders of the Company voted to approve an amendment to the Company's Restated Certificate of Incorporation to increase the authorized number of shares of the Company's common stock to 140,000,000 (the "Charter Amendment"), the Company is not required to return the Option Fee.

Note 7. Redeemable Convertible Preferred Stock

The purchase and sale of the securities issuable under tranches 2, 3 and 4 may occur in up to three separate closings, each to be conducted at the Purchasers' discretion. The right of the Purchasers to purchase Series B2, Series B3 and Series B4 Preferred Stock will expire on the 10th business day following the Company's ORR Data Announcement, as defined in the December 2019 Securities Purchase Agreement, for its ILLUMINATE-301 study, August 12, 2021, and February 12, 2022, respectively. However, the Purchasers' right to purchase securities under tranches 3 and 4 is contingent on the purchase of all of the securities in each preceding tranche right. In the event the Purchasers do not purchase all of the securities in a given tranche, their right to purchase shares in future tranches terminates and any outstanding warrants issued under the December 2019 Securities Purchase Agreement would terminate. Additionally, the Company has the right to decline the Series B4 Preferred Stock investment if its common stock trades at $7.60 for 20 days out of 30 days subsequent to the closing of the Series B3 Preferred Stock investment.

In addition to the aggregate gross proceeds received from the Initial Closing and the Option Fee, the Company is eligible to receive aggregate gross proceeds of up to an additional $87.6 million under the December 2019 Securities Purchase Agreement.

Accounting Considerations

The Company determined that the Series B1 Preferred Stock, the accompanying Series B1 warrants, and each of the Future Tranche Rights represent freestanding financial instruments. The warrants and the Future Tranche Rights are liability classified as the underlying shares are potentially redeemable and such redemption is deemed to be outside of the Company's control. The $10.1 million in gross proceeds received in December 2019 was allocated to the Series B1 warrants and the Future Tranche Rights based on their estimated fair values of $2.6 million and $35.5 million, respectively. The excess fair value of $28.0 million over the gross proceeds received of $10.1 million was recorded as a deemed dividend to Baker Brothers, an existing significant shareholder. Costs incurred in connection with the December 2019 Securities Purchase Agreement were expensed as incurred.

Due to the redeemable nature of the Series B1 Preferred Stock, the Series B1 Preferred Stock has been classified as temporary equity. While the Series B1 Preferred Stock is not currently redeemable, it will become redeemable either on (i) the fifth anniversary of the initial issue date, or December 23, 2024, provided that certain events (the "Redemption Loss Events") do not occur first or (ii) upon a liquidation or deemed liquidation event, provided that certain events (the "Liquidation Loss Events") do not occur first. The Company cannot assess the probability of whether the Redemption Loss Events will occur prior to the fifth anniversary of the initial issue date, if ever, as certain factors triggering such events are outside the control of the Company. Accordingly, the carrying value of the Series B1 Preferred Stock is currently being accreted to its redemption value. In the event the holders of the Series B1 Preferred Stock lose their right to request redemption, the Series B Preferred Stock will no longer be accreted to its redemption value until redemption upon a liquidation event is deemed probable. For the years ended December 31, 2020 and 2019, accretion was de minimis.

Note 8. Stockholders' Equity

Preferred Stock

The Restated Certificate of Incorporation, as amended, of the Company permits its board of directors to issue up to 5,000,000 shares of preferred stock, par value $0.01 per share, in one or more series, to designate the number of shares constituting such series, and fix by resolution, the powers, privileges, preferences and relative, optional or special rights thereof, including liquidation preferences and dividends, and conversion and redemption rights of each such series.

As of December 31, 2020, the Company has designated the following class of preferred stock:

- Series A: 1,500,000 authorized shares of Series A Convertible Preferred Stock
- Series B1: 277,921 authorized shares of Series B1 Redeemable Convertible Preferred Stock
- Series B2: 98,685 authorized shares of Series B2 Redeemable Convertible Preferred Stock
- Series B3: 82,814 authorized shares of Series B3 Redeemable Convertible Preferred Stock
- Series B4: 82,814 authorized shares of Series B4 Redeemable Convertible Preferred Stock

Series A Convertible Preferred Stock. The dividends on the Series A convertible preferred stock ("Series A Preferred Stock") are payable semi-annually in arrears at the rate of 1% per annum, at the election of the Company, either in cash or additional duly designated, fully paid and nonassessable shares of Series A Preferred Stock. In the event of liquidation, dissolution or winding up of the Company, after payment of debts and other liabilities of the Company, the holders of the Series A Preferred Stock then outstanding will be entitled to a distribution of $1 per share out of any assets available to shareholders. The Series A Preferred Stock is non-voting. All remaining shares of Series A Preferred Stock rank, as to payment upon the occurrence of any liquidation event, senior to the Company's common stock. Shares of Series A Preferred Stock are convertible, in whole or in part, at the option of the holder into fully paid and nonassessable shares of common stock at $272.00 per share, subject to adjustment. As of December 31, 2020 and 2019, there were 655 shares of Series A Preferred Stock outstanding.

Series B1, B2, B3 and B4 Convertible Preferred Stock. Holders of Series B1 Preferred Stock, Series B2 Preferred Stock, Series B3 Preferred Stock and Series B4 Preferred Stock (collectively, the "B1/B2/B3/B4 Preferred Stock") are entitled to the amount of dividends, if and when declared, as would be payable to holders of common stock on an "as converted" basis (e.g. participating dividends). Until the applicable Transition Date (defined below), in the event of a liquidation event or deemed liquidation event, after payment of debts and other liabilities of the Company, the holders of the Series B1/B2/B3/B4 Preferred Stock then outstanding will be entitled to a distribution equal to the then applicable stated value per share of the Series B1/B2/B3/B4 Preferred Stock. Additionally, until the applicable Transition Date (defined below), at any time on or after the date that is the fifth (5th) anniversary of the initial issue date of the applicable series of preferred stock, all or any portion of the preferred stock is redeemable at the option of the holder at a redemption price of $152.00 per share (for Series B1 and Series B2 Preferred Stock) and $182.00 per share (for Series B3 and Series B4 Preferred Stock). The "Transition Date" means:

a) With respect to the Series B1 Preferred Stock, the first date following December 23, 2021, on which each of the Conditions (as defined below) is met (the "Series B1 Transition Date"); and

b) With respect to the Series B2 Preferred Stock, Series B3 Preferred Stock and Series B4 Preferred Stock, the first date following the two-year anniversary of the applicable series of preferred stock's initial issue date, on which each of the Conditions (as defined below) is met (the "Series B2 Transition Date").

Note 8. Stockholders' Equity (Continued)

The "Conditions" shall mean: (a) the closing price of the Company's common stock has been equal to or exceeded the price that is equal to three times (3x) the applicable series of preferred stock's conversion price ($1.52 for Series B1 Preferred Stock and B2 Preferred Stock; $1.82 for Series B3 Preferred Stock and Series B4 Preferred Stock) for 180 calendar days; (b) the 50-day average trading volume of the Company's common stock is greater than 500,000 shares (subject to adjustment for any stock dividend, stock split, stock combination or other similar transaction); and (c) the presentation by the Company at an appropriate medical conference of the "Overall Survival" data as defined in its ILLUMINATE-301 study protocol.

The Series B1/B2/B3/B4 Preferred Stock is non-voting and rank, as to payment upon the occurrence of any liquidation event, senior to the Company's common stock. Shares of Series B1 Preferred Stock and Series B2 Preferred Stock are convertible, in whole or in part, at the option of the holder into fully paid and nonassessable shares of common stock at $1.52 per share, subject to adjustment. Shares of Series B3 Preferred Stock and Series B4 Preferred Stock are convertible, in whole or in part, at the option of the holder into fully paid and nonassessable shares of common stock at $1.82 per share, subject to adjustment. As more fully described in Note 7, the Company's outstanding Series B1 Preferred Stock is classified in temporary equity, outside of stockholders' equity as of December 31, 2020 and 2019. No shares of Series B2 Preferred Stock, Series B3 Preferred Stock or Series B4 Preferred Stock were outstanding as of December 31, 2020 and 2019.

Common Stock

Common Stock Authorized

On May 12, 2020, the Company's stockholders approved the Charter Amendment. Also, on May 12, 2020, following stockholder approval, the Company filed the Charter Amendment with the Secretary of State of the State of Delaware

As of December 31, 2020, the Company had 140,000,000 shares of common stock authorized of which 35,750,149 shares of common stock were reserved for the issuance upon the exercise of outstanding warrants and options to purchase common stock, outstanding restricted stock units, the conversion of Series A and Series B1 convertible preferred stock, shares required to be reserved under the LPC Purchase Agreement (defined below), and shares available for grant under the Company's 2013 Stock Incentive Plan and shares available for purchase under the Company's 2017 Employee Stock Purchase Plan.

Put Shares

Pursuant to the terms of a unit purchase agreement dated as of May 5, 1998, the Company issued and sold a total of 149,960 shares of common stock (the "Put Shares") at a price of $128.00 per share. Under the terms of the unit purchase agreement, the initial purchasers (the "Put Holders") of the Put Shares have the right (the "Put Right") to require the Company to repurchase the Put Shares. The Put Right may not be exercised by any Put Holder unless: (1) the Company liquidates, dissolves or winds up its affairs pursuant to applicable bankruptcy law, whether voluntarily or involuntarily; (2) all of the Company's indebtedness and obligations, including without limitation the indebtedness under the Company's then outstanding notes, has been paid in full; and (3) all rights of the holders of any series or class of capital stock ranking prior and senior to the common stock with respect to liquidation, including without limitation the Series A convertible preferred stock, have been satisfied in full. The Company may terminate the Put Right upon written notice to the Put Holders if the closing sales price of its common stock exceeds $256.00 per share for the twenty consecutive trading days prior to the date of notice of termination. Because the Put Right is not transferable, in the event that a Put Holder has transferred Put Shares since May 5, 1998, the Put Right with respect to those shares has terminated. As a consequence of the Put Right, in the event the Company is liquidated, holders of shares of common stock that do not have Put Rights with respect to such shares may receive smaller distributions per share upon the liquidation than if there were no Put Rights outstanding.

As of December 31, 2020, the Company has repurchased or received documentation of the transfer of 49,993 Put Shares and 4,472 of the Put Shares continued to be held in the name of Put Holders. The Company cannot determine at this time what portion of the Put Rights of the remaining 95,494 Put Shares have terminated.

Note 8. Stockholders' Equity (Continued)

Equity Financings

April 2020 Private Placement

On April 7, 2020, the Company entered into a Securities Purchase Agreement (as amended to date, the "April 2020 Securities Purchase Agreement") with Pillar Partners Foundation, L.P. ("Pillar Partners"), a related party as more fully described in Note 16, providing for the sale of securities in two closings exempt from the registration requirements of the Securities Act. Concurrent with the consummation of the April 2020 Securities Purchase Agreement, the Company issued and sold to Pillar Partners, for $5.0 million of aggregate consideration (the "April 2020 Private Placement First Closing"), (i) 3,039,514 shares of common stock and (ii) warrants to purchase 3,039,514 shares of the Company's common stock with an exercise price of $2.28 per share. Each share and the accompanying common warrant sold in the April 2020 Private Placement First Closing had a combined purchase price of $1.645, which included $0.125 for each share of common stock underlying each warrant.

On December 11, 2020, the Company entered into an amendment to the April 2020 Securities Purchase Agreement with Pillar Partners and Pillar Pharmaceuticals 6, L.P., a related party ("Pillar 6" and, collectively with Pillar Partners, the "April 2020 Purchasers"), principally to enable Pillar 6 to participate in the Second Closing (as defined below) pursuant to the April 2020 Purchase Agreement. Also on December 11, 2020, the Company issued and sold to the April 2020 Purchasers, for $5.0 million of aggregate consideration (the "April 2020 Private Placement Second Closing"), (i) 69,941 shares of the Company's common stock, (ii) pre-funded warrants to purchase up to 2,677,311 shares of the Company's common stock, at an exercise price of $0.01 per share, and (iii) warrants to purchase up to 1,373,626 shares of the Company's common stock with an exercise price of $2.71 per share. Each share and the accompanying 0.5 common warrant sold in the April 2020 Private Placement Second Closing had a combined purchase price of $1.82 and each pre-funded warrant and the accompanying 0.5 common warrant had a combined purchase price of $1.81.

Through December 31, 2020, net proceeds received pursuant to the April 2020 Securities Purchase Agreement, after deduction of offering expenses, was $9.8 million. All proceeds have been recorded within the Company's statements of stockholders' equity (deficit) as all securities issued pursuant to the April 2020 Securities Purchase Agreement were determined to be freestanding equity-classified instruments.

July 2020 Private Placement

On July 13, 2020, the Company entered into a Securities Purchase Agreement (the "July 2020 Securities Purchase Agreement") with Pillar Partners, Pillar 6, and Pillar Pharmaceuticals 7 L.P. ("Pillar 7") (collectively, the "July 2020 Purchasers"), each a related party as more fully described in Note 16, under which the Company issued and sold to the July 2020 Purchasers in a private placement transaction exempt from the registration requirements of the Securities Act, for $5.1 million of aggregate consideration (the "July 2020 Private Placement First Closing"), (i) 749,993 shares of common stock, (ii) pre-funded warrants to purchase up to 2,014,234 shares of common stock, at an exercise price of $0.01 per share, and (iii) warrants to purchase 2,764,227 shares of the Company's common stock with an exercise price of $2.58 per share. Each share (or pre-funded warrant) and the accompanying common warrant sold in the July 2020 Private Placement First Closing had a combined purchase price of $1.845, which included $0.125 for each share of common stock underlying each accompanying warrant.

In addition, the Company has agreed to sell to the July 2020 Purchasers, at their option, pre-funded warrants to purchase up to 784,615 shares of the Company's common stock, at an exercise price of $0.01 per share, and warrants to purchase up to 274,615 shares of the Company's common stock, at an exercise price of $9.75, for aggregate gross proceeds of $5.1 million (the "July 2020 Private Placement Second Closing"). Each pre-funded warrant and the 0.35 associated common warrant will have a combined purchase price of $6.50 ($6.45625 per pre-funded warrant plus $0.04375 per 0.35 associated common warrant). The July 2020 Private Placement Second Closing can occur (at the option of the July 2020 Purchasers) on or before the tenth Business Day following the ORR Data Announcement (as defined in the July 2020 Securities Purchase Agreement) and will be held on or before the fifth day following delivery of written notice by the July 2020 Purchasers to the Company.

Note 8. Stockholders' Equity (Continued)

Through December 31, 2020, net proceeds received pursuant to the July 2020 Securities Purchase Agreement, after deduction of offering expenses, was $5.0 million. All proceeds have been recorded within the Company's statements of stockholders' equity (deficit) as the securities issued pursuant to the July 2020 Securities Purchase Agreement, including the July 2020 Private Placement Second Closing option, were determined to be freestanding equity-classified instruments.

Common Stock Purchase Agreement

On March 4, 2019, the Company entered into a Purchase Agreement with Lincoln Park Capital Fund, LLC ("Lincoln Park"), which was amended on September 2, 2020 (as amended to date, the "LPC Purchase Agreement"), pursuant to which, upon the terms and subject to the conditions and limitations set forth therein, Lincoln Park has committed to purchase an aggregate of $35.0 million of shares of Company common stock from time to time at the Company's sole discretion over a 36-month period. As consideration for entering into the LPC Purchase Agreement, the Company issued 269,749 shares of Company common stock to Lincoln Park as a commitment fee (the "Commitment Shares"). The closing price of the Company's common stock on March 4, 2019 was $2.84 and the Company did not receive any cash proceeds from the issuance of the Commitment Shares.

During the years ended December 31, 2020 and 2019, the Company sold 750,000 and 1,535,848 shares, respectively, pursuant to the LPC Purchase Agreement, resulting in net proceeds of $1.7 million and $3.7 million, respectively. As of December 31, 2020, the Company may sell up to an additional $29.5 million of shares under the LPC Purchase Agreement, subject to certain limitations.

"At-The-Market" Equity Program

In November 2018, the Company entered into a Equity Distribution Agreement (the "ATM Agreement") with JMP Securities LLC ("JMP") pursuant to which the Company may issue and sell shares of its common stock having an aggregate offering price of up to $50.0 million (the "Shares") through JMP as its agent. Subject to the terms and conditions of the ATM Agreement, JMP will use its commercially reasonable efforts to sell the Shares from time to time, based upon the Company's instructions, by methods deemed to be an "at the market offering" as defined in Rule 415(a)(4) promulgated under the Securities Act of 1933, as amended, or if specified by the Company, by any other method permitted by law, including but not limited to in negotiated transactions. The Company has no obligation to sell any of the Shares, and the Company or JMP may at any time suspend sales under the ATM Agreement or terminate the ATM Agreement. JMP is entitled to a fixed commission of 3.0% of the gross proceeds from Shares sold.

During the years ended December 31, 2020 and 2019, the Company sold 3,608,713 and 532,700 Shares, respectively, pursuant to the ATM Agreement resulting in net proceeds, after deduction of commissions and other offering expenses, of $12.3 million and $1.6 million, respectively. No Shares were sold pursuant to the ATM Agreement during 2018. As of December 31, 2020, the Company may sell up to an additional $35.4 million of shares under the ATM Agreement.

Note 8. Stockholders' Equity (Continued)

Common Stock Warrants

In connection with various financing transactions, the Company has issued warrants to purchase shares of the Company's common stock and preferred stock. The Company accounts for common stock and preferred stock warrants as equity instruments or liabilities, depending on the specific terms of the warrant agreement. See Note 2 for further details on accounting policies related to the Company's warrants.

The following table summarizes outstanding warrants to purchase shares of the Company's common stock and/or preferred stock as of December 31, 2020 and 2019:

	Number of Shares			
Description	December 31, 2020	December 31, 2019	Weighted-Average Exercise Price	Expiration Date
Liability-classified Warrants				
December 2019 Series B1 warrants (1)	2,368,400	2,368,400	$ 1.52	Dec 2026
	2,368,400	2,368,400		
Equity-classified Warrants				
May 2013 warrants	1,949,754	1,949,754	$ 0.08	None
September 2013 warrants	514,756	514,756	$ 0.08	None
February 2014 warrants	266,006	266,006	$ 0.08	None
April 2020 Private Placement first closing warrants	3,039,514	—	$ 2.28	Apr 2023
April 2020 Private Placement second closing warrants	1,373,626	—	$ 2.71	Dec 2023
April 2020 Private Placement second closing warrants	2,677,311	—	$ 0.01	None
July 2020 Private Placement first closing warrants	2,014,234	—	$ 0.01	None
July 2020 Private Placement first closing warrants	2,764,227	—	$ 2.58	Jul 2023
	14,599,428	2,730,516		
Total outstanding	16,967,828	5,098,916		

(1) The Series B1 warrants are exercisable for either common stock (exercise price of $1.52) or Series B1 Convertible Preferred Stock (exercise price of $152) at the discretion of the warrant holder.

The table below is a summary of the Company's warrant activity for the year ended December 31, 2020.

	Number of Warrants	Weighted-Average Exercise Price
Outstanding at December 31, 2019	5,098,916	$ 0.75
Issued (1)	11,868,912	1.50
Exercised	—	—
Expired	—	—
Outstanding at December 31, 2020	16,967,828	$ 1.28

(1) During the year ended December 31, 2020, certain related parties were issued warrants as more fully described in Note 16.

Note 9. Alliance Revenue

Alliance revenue for the years ended December 31, 2020, 2019 and 2018 represents revenue from contracts with customers accounted for in accordance with ASC Topic 606.

For the year ended December 31, 2019, the Company recognized Alliance revenues totaling $1.4 million which consistent primarily of revenues recognized under the Licensee Agreement, as more fully described in Note 10, primarily related to the transfer of the IMO-8400 License and IMO-8400 drug product. For the year ended December 31, 2018, the Company recognized Alliance revenues totaling $0.7 million which consisted of (i) $0.5 million pursuant to the GSK Agreement, as more fully described in Note 10, and (ii) $0.2 million related to collaborations which have either been terminated and/or are not material to the Company's current operations nor expected to be material in the future, including reimbursements by licensees of costs associated with research services and patent maintenance.

During the year ended December 31, 2018, the Company recognized Alliance revenues of $0.6 million as a result of changes in the contract liability balances associated with its contracts with customers. Such revenue recognized was included in the contract liability balance at the beginning of the period.

See Note 10 for additional details regarding the Company's collaboration arrangements.

Note 10. Collaboration and License Agreements

Option and License Agreement with Licensee

In April 2019, the Company entered into an amended and restated option and license agreement with a privately-held biopharmaceutical company ("Licensee"), pursuant to which the Company granted Licensee (i) exclusive worldwide rights to develop and market IMO-8400 for the treatment, palliation and diagnosis of all diseases, conditions or indications in humans (the "IMO-8400 License"), (ii) an exclusive right and license to develop IMO-9200 in accordance with certain IMO-9200 pre-option exercise protocols (the "IMO-9200 Option Period License"), and (iii) an exclusive one-year option, exercisable at Licensee's discretion, to obtain the exclusive worldwide rights to develop and market IMO-9200 for the treatment, palliation and diagnosis of all diseases, conditions or indications in humans (the "IMO-9200 Option") (collectively, the "Licensee Agreement"). In connection with the Licensee Agreement, the Company transferred certain drug material to Licensee for Licensee's use in development activities. Licensee is solely responsible for the development and commercialization of IMO-8400 and, if Licensee exercises the IMO-9200 Option, Licensee would be solely responsible for the development and commercialization of IMO-9200.

Under the terms of the Licensee Agreement, the Company received upfront, non-refundable fees totaling approximately $1.4 million and ownership of 10% of Licensee's outstanding common stock, subject to future adjustment, for granting Licensee the IMO-8400 License, the IMO-9200 Option Period License and transfer of related drug materials. In addition, following expiry of the IMO-9200 Option in 2020, the Company is now only eligible to receive certain development and sales-based milestone payments and royalties on global net sales related to the IMO-8400 Compound and potential future IMO-8400 Products, each as defined in the Licensee Agreement. The Company does not anticipate the receipt of any of the future milestones or royalties in the short term, if ever.

The Company accounts for the Licensee Agreement in accordance with ASC 606. As of December 31, 2020, the total transaction price of the contract was $1.4 million, which excluded the Option Fee and all development and sales milestones as all such payments were fully constrained. Additionally, as of December 31, 2020, there were no remaining performance obligations under the Licensee Agreement. The Company re-evaluates its performance obligations and transaction price in each reporting period and as uncertain events are resolved or other changes in circumstances occur.

Note 10. Collaboration and License Agreements (Continued)

As disclosed above, in connection with the Licensee Agreement, the Company owns 10% of Licensee's outstanding common stock, subject to future adjustment. The Company evaluated the guidance in ASC Topic 321, *Investments-Equity Securities*, and elected to account for the investment using the measurement alternative as the equity securities are without a readily determinable fair value, and the arrangement does not result in Idera having control or significant influence over Licensee. Accordingly, the securities are measured at cost, less any impairment, plus or minus changes resulting from observable price changes and are recorded in Other assets at a value of less than $0.1 million in the accompanying balance sheets. As of December 31, 2020, the Company considered the cost of the investment to not exceed the fair value of the investment and did not identify any observable price changes.

Collaboration with GSK

In November 2015, the Company entered into a collaboration and license agreement with GSK to license, research, develop and commercialize pharmaceutical compounds from the Company's nucleic acid chemistry technology for the treatment of selected targets in renal disease (the "GSK Agreement"). In connection with the GSK Agreement, GSK identified an initial target for the Company to attempt to identify a potential population of development candidates to address such target under a mutually agreed upon research plan. Prior to the wind-down of its discovery operations as more fully described in Note 10, the Company created multiple development candidates to address the initial target designated by GSK. Until November 2019, the expiration of the collaboration term, GSK had the right to designate one development candidate in its sole discretion, from the population of identified candidates, to move forward into clinical development. However, GSK did not designate any candidate for development during the collaboration term. If such designation had occurred, GSK would have been solely responsible for the development and commercialization activities of that designated development candidate.

The GSK Agreement also provided GSK with the option to select up to two additional targets at any time during the first two years of the GSK agreement, for further research under mutually agreed upon research plans. Upon selecting additional targets, GSK then had the option to designate one development candidate for each additional target, at which time GSK would have sole responsibility to develop and commercialize each such designated development candidate. GSK did not select any additional targets for research through expiry of the option period.

Under the terms of the GSK Agreement, the Company received a $2.5 million upfront, non-refundable, non-creditable cash payment upon the execution of the GSK Agreement. Additionally, the Company was initially eligible to receive a total of up to approximately $100 million in license, research, clinical development and commercialization milestone payments, of which $9 million of these milestone payments would have been payable by GSK upon the identification of the additional targets, the completion of current and future research plans and the designation of development candidates and $89 million would have been payable by GSK upon the achievement of clinical milestones and commercial milestones. As a result of GSK not designating a development candidate during the collaboration term, the Company is no longer eligible to receive any additional license, research, clinical development and commercialization milestone payments, or any royalty payments.

For the year ended December 31, 2018, the Company recognized Alliance revenues of $0.5 million pursuant to the GSK Agreement primarily related to the amortization of the $2.5 million upfront, non-refundable, non-creditable cash payment received upon the execution of the GSK Agreement, which was recognized as revenue on a straight-line basis over the estimated 36-month research plan period, which approximated the timing in which performance obligations were satisfied. No such revenues were recognized during 2020 or 2019.

Note 11. Restructuring Costs

In July 2018, the Company determined to wind-down its discovery operations, reduce the workforce in Cambridge, Massachusetts that supports such operations, and close its Cambridge facility (the "July 2018 Restructuring"). In connection with the reduction-in-workforce, 18 positions were eliminated, primarily in the area of discovery, representing approximately 40% of the Company's employees. Of the 18 positions eliminated, 15 were effective July 31, 2018 with the remaining effective during the first half of 2019. The Company completed the consolidation of its operations to its Exton, Pennsylvania location in the third quarter of 2018.

Total restructuring-related charges incurred in connection with the July 2018 Restructuring was $3.3 million and comprised of (i) one-time termination costs in connection with the reduction in workforce, including severance, benefits and related costs, of approximately $2.8 million; (ii) contract termination costs of approximately $0.2 million in connection with the early lease termination for the Cambridge facility; and (iii) non-cash asset impairments of approximately $0.7 million, inclusive of $0.5 million of fixed asset impairments and $0.2 million in write-offs of facility-related prepaid expenses; offset by (iv) a non-cash gain of approximately $0.4 million related to the write-off of the remaining deferred rent liability associated with the Cambridge facility lease.

The following summarizes restructuring-related activity for the years ended December 31, 2020, 2019 and 2018:

(in thousands)	Employee Severance and Benefits	Contract Termination Costs	Asset Impairments	Total
Accrued restructuring balance as of December 31, 2017	$ —	$ —	$ —	$ —
Charges incurred (1)	2,635	225	674	3,534
Cash payments	(1,380)	(225)	—	(1,605)
Non-cash settlements	(24)	—	(674)	(698)
Adjustments	(84)	—	—	(84)
Accrued restructuring balance as of December 31, 2018	$ 1,147	$ —	$ —	$ 1,147
Charges incurred	181	—	—	181
Cash payments	(1,215)	—	—	(1,215)
Accrued restructuring balance as of December 31, 2019	$ 113	$ —	$ —	$ 113
Charges incurred	—	—	—	—
Cash payments	(113)	—	—	(113)
Accrued restructuring balance as of December 31, 2020	$ —	$ —	$ —	$ —

(1) Excludes $0.4 million gain due to the write-off of the remaining deferred rent liability associated with the termination of the Cambridge, Massachusetts facility lease.

Note 12. Stock-based Compensation

As of December 31, 2020, the only equity compensation plans from which the Company may currently issue new awards are the Company's 2013 Stock Incentive Plan (as amended to date, the "2013 Plan") and 2017 Employee Stock Purchase Plan (the "2017 ESPP"), each as more fully described below.

Equity Incentive and Employee Stock Purchase Plans

2013 Stock Incentive Plan

The Company's board of directors adopted the 2013 Plan, which was approved by the Company's stockholders effective July 26, 2013. Amendments to the 2013 Plan were approved by the Company's stockholders in June 2014, June 2015, June 2017 and June 2019. The 2013 Plan is intended to further align the interests of the Company and its stockholders with its employees, including its officers, non-employee directors, consultants and advisers by providing equity-based incentives. The 2013 Plan allows for the issuance of incentive stock options intended to qualify under Section 422 of the Internal Revenue Code, non-statutory stock options, stock appreciation rights, restricted stock awards, restricted stock units ("RSUs"), other stock-based awards and performance awards. The total number of shares of common stock authorized for issuance under the 2013 Plan is 5,653,057 shares of the Company's common stock, plus such additional number of shares of common stock (up to 868,372 shares) as is equal to the number of shares of common stock subject to awards granted under the Company's 2005 Stock Incentive Plan or 2008 Stock Incentive Plan (the "2008 Plan"), to the extent such awards expire, terminate or are otherwise surrendered, canceled, forfeited or repurchased by the Company at their original issuance price pursuant to a contractual repurchase right.

As of December 31, 2020, options to purchase a total of 4,034,540 shares of common stock and 903,321 RSUs were outstanding and up to 838,800 shares of common stock remained available for grant under the 2013 Plan.

Other Awards and Inducement Grants

The Company has not made any awards pursuant to other equity incentive plans, including the 2008 Plan, since the Company's stockholders approved the 2013 Plan. As of December 31, 2020, options to purchase a total of 220,408 shares of common stock were outstanding under the 2008 Plan. In addition, as of December 31, 2020, non-statutory stock options to purchase an aggregate of 359,375 shares of common stock were outstanding that were issued outside of the 2013 Plan to certain employees in 2017, 2015 and 2014 pursuant to the Nasdaq inducement grant exception as a material component of new hires' employment compensation.

2017 *Employee Stock Purchase Plan*

The Company's board of directors adopted the 2017 ESPP which was approved by the Company's stockholders and became effective June 7, 2017. An amendment to the 2017 ESPP was approved by the Company's stockholders in June 2019. The 2017 ESPP is intended to qualify as an "employee stock purchase plan" as defined in Section 423 of the Internal Revenue Code, and is intended to encourage our employees to become stockholders of ours, to stimulate increased interest in our affairs and success, to afford employees the opportunity to share in our earnings and growth and to promote systematic savings by them. The total number of shares of common stock authorized for issuance under the 2017 ESPP is 412,500 shares of common stock, subject to adjustment as described in the 2017 ESPP. Participation is limited to employees that would not own 5% or more of the total combined voting power or value of the stock of the Company after the grant. As of December 31, 2020, 245,342 shares remained available for issuance under the 2017 ESPP.

Note 12. Stock-based Compensation (Continued)

Stock Purchase Plan Administration

The 2017 ESPP provides for offerings to employees to purchase common stock with offerings beginning on dates determined by the compensation committee of the board of directors or on the first business day thereafter. Each offering begins a "plan period" during which payroll deductions are to be made and held for the purchase of common stock at the end of the plan period. The compensation committee may, at its discretion, choose a plan period of 12 months or less for subsequent offerings and/or choose a different commencement date for offerings. During each plan period participating employees may elect to have a portion of their compensation, ranging from 1% to 10% of compensation as defined by the plan, withheld and used for the purchase of common stock at the end of each plan period. The purchase price is equal to 85% of the lower of the fair market value of a share of common stock on the first trading date of each plan period or the fair market value of a share of common stock on the last trading day of the plan period, and is limited by participant to $25,000 in fair value of common stock per year as well as other quarterly plan limitations as defined by each plan.

For the years ended December 31, 2020, 2019 and 2018, the Company issued 75,999, 60,953, and 24,824 shares of common stock, in each year respectively, under the 2017 ESPP and received proceeds of $0.1 million, $0.1 million and $0.2 million, in each year respectively, as a result of stock purchases.

Accounting for Stock-based Compensation

The Company recognizes non-cash compensation expense for stock-based awards under the Company's equity incentive plans and employee stock purchases under the Company's 2017 ESPP as follows:

- Stock Options: Compensation cost is recognized over an award's requisite service period, or vesting period, using the straight-line attribution method, based on the grant date fair value determined using the Black-Scholes option-pricing model.
- RSUs: Compensation cost for time-based RSUs, which vest over time based only on continued service, is recognized on a straight-line basis over the requisite service period based on the fair value of the Company's common stock on the date of grant. Compensation cost for awards that are subject to market considerations is recognized on a straight-line basis over the implied requisite service period, based on the grant date fair value estimated using a Monte Carlo simulation. Compensation cost for awards that are subject to performance conditions is recognized over the period of time commencing when the performance condition is deemed probable of achievement based on the fair value of the Company's common stock on the date of grant.
- Employee Stock Purchases: Compensation cost is recognized over each plan period based on the fair value of the look-back provision, calculated using the Black-Scholes option-pricing model, considering the 15% discount on shares purchased.

Total stock-based compensation expense attributable to stock-based payments made to employees and directors and employee stock purchases included in operating expenses in the Company's statements of operations for the years ended December 31, 2020, 2019 and 2018 was as follows:

(in thousands)	2020	2019	2018
Stock-based compensation:			
Research and development			
Employee Stock Purchase Plan	$ 88	$ 36	$ 71
Equity Incentive Plan	673	1,312	1,780
	$ 761	$ 1,348	$ 1,851
General and administrative			
Employee Stock Purchase Plan	$ 9	$ 20	$ 48
Equity Incentive Plan	2,871	2,477	3,751
	$ 2,880	$ 2,497	$ 3,799
Restructuring costs			
Equity Incentive Plan	$ —	$ —	$ 24
	$ —	$ —	$ 24
Total stock-based compensation expense	$ 3,641	$ 3,845	$ 5,674

Note 12. Stock-based Compensation (Continued)

During the years ended December 31, 2020, 2019 and 2018, the weighted average fair market value of stock options granted was $1.25, $1.64, and $7.00, respectively.

Assumptions Used in Determining Fair Value of Stock Options

Inherent in the Black-Scholes option-pricing model are the following assumptions:

Volatility. The Company estimates stock price volatility based on the Company's historical stock price performance over a period of time that matches the expected term of the stock options.

Risk-free interest rate. The risk-free interest rate is based on the U.S. Treasury yield curve in effect at the time of grant commensurate with the expected term assumption.

Expected term. The expected term of stock options granted is based on an estimate of when options will be exercised or cancelled in the future.

Dividend rate. The dividend rate is based on the historical rate, which the Company anticipates will remain at zero.

Forfeitures. The Company accounts for forfeitures when they occur. Ultimately, the actual expense recognized over the vesting period will be for only those shares that vest. See Note 2.

The fair value of each option award at the date of grant was estimated using the Black-Scholes option pricing model. All options granted during the three years in the period ended December 31, 2020 were granted at exercise prices equal to the fair market value of the common stock on the dates of grant**.**

The following weighted average assumptions apply to the options to purchase 1,215,382, 1,279,016, and 1,136,874 shares of common stock granted to employees and directors during the years ended December 31, 2020, 2019 and 2018, respectively:

	2020	2019	2018
Average risk-free interest rate	1.0%	2.1%	2.5%
Expected dividend yield	—	—	—
Expected lives (years)	3.9	3.7	3.7
Expected volatility	84%	84%	74%
Weighted average exercise price (per share)	$ 2.08	$ 2.75	$ 12.63

All options granted during the years ended December 31, 2020, 2019 and 2018 were granted at exercise prices equal to the fair market value of the common stock on the dates of grant**.**

Stock Option Activity

The following table summarizes stock option activity for the year ended December 31, 2020.

($ in thousands, except per share data)	Stock Options	Weighted-Average Exercise Price	Weighted-Average Remaining Contractual Life (in years)	Aggregate Intrinsic Value
Outstanding at December 31, 2019	4,220,417	$ 13.08	6.6	$ —
Granted	1,215,382	2.08		
Exercised	(5,265)	2.84		
Forfeited	(206,323)	6.12		
Expired	(609,888)	18.61		
Outstanding at December 31, 2020 (1)	4,614,323	$ 9.78	6.8	$ 2,949
Exercisable at December 31, 2020	2,490,179	$ 15.12	5.2	$ 455

(1) Includes both vested stock options as well as unvested stock options for which the requisite service period has not been rendered but that are expected to vest based on achievement of a service condition.

Note 12. Stock-based Compensation (Continued)

The fair value of options that vested during the year ended December 31, 2020 was $2.9 million. As of December 31, 2020, there was $3.5 million of unrecognized compensation cost related to unvested options, which the Company expects to recognize over a weighted average period of 2.2 years.

Restricted Stock Activity

The following table summarizes restricted stock activity for the year ended December 31, 2020:

	Time-based Awards		Market/Performance-based Awards	
($ in thousands, except per share data)	Number of Shares	Weighted-Average Grant Date Fair Value	Number of Shares	Weighted-Average Grant Date Fair Value
Nonvested shares at December 31, 2019	193,625	$ 3.14	—	$ —
Granted	365,845	2.65	556,888	1.54
Cancelled	(28,895)	2.75	(7,570)	1.54
Vested	(176,572)	3.95	—	—
Nonvested shares at December 31, 2020	354,003	$ 2.27	549,318	$ 1.54

Time-based Restricted Stock Units

In December 2020, the Company's Chief Executive Officer was granted an award of 128,170 RSUs, pursuant to the 2013 Plan, in lieu of salary pursuant to a January 10, 2020 amendment to the officers' employment agreement. The RSUs were fully vested on the grant date.

As of December 31, 2020, there was $0.7 million of unrecognized compensation cost related to the Company's time-based RSUs, which is expected to be recognized over a weighted average period of 1.9 years.

Market/Performance-based Restricted Stock Units

In July 2020, the Company granted RSUs to certain employees, including executive officers, under the 2013 Plan, with vesting that may occur upon a combination of specific performance and/or market conditions. Accordingly, the Company views these RSUs as two separate awards: (i) an award that vests if the market condition is achieved, and (ii) an award that vests whether or not the market condition is achieved, so long as the performance condition is achieved. The Company is currently recognizing compensation expense for these awards over the estimated requisite service period of 2.36 years based on the estimated fair value when considering the market condition of the award, which was determined using a Monte Carlo simulation. During the year ended December 31, 2020, the Company recognized $0.2 million of compensation expense related to these awards. As of December 31, 2020, the remaining unrecognized compensation cost for the market-based component of these awards, which is expected to be recognized over a weighted-average period of 1.5 years, is $0.7 million. In addition, should the performance condition be achieved, the Company would recognize an additional $0.3 million of compensation expense.

Note 13. Commitments and Contingencies

Lease Commitments

As of December 31, 2020, the Company's leased assets primarily consisted of its office headquarters in Exton, Pennsylvania. Prior to the September 30, 2018 termination date, the Company also leased a facility in Cambridge, Massachusetts. During 2020, 2019 and 2018, rent expense, including real estate taxes, was $0.4 million, $0.3 million, and $1.7 million, respectively. The leases are classified as operating leases.

Future minimum commitments as of December 31, 2020 under the Company's lease agreements are approximately:

December 31,	Operating Leases *(in thousands)*
2021	244
2022	249
2023	250
2024	240
2025	101
	$ 1,084

The Company entered into the Exton, Pennsylvania facility lease on April 1, 2015, which was subsequently amended on September 23, 2015 to include additional space. The Company currently leases approximately 11,000 square feet of office space at our Exton facility. The lease expires on May 31, 2025.

Vendor Financing Arrangement

In October 2020, the Company entered into a short-term financing arrangement with a third-party vendor to finance insurance premiums. As of December 31, 2020, the balance of $0.4 million, is scheduled to be paid in monthly installments through June 2020.

Note 14. Income Taxes

As of December 31, 2020, the Company had cumulative federal and state net operating loss carryforwards ("NOLs") of approximately $328.7 million and $323.2 million available to reduce federal and state taxable income, respectively. As a result of the Tax Cuts and Jobs Act of 2017, federal net operating losses incurred for taxable years beginning after January 1, 2018 have an unlimited carryforward period, but can only be utilized to offset 80% of taxable income in future taxable periods. Of the $328.7 million of federal NOLs, $131.3 million have an unlimited carryforward and the remaining NOLs are still subject to expiration through 2037. State NOLs are still subject to expiration according to the laws of each respective jurisdiction. The Company files state tax returns in Massachusetts and Pennsylvania whereby both jurisdictions impose a 20-year carryforward period. All $323.2 million of state NOLs expire through 2040, with the first year of expiration being 2032 for $23.4 million of Massachusetts NOLs. In addition, at December 31, 2020, the Company had cumulative federal and state tax credit carryforwards of $25.0 million and $1.9 million, respectively, available to reduce federal and state income taxes, respectively, which expire through 2040 and 2033, respectively, for federal and state purposes, other than those that have an unlimited carryforward period.

Sections 382 and 383 of the Internal Revenue Code prescribe limitations on the amount of NOLs and tax credit carryforwards that may be utilized in any one year. The Company has completed several financings since the effective date of the Tax Reform Act of 1986, which as of December 31, 2020, have resulted in ownership changes that will significantly limit the Company's ability to utilize its net operating loss and tax credit carryforwards. In December 2017, the Company completed a study which determined that ownership changes had occurred. The federal and state net operating loss and tax credit carryforwards and related deferred tax assets shown in the table below have been adjusted to reflect the limitations that resulted from this study. As no study has been completed subsequent to 2017, additional ownership change limitations may result from ownership changes that have occurred, or may occur in the future. The Company continues to monitor equity activity and potential ownership changes.

Note 14. Income Taxes (Continued)

As of December 31, 2020 and 2019, the components of the deferred tax assets are approximately as follows:

(in thousands)	2020	2019
Operating loss carryforwards	$ 90,895	$ 81,403
Tax credit carryforwards	26,550	23,072
Stock-based compensation	6,820	7,818
Lease liabilities	276	308
Other	162	176
Total deferred tax assets	124,703	112,777
Right-of-use asset	(270)	(306)
Valuation allowance	(124,433)	(112,471)
Net deferred tax assets	$ —	$ —

The Company has provided a full valuation allowance for its deferred tax asset due to the uncertainty surrounding the ability to realize these assets.

The difference between the U.S. federal corporate tax rate and the Company's effective tax rate for the years ended December 31, 2020, 2019 and 2018 is as follows:

	2020	2019	2018
Expected federal income tax rate	(21.0)%	(21.0)%	(21.0)%
Expiring credits and NOLs	—	—	1.0
Change in valuation allowance	10.6	26.2	37.9
Federal and state credits	(3.1)	(8.1)	(7.4)
State income taxes, net of federal benefit	(1.9)	(4.7)	(9.7)
Warrant and future tranche right revaluation loss	14.2	4.3	—
Stock-based compensation	0.2	0.5	0.5
Other	1.0	2.8	(1.3)
Effective tax rate	0.0 %	0.0 %	0.0 %

The Company applies ASC 740-10, *Accounting for Uncertainty in Income Taxes, an interpretation of ASC 740*. ASC 740-10 clarifies the accounting for uncertainty in income taxes recognized in financial statements and requires the impact of a tax position to be recognized in the financial statements if that position is more likely than not of being sustained by the taxing authority. The Company had no unrecognized tax benefits resulting from uncertain tax positions at December 31, 2020 and 2019.

The Company has not conducted a study of its research and development tax credit carryforwards. Such a study might result in an adjustment to the Company's research and development credit carryforwards, however, until a study is completed and any adjustment is known, no amounts are being presented as an uncertain tax position under ASC 740-10. A full valuation allowance has been provided against the Company's research and development credits and, if an adjustment is required, this adjustment would be offset by an adjustment to the valuation allowance. Thus, there would be no impact to the statements of operations if an adjustment was required.

The Company files income tax returns in the U.S. federal, Massachusetts and Pennsylvania jurisdictions. The Company is no longer subject to tax examinations for years before 2017, except to the extent that it utilizes tax attributes that originated before 2017. The Company does not believe there will be any material changes in its unrecognized tax positions over the next 12 months. The Company has not incurred any interest or penalties. In the event that the Company is assessed interest or penalties at some point in the future, they will be classified in the statements of operations as general and administrative expense.

Note 15. Employee Benefit Plan

The Company has an employee benefit plan under Section 401(k) of the Internal Revenue Code. The plan allows employees to make contributions up to a specified percentage of their compensation. Under the plan, the Company matches a portion of the employees' contributions up to a defined maximum. Prior to August 2018, the Company historically contributed up to 3% of employee base salary, by matching 50% of the first 6% of annual base salary contributed by each employee. Effective August 2018, the Company began contributing up to 5% of employee base salary, by matching 100% of the first 5% of annual base salary contributed by each employee. Approximately $0.3 million, $0.3 million and $0.2 million of 401(k) benefits were charged to operating expenses for the years ended December 31, 2020, 2019 and 2018, respectively.

Note 16. Related Party Transactions

Baker Brothers

Julian C. Baker, a member of the Company's Board until his resignation in September 2018, is a principal of Baker Bros. Advisors, LP. Additionally, Kelvin M. Neu, a member of Company's Board until his resignation in June 2019, is an employee of Baker Bros. Advisors, LP. As of December 31, 2020, Baker Bros. Advisors, LP and certain of its affiliated funds (collectively, "Baker Brothers") held sole voting power with respect to an aggregate of 4,608,786 shares of the Company's common stock, representing approximately 12% of the Company's outstanding common stock.

During 2019, Baker Brothers purchased shares of the Company's Series B1 Preferred Stock and accompanying warrants to purchase common stock in connection with the December 2019 Private Placement, as more fully described in Note 7. Concurrent with the December 2019 Private Placement, the Company amended the warrants initially issued to Baker Brothers and other holders on May 7, 2013, September 30, 2013 and February 10, 2014 to remove expiration date. Under the terms of the warrants issued to Baker Brothers and the December 2019 Securities Purchase Agreement related to the securities issued in connection with the 2019 Private Placement, Baker Brothers is not permitted to convert or exercise any common stock equivalents to the extent that such conversion or exercise would result in Baker Brothers (and its affiliates) beneficially owning more than 4.99% of the number of shares of our common stock outstanding immediately after giving effect to the issuance of shares of common stock issuable upon conversion or exercise of such securities. Baker Brothers has the right to increase this beneficial ownership limitation in its discretion on 61 days' prior written notice to us, provided that in no event is Baker Brothers permitted to convert or exercise such securities to the extent that such exercise would result in Baker Brothers (and its affiliates) beneficially owning more than 19.99% of the number of shares of our common stock outstanding immediately after giving effect to the issuance of shares of common stock issuable upon conversion or exercise of such securities.

During 2018, Baker Brothers exercised warrants to purchase 2,700,791 shares of the Company's common stock at an exercise price of $3.76 per share for a total exercise price of approximately $9.5 million.

As of December 31, 2020, Baker Brothers held warrants to purchase up to 2,708,812 shares of the Company's common stock at an exercise price of $0.08 per share, warrants to purchase up to 2,368,400 shares of the Company's common stock (or, if Baker Brothers elects to exercise the warrants for shares of Series B1 Preferred Stock, 23,684 shares of Series B1 Preferred Stock), at an exercise price of $1.52 per share (or, if Baker Brothers elects to exercise the warrants for shares of Series B1 Preferred Stock, $152 per Series B1 Preferred Warrant Share).

Pillar Investment Entities

Youssef El Zein, a member of the Company's board of directors until his resignation in October 2017, is a director and controlling stockholder of Pillar Invest Corporation ("Pillar Invest"), which is the general partner of Pillar Pharmaceuticals I, L.P., Pillar Pharmaceuticals II, L.P., Pillar Pharmaceuticals III, L.P., Pillar Pharmaceuticals IV, L.P., Pillar Pharmaceuticals V, L.P., Pillar 6 and Pillar Partners (collectively, the "Pillar Investment Entities"). As of December 31, 2020, the Pillar Investment Entities own approximately 18% of the Company's common stock.

Note 16. Related Party Transactions (Continued)

During 2020, the Company sold shares of its common stock, prefunded warrants and common stock warrants to entities affiliated with Pillar Invest Corporation in connection with private placement transactions, as more fully descried in Note 8.

During 2018, Participations Besancon, an investment fund advised by Pillar Invest having no affiliation with Mr. El Zein, exercised warrants to purchase 150,000 shares of the Company's common stock at an exercise price of $3.76 per share for a total exercise price of approximately $0.6 million.

As of December 31, 2020, the Pillar Investment Entities held (i) warrants to purchase up to 3,039,514 shares of the Company's common stock at an exercise price of $2.28 per share, (ii) warrants to purchase up to 2,764,227 shares of the Company's common stock at an exercise price of $2.58 per share, (iii) prefunded warrants to purchase up to 2,014,234 shares of the Company's common stock at an exercise price of $0.01 per share, (iv) warrants to purchase up to 1,373,626 shares of the Company's common stock at an exercise price of $2.71 per share, and (v) prefunded warrants to purchase up to 2,677,311 shares of the Company's common stock at an exercise price of $0.01 per share. Additionally, Pillar held options to purchase Company securities in the April 2020 Private Placement Second Closing and July 2020 Private Placement Second Closing, as more fully described in Note 8.

Subsequent to December 31, 2020, in January 2020, Pillar 6 exercised prefunded warrants to purchase 643,525 shares of the Company's common stock at an exercise price of $0.01 per share.

Board Fees Paid in Stock

Pursuant to the Company's director compensation program, in lieu of director board and committee fees of $0.3 million, $0.1 million, and $0.1 million, respectively, incurred during each of the years ended December 31, 2020, 2019 and 2018, respectively, the Company issued 145,392, 53,985, and 13,654 shares of common stock, respectively, to certain of its directors. Director board and committee fees are paid in arrears and the number of shares issued was calculated based on the market closing price of the Company's common stock on the issuance date.

Officer Salary Paid in Stock

In December 2020, the Company's Chief Executive Officer was granted an award of 128,170 RSUs, pursuant to the 2013 Plan, in lieu of salary of $0.6 million pursuant to a January 10, 2020 amendment to the officers' employment agreement. The RSUs were fully vested on the grant date.

Note 17. Net Loss per Common Share Applicable to Common Stockholders

Net loss applicable to common stockholders represents net loss adjusted for deemed dividends related to the December 2019 Private Placement, as more fully described in Note 7.

The Company uses the two-class method to compute net income (loss) per common share during periods the Company realizes net income and has securities outstanding (e.g. redeemable convertible preferred stock) that entitle the holder to participate in dividends and earnings of the Company. In addition, the Company analyzes the potential dilutive effect of outstanding redeemable convertible preferred stock under the "if-converted" method when calculating diluted earnings per share and reports the more dilutive of the approaches (two class or "if-converted"). The two-class method is not applicable during periods with a net loss, as the holders of the redeemable convertible preferred stock have no obligation to fund losses. For all periods presented, the two-class method was not applicable. The Company also analyzes the potential dilutive effect of outstanding stock options, unvested restricted stock units, warrants and shares underlying future tranche rights under the treasury stock method (as applicable), during periods of income, or during periods in which income is recognized related to changes in fair value of its liability-classified securities.

For the years ended December 31, 2020, 2019 and 2018, diluted net loss per common share applicable to common stockholders was the same as basic net loss per common share applicable to common stockholders as the effects of the Company’s potential common stock equivalents are antidilutive. Potentially dilutive securities, whose effect would have been antidilutive, were excluded from the computation of diluted earnings per share for each of the years ended December 31, 2020, 2019 and 2018.

Total antidilutive securities excluded from the calculation of diluted net loss per share for the years ended December 31, 2020, 2019 and 2018, were as follows:

(in thousands)	2020	2019	2018
Stock options	4,614	4,220	3,305
Restricted stock units	903	194	—
Common stock warrants	16,968	5,099	2,769
Convertible preferred stock	2,369	2,369	1
Future tranche rights	50,467	49,407	—
Total	75,321	61,289	6,075

Note 18. Subsequent Events

The Company considers events or transactions that occur after the balance sheet date but prior to the issuance of the financial statements to provide additional evidence relative to certain estimates or to identify matters that require additional disclosure.

Proceeds from Sale of Common Stock

"At-The-Market" Equity Program

During the period January 1, 2021 through February 28, 2021, the Company sold 2,394,956 shares of its common stock pursuant to the ATM Agreement, as more fully described in Note 8, resulting in net proceeds, after deduction of commissions, of $12.1 million. As of February 28, 2021, the Company may sell up to an additional $22.9 million of shares under the ATM Agreement.

Common Stock Purchase Agreement

During the period January 1, 2020 through February 28, 2021, the Company sold 800,000 shares of its common stock pursuant to the LPC Purchase Agreement, as more fully described in Note 8, resulting in net proceeds of $4.2 million. As of February 28, 2021, the Company may sell up to an additional $25.3 million of shares under the LPC Purchase Agreement.

DESCRIPTION OF THE REGISTRANT'S SECURITIES REGISTERED PURSUANT TO SECTION 12 OF THE SECURITIES EXCHANGE ACT OF 1934

The following description sets forth certain material terms and provisions of Idera Pharmaceuticals, Inc.'s ("Idera," "we," "us," and "our") securities that are registered under Section 12 of the Securities Exchange Act of 1934, as amended.

The following description is a summary and does not purport to be complete. It is subject to, and qualified in its entirety by reference to, Idera's Restated Certificate of Incorporation, as amended (the "Certificate of Incorporation") and Idera's Amended and Restated Bylaws (the "Bylaws"), each of which are incorporated by reference as an exhibit to the Annual Report on Form 10-K of which this Exhibit 4.21 is a part. The terms of these securities also may be affected by the Delaware General Corporation Law.

Unless otherwise indicated, any share and per share amounts included in the description of our securities, reflect, as applicable, the occurrence of a 1-for-8 reverse split of our common stock that occurred on June 29, 2006 and a 1-for-8 reverse split of our common stock that occurred on July 27, 2018.

Authorized Capital Stock

We are authorized to issue a total of 145,000,000 shares of capital stock consisting of 140,000,000 shares of common stock, par value $0.001 per share, and 5,000,000 shares of preferred stock, par value $0.01. Our common stock is listed on the Nasdaq Capital Market under the trading symbol "IDRA."

Description of Common Stock

Voting

Each outstanding share of common stock is entitled to one vote per share on all matters submitted to a vote of our stockholders, except as set forth in the Certificate of Incorporation. Holders of common stock do not have cumulative voting rights.

Dividends; Liquidation and Dissolution

Subject to the preferences that may be applicable to any then outstanding shares of preferred stock, holders of common stock are entitled to receive ratably on a per share basis such dividends and other distributions in cash, stock or property of Idera as may be declared by our Board of Directors (the "Board") from time to time out of the legally available assets or funds of Idera. Upon our voluntary or involuntary liquidation, dissolution or winding up, holders of common stock are entitled to receive ratably all assets of Idera available for distribution to its stockholders after payment of any amounts due to creditors and any amounts due to the holders of our preferred stock.

Other Rights and Restrictions

Holders of our common stock have no preemptive rights and no right to convert their common stock into any other securities. There are no redemption or sinking fund provisions applicable to our common stock. The Certificate of Incorporation and Bylaws do not restrict the ability of holders of common

stock to transfer their shares of common stock. Our Board may authorize the issuance of preferred stock with voting, conversion, dividend, liquidation and other rights that may adversely affect the rights of the holder of our common stock.

Put Right

Pursuant to the terms of that certain Unit Purchase Agreement, dated May 5, 1998 (the "UPA") we issued and sold a total of 149,960 shares of common stock (the "Put Shares") at a price of $128.00 per share. Under the UPA, the initial purchasers of the Put Shares (the "Put Holders") have the right to require us to repurchase the put shares (the "Put Right"). In order for the Put Right to be exercised by any Put Holder all of the following must occur: (1) we liquidate, dissolve or wind up our affairs pursuant to applicable bankruptcy law, whether voluntarily or involuntarily; (2) all of our indebtedness and obligations, including without limitation the indebtedness under our outstanding notes, has been paid in full; and (3) all rights of the holders of any series or class of capital stick raking prior and senior to the common stock with respect to liquidation have been satisfied in full. We may terminate the Put Right upon written notice to the Put Holders if the closing sales price of our common stock exceeds $256.00 per share for the 20 consecutive trading days prior to the date of notice of termination. Because the Put Right is not transferable, in the event that a Put Holder has transferred Put Shares since May 5, 1998, the Put Right with respect to those Put Shares has terminated. As a consequence of the Put Right, in the event we are liquidated, holders of shares of common stock that do not have a Put Right with respect to such shares may receive smaller distributions per share upon our liquidation than if there was no Put Right outstanding. As of the date of the Annual Report on Form 10-K of which this Exhibit 4.21 is a part, we had repurchased or received documentation of the transfer of 49,993 Put Shares and 4,472 of the Put Shares continued to be held in the name of the Put Holders. We cannot determine at this time what portion of the Put Rights of the remaining 95,494 Put Shares have terminated.

As of the date of the Annual Report on Form 10-K of which this Exhibit 4.21 is a part, 42,257,456 shares of common stock are issued and outstanding and 34,144,163 shares of common stock were reserved for the issuance upon the exercise of outstanding warrants and options to purchase common stock, outstanding restricted stock units, the conversion of Series A convertible preferred stock ("Series A") and Series B1 redeemable convertible preferred stock ("Series B1"), shares required to be reserved under the Purchase Agreement with Lincoln Park Capital Fund, LLC, which was amended on September 2, 2020, and shares available for grant under our 2013 Stock Incentive Plan and shares available for purchase under our 2017 Employee Stock Purchase Plan.

Preferred Stock Convertible Into Common Stock

We are authorized to issue 5,000,000 shares of preferred stock, of which 1,500,000 has been designated Series A, 277,921 has been designated Series B1, 98,685 has been designated Series B2 redeemable convertible preferred stock ("Series B2"), 82,814 has been designated Series B3 redeemable convertible preferred stock ("Series B3"), and 82,814 has been designated Series B4 redeemable convertible preferred stock ("Series B4" and, together with Series B1, Series B2, and Series B3, "Series B Preferred Stock").

Shares of Series A, in whole or in part, at the option of the holder, are convertible into fully paid and nonassessable shares of common stock at $272.00 per share, subject to adjustment. Each share of Series B Preferred Stock is initially convertible into 100 shares of common stock. Shares of Series B1 and Series

B2 are convertible, in whole or in part, at the option of the holder into fully paid and nonassessable shares of common stock at $1.52 per share, subject to adjustment. Shares of Series B3 and Series B4 are convertible, in whole or in part, at the option of the holder into fully paid and nonassessable shares of common stock at $1.82 per share, subject to adjustment.

As of the date of the Annual Report on Form 10-K of which this Exhibit 4.21 is a part, there were 655 shares of Series A outstanding and 23,684 shares of Series B1 outstanding. No other shares of preferred stock were outstanding.

Common Stock Issuable Upon Exercise of Warrants

In connection with various financing transactions, we have issued warrants to purchase shares of our common stock and preferred stock. As of the date of the Annual Report on Form 10-K of which this Exhibit 4.21 is a part, there were 16,324,303 warrants outstanding, which includes 2,368,400 Series B1 warrants that are exercisable for either common stock (exercise price of $1.52) or Series B1 (exercise price of $152) at the discretion of the warrant holder.

Certain Anti-Takeover Provisions of Our Certificate Incorporation and Bylaws

The following is a summary of certain provisions of our Certificate of Incorporation and Bylaws that may have the effect of delaying, deterring or preventing hostile takeovers or changes in control or management of Idera. Such provisions could deprive our stockholders of opportunities to realize a premium on their stock. At the same time, these provisions may have the effect of inducing any persons seeking to acquire or control us to negotiate terms acceptable to our Board.

Undesignated Preferred Stock

Our Certificate of Incorporation authorizes our Board to issue shares of preferred stock and set the voting powers, designations, preferences, and other rights related to that preferred stock without stockholder approval. Any such designation and issuance of shares of preferred stock could delay, defer or prevent any attempt to acquire or control us.

Staggered Board

Our Certificate of Incorporation and Bylaws provide for the division of our Board into three classes as nearly equal in size as possible with staggered three-year terms. The classification of the Board could have the effect of making it more difficult for a third party to acquire, or of discouraging a third party from acquiring, control of us. Our Certificate of Incorporation and Bylaws require the affirmative vote of the holders of at least 75% of the shares of our capital stock issued and outstanding and entitled to vote to amend or repeal this provision.

Vacancies on the Board of Directors; Removal of Directors

Our Certificate of Incorporation and our Bylaws provide that, subject to any rights of holders of our preferred stock, any vacancies in our Board for any reason will be filled only by a majority of our directors remaining in office, and directors so elected will hold office until the next election of directors. The inability of our stockholders to fill vacancies on the Board may make it more difficult to change the

composition of our Board. Additionally, our Certificate of Incorporation and Bylaws provide that a director may be removed from office by our stockholders only for cause and by the affirmative vote of at least two-thirds of our outstanding voting stock. Our Certificate of Incorporation and Bylaws require the affirmative vote of the holders of at least 75% of the shares of our capital stock issued and outstanding and entitled to vote to amend or repeal these provisions.

Cumulative Voting

Our Certificate of Incorporation and Bylaws do not provide for cumulative voting. Accordingly, the holders of a majority of the shares of common stock entitled to vote in any election of directors may elect all of the directors standing for election. As a result, subject to the voting rights, of which there currently are none, of any outstanding preferred stock, persons who hold more than 50% of the outstanding common stock entitled to elect members of our Board can elect all of the directors who are up for election in a particular year.

Business Combinations

We are subject to Section 203 of the Delaware General Corporation Law. Subject to certain exceptions, Section 203 prevents a publicly-held Delaware corporation from engaging in a "business combination" with any "interested stockholder" for three years following the date that such person became an interested stockholder, unless either the interested stockholder attained such status with the approval of our Board, the business combination is approved by our Board and stockholders in a prescribed manner or the interested stockholder acquired at least 85% of our outstanding voting stock in the transaction in which such person became an interested stockholder. A "business combination" includes, among other things, a merger or consolidation involving us and the "interested stockholder" and the sale of more than 10% of our assets. In general, an "interested stockholder" is any entity or person beneficially owning 15% or more of our outstanding voting stock and any entity or person affiliated with or controlling or controlled by such entity or person.

No Stockholder Action by Written Consent; Special Meeting of Stockholders

Our Certificate of Incorporation and our Bylaws provide do not provide for action by written consent, which may require our stockholders to wait for a regularly scheduled annual meeting to change the composition of our Board. Our Certificate of Incorporation and our Bylaws also provide that special meetings of our stockholders may be called only by the Board or by our chief executive officer or, if the office the chief executive officer is vacant, our president. In no event may our stockholders call a special meeting of stockholders. Our Certificate of Incorporation and Bylaws require the affirmative vote of the holders of at least 75% of the shares of our capital stock issued and outstanding and entitled to vote to amend or repeal these provisions.

Advance Notification of Stockholder Nominations and Proposals

Our Bylaws provide that stockholders seeking to bring business before an annual meeting of stockholders, or to nominate candidates for election as directors at an annual meeting of stockholders, must meet specified procedural requirements. These provisions may preclude stockholders from bringing matters before an annual meeting of stockholders or from making nominations for directors at an annual or special meeting of stockholders.

November 16, 2020

Daniel Soland
[Street Address]
[City, State, Zip Code]

Dear Daniel,

On behalf of Idera Pharmaceuticals, Inc., ("Company"), we are pleased to offer you the position of **Senior Vice President & Chief Operating Officer**, reporting directly to **Vin Milano**, **President & CEO**. This role will report to our **Exton Pennsylvania** office. Your start date will be determined upon your acceptance of this offer. A summary of the terms of your employment follows.

Exempt Base Salary
Your base salary will be based on a semi-monthly pay schedule at the rate of **USD $17,708.34**. This annualizes to a full-time equivalent of **USD $425,000.16** and will be subject to customary tax withholdings and other payroll deductions. The Company utilizes a semi-monthly pay period, which ends on the 15th and the last day of the month. This position is considered an exempt position for purposes of federal wage-hour law, which means that you will not be eligible for overtime time pay for hours actually worked in excess of 40 in a given work week.

Annual Incentive Plan
Subject to the terms of the Company's Annual Incentive Plan (AIP) then in effect, you are eligible to earn a target incentive award of **40%** of your annual base salary. Awards are discretionary and the determination of this discretionary award is subject to evaluation of performance at the corporate and individual levels, and other performance criteria as they apply to your position. AIP will be pro-rated in your first year of hire, based on your start date.

Benefits
You will be eligible to participate in Idera's benefit plans in accordance with the terms and conditions of each plan. Benefits currently include, but are not limited to, medical, dental, vision, life and disability insurance, flexible spending accounts, and a 401(k) savings plan. Full details of these programs, as well as vacation and holidays, will be provided to you under separate cover.

Equity Grant
Upon joining the Company, you will be granted **200,000** options of Idera Common Stock at an exercise price which is equal to the fair market value on the date of hire. This grant is governed by Idera's Stock Incentive Plan and are granted at the discretion of the Compensation Committee of the Board of Directors.

Waiver and Amendment
No amendment to this offer shall be valid unless in writing and signed by you and the Head of Human Resources on behalf of the Company.

Employment at Will
While we both fully intend to begin our relationship on a positive note, it is essential to understand our employment arrangement. The Company is an “at will” employer, which means that either of us can terminate our employment arrangement at any time and for any reason or no reason.

For purposes of federal immigration law, you will be required to provide the company with documentary evidence of your identity and eligibility for employment in the United States. Such documentation must be provided to the Company within three (3) business days of your date of hire, or our employment relationship with you may be terminated.

Your employment is fully contingent upon a satisfactory background check and your execution and ongoing compliance with the attached Idera Pharmaceuticals’ Non-Disclosure Agreement, Code of Business Conduct and Ethics Agreement and our Insider Trading and Public Disclosure Policies. If the foregoing is satisfactory, please indicate your agreement by signing and returning to us the enclosed copy of this letter, together with a signed copy of the Non-Disclosure Agreement and a signed Acknowledgement and Understanding form of the Code of Business Conduct and Ethics agreement.

Please carefully review the terms and conditions of this offer as outlined in this letter. Feel free to contact Christina Amendola at 484-348-1665 if there is anything further we can do to assist you.

Please confirm your acceptance of this offer by signing the attached copy of this letter; including specifying your actual start date. If we do not receive these executed documents by the end of the business day on 11/17/2020, the offer set forth in this letter shall terminate.

Congratulations Daniel! This position is critical to the continued success and growth of Idera. We are excited to welcome you to Idera and look forward to having you join the team.

Sincerely,

/S/ JILL CONWELL
Jill Conwell
Head of Human Resources

Agreed and Accepted,

/S/ DANIEL SOLAND
Daniel Soland

Date: November 16, 2020

Start Date: January 4, 2021

SEVERANCE AND CHANGE OF CONTROL AGREEMENT

CHANGE OF CONTROL AGREEMENT by and between Idera Pharmaceuticals, Inc., a Delaware corporation (the "Company"), and Daniel Soland (the "Executive"), dated as of February 19, 2021.

WHEREAS, the Board of Directors of the Company (the "Board"), has determined that it is in the best interests of the Company and its shareholders to assure that the Company will have the continued dedication of the Executive, notwithstanding the possibility, threat, or occurrence of a Change of
Control (as defined below) of the Company. The Board believes it is imperative to diminish the inevitable distraction of the Executive by virtue of the personal uncertainties and risks created by a pending or threatened Change of Control and to encourage the Executive's full attention and dedication to the Company currently and in the event of any threatened or pending Change of Control, and to provide the Executive with compensation and benefits arrangements upon a Change of Control which ensure that the compensation and benefits expectations of the Executive will be satisfied and which are competitive with those of other corporations;

WHEREAS, the Executive was hired as Senior Vice President and Chief Operating Officer (“COO”) of the Company with a start date of January 4, 2021;

WHEREAS, in recognition of the Executive’s hiring as COO, the Company and Executive now desire to enter into this Severance and Change of Control Agreement, which is generally consistent with the change of control and severance protection provided to the Company’s most senior officers (the “Agreement”).

NOW, THEREFORE, in consideration of the mutual covenants and agreements hereinafter set forth, the parties hereto, each intending to be legally bound, do hereby agree as follows:

1. **Certain Definitions**.
   a) The "Effective Date" shall be the first date during the "Change of Control Period" (as defined in Section 1(b)) on which a Change of Control occurs. Anything in this Agreement to the contrary notwithstanding, if the Executive's employment with the Company is terminated or the Executive ceases to be an officer of the Company prior to the date on which a Change of Control occurs, and it is reasonably demonstrated that such termination of employment (1) was at the request of a third party who has taken steps reasonably calculated to effect the Change of Control or (2) otherwise arose in connection with or in anticipation of the Change of Control, then for all purposes of this Agreement the "Effective Date" shall mean the date immediately prior to the date of such termination of employment. If prior to the Effective Date, the Executive’s employment with the Company terminates, then the Executive shall have no further rights under this Agreement, except with respect to benefits under Section 6(e), if applicable, or unless such termination of Employment was in anticipation of the Change of Control in which case the termination shall be deemed to have occurred after the consummation of the Change of Control.

   b) The "Change of Control Period" is the period commencing on the date hereof and ending on December 31, 2018 provided, that commencing on December 31, 2017 and each December 31 thereafter (each such date to be referred to as the “Renewal Date”), the term of this Agreement shall automatically be extended, without any further action by the Company or

the Executive, so as to terminate two years from such Renewal Date; provided, however that if the Company shall give notice in writing to the Executive at least thirty (30) days prior to a Renewal Date (the “Pending Renewal Date”), stating that the Change of Control Period shall not be extended, then the Change of Control Period shall expire two years from the Pending Renewal Date.

2. **Change of Control**. For the purpose of this Agreement, a "Change of Control" shall mean the occurrence of any of the following events:
    a) Change in the composition of the Board over a period of thirty-six consecutive months or less such that a majority of the members of the Board ceases to be comprised of individuals who are Continuing Members; for such purpose, a "Continuing Member" shall mean an individual who is a member of the Board on the date of this Agreement and any successor of a Continuing Member who is elected to the Board or nominated for election by action of a majority of Continuing Members then serving on the Board;
    b) any merger or consolidation that results in the voting securities of the Company outstanding immediately prior thereto representing (either by remaining outstanding or by being converted into voting securities of the surviving or acquiring entity) less than 60% of the combined voting power of the voting securities of the Company or such surviving or acquiring entity outstanding immediately after such merger or consolidation;
    c) any sale of all or substantially all of the assets of the Company;
    d) the complete liquidation or dissolution of the Company; or
    e) the acquisition of "beneficial ownership" (as defined in Rule 13d-3 under the Exchange Act) of securities of the Company representing 50% or more of the combined voting power of the Company's then outstanding securities (other than through a merger or consolidation or an acquisition of securities directly from the Company) by any "person," as such term is used in Sections 13(d) and 14(d) of the Exchange Act, other than the Company, any trustee or other fiduciary holding securities under an employee benefit plan of the Company or any corporation owned directly or indirectly by the stockholders of the Company in substantially the same proportion as their ownership of stock of the Company; provided however that, where applied to compensation subject to Section 409A of the Internal Revenue Code and the guidance issued thereunder (“Section 409A”), any acceleration of or change in payment shall only apply (if required by Section 409A) if the Change in Control is also a change in control event described in Treasury Regulation 1.409A-3(i)(5).

3. **Employment Period**. Subject to the terms and conditions hereof, the Company hereby agrees to continue the Executive in its employ, and the Executive hereby agrees to remain in the employ of the Company, for the period commencing on the Effective Date and ending on the last day of the twenty-fourth month following the month in which the Effective Date occurs (the "Employment Period").

4. **Terms of Employment**.
    a) Position and Duties.
        i. During the Employment Period, (A) the Executive's position (including status, offices, titles and reporting requirements), authority, duties and responsibilities shall be at least commensurate in all material respects with the most significant of those held, exercised and assigned at any time during the 90-day period immediately preceding the Effective Date and (B) the Executive's services shall be

performed at the location where the Executive was employed immediately preceding the Effective Date or any office or location less than 35 miles from such location.

ii. During the Employment Period, and excluding any periods of vacation and sick leave to which the Executive is entitled, the Executive agrees to devote his full business time to the business and affairs of the Company and, to the extent necessary to discharge the responsibilities assigned to the Executive hereunder, to use the Executive's reasonable best efforts to perform faithfully and efficiently such responsibilities. During the Employment Period it shall not be a violation of this Agreement for the Executive to (A) serve on corporate, civic or charitable boards or committees, (B) deliver lectures, fulfill speaking engagements or teach at educational institutions and (C) manage personal investments, so long as such activities do not significantly interfere with the performance of the Executive's responsibilities as an employee of the Company in accordance with this Agreement. It is expressly understood and agreed that to the extent that any such activities
have been conducted by the Executive prior to the Effective Date, the continued conduct of such activities (or the conduct of activities similar in nature and scope thereto) subsequent to the Effective Date.

b) Compensation.

i. Base Salary. During the Employment Period, the Executive shall receive an annual base salary ("Annual Base Salary"), which shall be paid at no less than a monthly rate, at least equal to twelve times the highest monthly base salary paid or payable to the Executive by the Company and its affiliated companies in respect of the twelve-month period immediately preceding the month in which the Effective Date occurs. During the Employment Period, the Annual Base Salary shall be reviewed at least annually and shall be increased at any time and from time to time as shall be substantially consistent with increases in base salary awarded in the ordinary course of business to other peer executives of the Company and its affiliated companies. Any increase in Annual Base Salary shall not serve to limit or reduce any other obligation to the Executive under this Agreement. Annual Base Salary shall not be reduced after any such increase and the term Annual Base Salary as utilized in this Agreement shall refer to Annual Base Salary as so increased. As used in this Agreement, the term "affiliated companies" includes any company controlled by, controlling or under common control with the Company.

ii. Annual Bonus. In addition to Annual Base Salary, the Executive shall be awarded, for each fiscal year during the Employment Period, an annual cash bonus (the "Annual Bonus"; which shall include, without limitation, any annual cash bonus plan or program provided to Executive or any other similar plan) in cash at least equal to the greatest of (a) the average (annualized for any fiscal year consisting of less than twelve full months or with respect to which the Executive has been employed by the Company for less than twelve full months) bonus paid or that has been earned and accrued, but unpaid to the Executive by the Company and its affiliated companies in respect of the three fiscal years immediately preceding the fiscal year in which the Effective Date occurs, (b) the Annual Bonus paid for the fiscal year

immediately preceding the fiscal year in which the Effective Date occurs, or (c) the 100 percent target bonus payout amount determined in accordance with the terms of the Company's bonus plans for senior executives for the fiscal year immediately preceding the Effective Date, the fiscal year in which the Effective Date occurs or any fiscal year following the Effective Date and prior to the then current fiscal year, whichever is highest (the "Target Bonus"). Each such Annual Bonus shall be paid no later than the 15th day of the third month of the fiscal year next following the fiscal year for which the Annual Bonus is awarded, unless the Executive shall elect to defer the receipt of such Annual Bonus pursuant to any nonqualified plan of the Company. Notwithstanding anything herein to the contrary, any portion of Annual Base Salary or Annual Bonus electively deferred by the Executive pursuant to a qualified or a non-qualified plan shall be included in determining the Annual Base Salary and Annual Bonus. If the fiscal year of any successor to this Agreement, as described by Section 11(c) herein, is different than the Company's fiscal year at the time of the Effective Date, then the Executive shall be paid (i) the Annual Bonus that would have been paid upon the end of Company's fiscal year in which the Effective Date Occurs, and (ii) a pro-rata Annual Bonus for any months of service performed following the end of the Company's fiscal year, but prior to the first day of the successor's fiscal year immediately following the Change of Control. The Annual Bonuses thereafter shall be based on the successor's first full fiscal year beginning after the Change of Control and successive fiscal years thereafter. Any partial months shall be rounded to the nearest whole number using normal mathematical convention.

iii. Incentive, Savings and Retirement Plans. In addition to Annual Base Salary and Annual Bonus payable as hereinabove provided, the Executive shall be entitled to participate during the Employment Period in all incentive, savings and retirement plans, practices, policies and programs applicable to other peer executives of the Company and its affiliated companies, but in no event shall such plans practices, policies and programs provide the Executive with incentive, savings and retirement benefits opportunities, in each case, less favorable, in the aggregate, than the most favorable of those provided by the Company and its affiliated companies for the Executive under such plans, practices, policies and programs as in effect at any time during the one-year immediately preceding the Effective Date, or, if more favorable to the Executive, those provided generally at any time after the Effective Date to other peer executives of the Company and its affiliated companies.

iv. Welfare Benefit Plans. During the Employment Period, the Executive and/or the Executive's family, as the case may be, shall be eligible for participation in and shall receive all benefits under welfare benefit plans, practices, policies and programs provided by the Company and its affiliated companies (including, without limitation, medical, prescription, dental, disability, salary continuance, employee life, group life, accidental death and travel accident insurance plans and programs) and applicable to other peer executives of the Company and its affiliated companies, but in no event shall such plans, practices, policies and programs provide benefits which are less favorable, in the aggregate, than the most favorable of such plans, practices, policies and programs in effect at any time during the one-year period

immediately preceding the Effective Date, or, if more favorable to the Executive, those provided generally at any time after the Effective Date to other peer executives of the Company and its affiliated companies.

v. Expenses. During the Employment Period, the Executive shall be entitled to receive prompt reimbursement for all reasonable expenses incurred by the Executive upon submission of appropriate accountings in accordance with the most favorable policies, practices and procedures of the Company and its affiliated companies in effect at any time during the one-year period immediately preceding the Effective Date or, if more favorable to the Executive, as in effect at any time thereafter with respect to other peer executives of the Company and its affiliated companies.

vi. Fringe Benefits. During the Employment Period, the Executive shall be entitled to fringe benefits in accordance with the most favorable plans, practices, programs and policies of the Company and its affiliated companies in effect at any time during the one-year period immediately preceding the Effective Date or, if more favorable to the Executive, as in effect at any time thereafter with respect to other peer executives of the Company and its affiliated companies.

vii. Office and Support Staff. During the Employment Period, the Executive shall be entitled to an office or offices of a size and with furnishings and other appointments, and to exclusive personal secretarial and other assistance, at least equal to the most favorable of the foregoing provided to the Executive by the Company and its affiliated companies at any time during the one-year period immediately preceding the Effective Date or, if more favorable to the Executive, as provided at any time thereafter with respect to other peer executives of the Company and its affiliated companies.

viii. Vacation. During the Employment Period, the Executive shall be entitled to paid vacation in accordance with the most favorable plans, policies, programs and practices of the Company and its affiliated companies as in effect at any time during the one-year period immediately preceding the Effective Date or, if more favorable to the Executive, as in effect at any time thereafter with respect to other peer incentives of the Company and its affiliated companies.

5. **Termination of Employment**.

a) Death or Disability. The Executive's employment shall terminate automatically upon the Executive's death during the Employment Period. If the Company determines in good faith that the Disability of the Executive has occurred during the Employment Period (pursuant to the definition of "Disability" set forth below), it may give to the Executive written notice in accordance with Section 13(b) of this Agreement of its intention to terminate the Executive's employment. In such event, the Executive's employment with the Company shall terminate effective on the 30th day after receipt of such notice by the Executive (the "Disability Effective Date"), provided that, within the 30 days after such receipt, the Executive shall not have returned to full-time performance of the Executive's duties. For purposes of this Agreement, "Disability" means the absence of the Executive from the

Executive's duties with the Company on a full-time basis for 180 consecutive business days as a result of incapacity due to mental or physical illness which is determined to be total and permanent by a physician selected by the Company or its insurers and acceptable to the Executive or the Executive's legal representative (such agreement as to acceptability not to be withheld unreasonably).

b) Cause. The Company may terminate the Executive's employment during the Employment Period for "Cause". For purposes of this Agreement, "Cause" means (i) an act or acts of personal dishonesty taken by the Executive and intended to result in substantial personal enrichment of the Executive at the expense of the Company, (ii) repeated violations by the Executive of the Executive's obligations under Section 4(a) of this Agreement (other than as a result of incapacity due to physical or mental illness) which are demonstrably willful and deliberate on the Executive's part, which are committed in bad faith or without reasonable belief that such violations are in the best interests of the Company and which are not remedied in a reasonable period of time after receipt of written notice from the Company or (iii) the conviction of the Executive of a felony involving moral turpitude. The Company shall provide the Executive with 30 days written notice of any determination of Cause and provide the Executive, for a period of 30 days following such notice, with the opportunity to appear before the Board, with or without legal representation, to present arguments and evidence on his behalf and following such presentation to the Board, the Executive may only be terminated for Cause if the Board (excluding the Executive if he is a member of the Board), by unanimous consent reasonably determines in good faith that his actions did, in fact, constitute for Cause.

c) Good Reason. The Executive's employment may be terminated during the Employment Period by the Executive for Good Reason. For purposes of this Agreement, "Good Reason" means:

i. A material diminution in the Executive's base compensation;
ii. A material diminution in the Executive's authority, duties and responsibilities as in effect immediately prior to the Change of Control or, if applicable, the Date of Termination;
iii. A material change in the geographic location in which Executive's principal office was located immediately prior to the Change of Control or, if applicable, the Date of Termination, such that it makes it unreasonable for the Executive to commute to the Company's offices four or more business days per week;
iv. Any other action or inaction that constitutes a material breach by the Company of this Agreement or any other agreement under which the Executive provides services;

provided, however, that Good Reason shall not exist unless the Executive has given written notice to the Company within ninety (90) days of the initial existence of the Good Reason event or condition(s) giving specific details regarding the event or condition; and unless the Company has had at least thirty (30) days to cure such Good Reason event or condition after the delivery of such written notice and has failed to cure such event or condition to the reasonable satisfaction of the Executive within such thirty (30) day cure period.

d) Notice of Termination. Any termination by the Company for Cause or by the Executive for Good Reason shall be communicated by Notice of Termination to the other party hereto given in accordance with Section 13(b) of this Agreement. For purposes of this Agreement, a "Notice of Termination" means a written notice which (i) indicates the specific termination provision in this Agreement relied upon, (ii) to the extent applicable, sets forth in reasonable detail the facts and circumstances claimed to provide a basis for termination of the Executive's employment under the provision so indicated and (iii) if the Date of Termination (as defined below) is other than the date of receipt of such notice, specifies the termination date (which date shall be not more than fifteen days after the giving of such notice). The failure by the Executive or the Company to set forth in the Notice of Termination any fact or circumstance which contributes to a showing of Good Reason or Cause shall not waive any right of the Executive or the Company hereunder or preclude the Executive or the Company from asserting such fact or circumstance in enforcing the Executive's or the Company's rights hereunder.

e) Date of Termination. "Date of Termination" means the date of receipt of the Notice of Termination or any later date (taking into account any applicable notice and cure period) specified therein, as the case may be; provided however, that (i) if the Executive's employment is terminated by the Company other than for Cause, death or Disability, the Date of Termination shall be the date on which the Company notifies the Executive of such termination, and (ii) if the Executive's employment is terminated by reason of death or Disability, the Date of Termination shall be the date of death of the Executive or the Disability Effective Date, as the case may be.

6. **Obligations of the Company upon Termination**.

a) Death. If the Executive's employment is terminated by reason of the Executive's death during the Employment Period, this Agreement shall terminate without further obligations to the Executive's legal representatives under this Agreement, other than for (i) payment of the sum of the following amounts: (A) the Executive's Annual Base Salary through the Date of Termination to the extent not theretofore paid, (B) the product of (I) the Target Bonus for the fiscal year in which the Date of Termination occurs and (II) a fraction, the numerator of which is the number of days in the current fiscal year through the Date of Termination, and the denominator of which is 365, and (C) any accrued and unpaid Annual Bonus amounts, compensation or vacation pay, in each case, to the extent not yet paid by the Company (the amounts described in subparagraphs (A), (B) and (C) are hereafter referred to as "Accrued Obligations" and shall be paid to the Executive's estate or beneficiary, as applicable, in a lump sum in cash within 30 days of the Date of Termination), and (ii) any other benefits or compensation payable under any employee benefit plan in accordance with the applicable plans' terms, including, without limitation, any non-qualified plan; Subject to the provisions of Section 9 hereof, but, otherwise, anything herein to the contrary notwithstanding, the Executive's family shall be entitled to receive benefits at least equal to the most favorable benefits provided by the Company and any of its affiliated companies to surviving families of peer executives of the Company and such affiliated companies under such plans,

programs, practices and policies relating to family death benefits, if any, as in effect with respect to other peer executives and their families at any time during the one year period immediately preceding the Effective Date or, if more favorable to the Executive and/or the Executive's family, as in effect on the date of the Executive's death with respect to other peer executives of the Company and its affiliated companies and their families.

b) Disability. If the Executive's employment is terminated by reason of the Executive's Disability during the Employment Period, this Agreement shall terminate without further obligations to the Executive, other than for payment of the Accrued Obligations (which shall be paid in a lump sum in cash within 30 days of the Date of Termination). Subject to the provisions of Section 9 hereof, but, otherwise, anything herein to the contrary notwithstanding, the Executive shall be entitled after the Disability Effective Date to receive disability and other benefits at least equal to the most favorable of those provided by the Company and its affiliated companies to disabled executives and/or their families in accordance with such plans, programs, practices and policies relating to disability, if any, as in effect with respect to other peer executives and their families at any time during the one year period immediately preceding the Effective Date or, if more favorable to the Executive and/or the Executive's family, as in effect at any time thereafter with respect to other peer executives of the Company and its affiliated companies and their families.

c) Cause, Other than for Good Reason. If the Executive's employment shall be terminated by the Company for Cause or by the Executive other than for Good Reason (and other than by reason of his death or disability) during the Employment Period, this Agreement shall terminate without further obligations to the Executive other than the obligation to pay to the Executive Annual Base Salary through the Date of Termination. In such case, such amounts shall be paid to the Executive in a lump sum in cash within 30 days of the Date of Termination. The Executive shall, in such event, also be entitled to any benefits required by law that are not otherwise provided by this Agreement.

d) Termination Following a Change of Control by the Company without Cause or by the Executive for Good Reason. Following a Change of Control if the Executive is terminated by the Company without Cause or he resigns for Good Reason during the Employment Period, then the Executive shall be entitled to each and all of the following:

   i. the Company shall pay to the Executive in a lump sum in cash within 30 days after the Date of Termination (A) the Executive's Annual Base Salary through the Date of Termination to the extent not theretofore paid, (B) the product of (I) the Target Bonus for the fiscal year in which the Date of Termination occurs and (II) a fraction, the numerator of which is the number of days in the current fiscal year through the Date of Termination, and the denominator of which is 365, and (C) any accrued and unpaid Annual Bonus amounts, compensation or vacation pay, in each case, to the

extent not yet paid by the Company

ii. the Company shall pay to the Executive a lump sum amount in cash within 30 days after the Date of Termination (such amount shall be hereinafter referred to as the “Change of Control Payment”) equal to the product of (X) one point five (1.5) multiplied by the sum of (i) (Y) the Annual Base Salary for the fiscal year immediately preceding the Date of Termination and (ii) the greatest of (a) the average (annualized for any fiscal year consisting of less than twelve full months or with respect to which the Executive has been employed by the Company for less than twelve full months) bonus paid or that has been earned and accrued, but unpaid to the Executive by the Company and its affiliated companies in respect of the three fiscal years immediately preceding the fiscal year in which the Date of Termination occurs, (b) the Annual Bonus paid for the fiscal year immediately preceding the fiscal year in which the Date of Termination occurs, or (c) the Target Bonus for the fiscal year in which the Date of Termination occurs ; and

iii. the Company shall pay to the Executive in a lump sum in cash within 30 days the amount equal to one point five (1.5) times the Company share of the annual group medical and/or dental insurance premium for such coverage that was in place for the Executive immediately prior to the Date of Termination; and

iv. notwithstanding any other provisions to the contrary contained herein or in any option agreement, restricted stock agreement or other equity compensation agreement, between the Company and the Executive, or any stock option, restricted stock or other equity compensation plans sponsored by the Company, unless such agreement or plan expressly references and supercedes this Agreement, then all unvested options, restricted stock or stock appreciation rights which Executive then holds to acquire securities from the Company shall be immediately and automatically vested and/or exercisable as of the Date of Termination, and the Executive shall have the right to exercise any such options or stock appreciation rights for the longer of (A) the period of time provided for in the applicable equity award agreement or plan, or (B) the shorter of one year after the Date of Termination or the remaining term of the applicable equity award.

e) Termination by the Company Without Cause or by Executive for Good Reason. If the Executive's employment with the Company shall be terminated by the Company without Cause or by the Executive for Good Reason (as defined in Section 5(c) without regard to whether a Change of Control has occurred) at any time prior to the Effective Date, then the Executive shall be entitled to each and all of the following:

i. the Company shall pay the Executive within 30 days after the Date of Termination (A) the Executive's Annual Base Salary through the Date of Termination to the extent not theretofore paid, and (B) any accrued and unpaid Annual Bonus amounts, compensation or vacation pay, in each case,

to the extent not yet paid by the Company

ii. the Company shall pay the Executive within 30 days after the Date of Termination the product of (I) the greater of (a) the average bonus paid or that has been earned and accrued, but unpaid to the Executive by the Company and its affiliated companies in respect of the three fiscal years immediately preceding the fiscal year in which the Date of Termination occurs, and (b) the Annual Bonus paid for the fiscal year immediately preceding the Date of Termination (both (a) and (b) annualized for any fiscal year consisting of less than twelve full months or with respect to which the Executive has been employed by the Company for less than twelve full months), and (c) the Executive's target Annual Bonus and (II) a fraction, the numerator of which is the number of days in the current fiscal year through the Date of Termination, and the denominator of which is 365,

iii. the Company shall continue to pay the Executive his Base Salary from the Date of Termination, according to the Company's normal payroll schedule and practices and subject to applicable tax withholding, for duration of the severance period. The severance period shall be equal to the lesser of (a) the number of months the Executive has been employed by the Company and (b) one (1) year. For purposes of this Section 6(e)(iii), the calculation of months shall include any fraction of a month; and

iv. To the extent the Executive participated in the Company's group medical/dental insurance immediately prior to the Date of Termination, if Executive elects to continue receiving group medical and/or dental insurance under the continuation coverage rules known as COBRA, the Company shall pay the Company share of the premium for such coverage that it pays for active and similarly-situated employees who receive the same type of coverage (single, family, or other) until the end of the period for which the Company is paying Executive his current base salary pursuant to Section 6(e)(iii).

f) Mitigation. The Executive shall not be required to mitigate the amount of any payment provided for in this Agreement by seeking other employment or otherwise and no such payment shall be offset or reduced by the amount of any compensation or benefits provided to the Executive in any subsequent employment.

g) Other Severance Benefits. The severance pay and benefits provided for in Section 6(e) shall be in lieu of any other severance or termination pay to which the Executive may be entitled under any Company severance or termination plan, program, practice or arrangement. The Executive's entitlement to any other compensation or benefits shall be determined in accordance with the Company's employee benefit plans and other applicable programs, policies and practices then in effect.

7. **Non-exclusivity of Rights**. Except as provided in Section 6, nothing in this Agreement shall prevent or limit the Executive's continuing or future participation in any benefit, bonus, incentive or other plans, programs, policies or practices, provided by the Company or any of its affiliated companies and for which the Executive may qualify, nor shall anything herein limit or otherwise affect such rights as the Executive may have under any other agreements with the Company or any of its affiliated companies. Amounts which are vested benefits or which the Executive is otherwise entitled to receive under any plan, policy, practice or program of the Company or any of its affiliated companies at or subsequent to the Date of Termination shall be payable in accordance with such plan, policy, practice or program except as explicitly modified by this Agreement.

8. **Full Settlement**.

a) The Company's obligation to make the payments provided for in this Agreement and otherwise to perform its obligations hereunder shall not be affected by any set-off, counterclaim, recoupment, defense or other claim, right or action which the Company may have against the Executive or others. In no event shall the Executive be obligated to seek other employment or take any other action by way of mitigation of the amounts payable to the Executive under any of the provisions of this Agreement and, except as provided in Section 6(d)(ii), such amounts shall not be reduced whether or not the Executive obtains other employment.

b) Prior to the occurrence of a Change of Control, the Company agrees to reimburse the Executive for all legal fees and expenses which the Executive may reasonably incur as a result of any contest by the Company, the Executive or others of the validity or enforceability of, or liability under, any provision of this Agreement or any guarantee of performance thereof, if the Executive prevails in such contest. Following a Change of Control, the Company agrees to pay promptly as incurred, to the full extent permitted by law, all legal fees and expenses which the Executive may reasonably incur as a result of any contest (regardless of the outcome thereof) by the Company, the Executive or others of the validity or enforceability of, or liability under, any provision of this Agreement or any guarantee of performance thereof.

c) If there shall be any dispute between the Company and the Executive (i) in the event of any termination of the Executive's employment by the Company, whether such termination was for Cause, or (ii) in the event of any termination of employment by the Executive, whether Good Reason existed, then, unless and until there is a final, nonappealable judgment by a court of competent jurisdiction declaring that such termination was for Cause or that the determination by the Executive of the existence of Good Reason was not made in good faith, the Company shall pay all amounts, and provide all benefits, to the Executive and/or the Executive's family or other beneficiaries, as the case may be, that the Company would be required to pay or provide pursuant to Section 6(d) as though such termination were by the Company without Cause, or by the Executive with Good Reason; provided, however, that the Company shall not be required to pay any disputed amount pursuant to this paragraph except upon receipt of an undertaking

by or on behalf of the Executive to repay all such amounts to which the Executive is ultimately adjudged by such court not to be entitled.

9. **280G Protection**.

a) In the event that the Executive shall become entitled to payment and/or benefits provided by this Agreement or any other amounts in the "nature of compensation" (whether pursuant to the terms of this Agreement or any other plan, arrangement or agreement with the Company, any person whose actions result in a change of ownership or effective control covered by Section 280G(b)(2) of the Internal Revenue Code (the "Code") or any person affiliated with the Company or such person) as a result of such change in ownership or effective control (collectively the "Company Payments"), and such Company Payments will be subject to the tax (the "Excise Tax") imposed by Section 4999 of the Code (and any similar tax that may hereafter be imposed by any taxing authority) the Company shall pay to the Executive the greater of the following, whichever gives the Executive the highest net after-tax amount (after taking into account federal, state, local and social security taxes at the maximum marginal rates) (x) the Company Payments or (y) one dollar less than the amount of the Company Payments that would subject the Executive to the Excise Tax. In the event that the Company Payments are required to be reduced pursuant to the foregoing sentence, then the Company Payments shall be reduced as mutually agreed between the Company and the Executive or, in the event the parties cannot agree, in the following order (1) any lump sum severance based on Base Salary or Annual Bonus, (2) any other cash amounts payable to the Executive, (3) any benefits valued as parachute payments; and (4) acceleration of vesting of any equity.

b) For purposes of determining whether any of the Company Payments will be subject to the Excise Tax and the amount of such Excise Tax, (x) the Company Payments shall be treated as "parachute payments" within the meaning of Section 280G(b)(2) of the Code, and all "parachute payments" in excess of the "base amount" (as defined under Code Section 280G(b)(3) of the Code) shall be treated as subject to the Excise Tax, unless and except to the extent that, in the opinion of the Company's independent certified public accountants appointed prior to any change in ownership (as defined under Section 280G(b)(2) of the Code) or tax counsel selected by such accountants or the Company (the "Accountants") such Company Payments (in whole or in part) either expressly do not constitute "parachute payments," represent reasonable compensation for services actually rendered within the meaning of Section 280G(b)(4) of the Code in excess of the "base amount" or are otherwise not subject to the Excise Tax, and (y) the value of any non-cash benefits or any deferred payment or benefit shall be determined by the Accountants. All determinations hereunder shall be made by the Accountants which shall provide detailed supporting calculations both to the Company and the Executive at such time as it is requested by the Company or the Executive. If the Accountants determine that payments under this Agreement must be reduced pursuant to this paragraph, they shall furnish the Executive with a written opinion to such effect. The determination of the Accountants shall be final and binding upon

the Company and the Executive.

c) In the event of any controversy with the Internal Revenue Service (or other taxing authority) with regard to the Excise Tax, the Executive shall permit the Company to control issues related to the Excise Tax (at its expense), provided that such issues do not potentially materially adversely affect the Executive, but the Executive shall control any other issues. In the event the issues are interrelated, the Executive and the Company shall in good faith cooperate so as not to jeopardize resolution of either issue, but if the parties cannot agree the Executive shall make the final determination with regard to the issues. In the event of any conference with any taxing authority regarding the Excise Tax or associated income taxes, the Executive shall permit the representative of the Company to accompany the Executive, and the Executive and the Executive's representative shall cooperate with the Company and its representative.

10. **Confidential Information**. The Executive shall hold in a fiduciary capacity for the benefit of the Company all secret or confidential information, knowledge or data relating to the Company or any of its affiliated companies, and their respective businesses, which shall have been obtained by the Executive during the Executive's employment by the Company or any of its affiliated companies and which shall not be or become public knowledge (other than by acts by the Executive or representatives of the Executive in violation of this Agreement). After termination of the Executive's employment with the Company, the Executive shall not, without the prior written consent of the Company or as may otherwise be required by law or legal process, communicate or divulge any such information, knowledge or data to anyone other than the Company and those designated by it. In no event shall an asserted violation of the provisions of this Section 10 constitute a basis for deferring or withholding any amounts otherwise payable to the Executive under this Agreement.

11. **Successors**.

a) This Agreement is personal to the Executive and without the prior written consent of the Company shall not be assignable by the Executive otherwise than by will or the laws of descent and distribution. This Agreement shall inure to the benefit of and be enforceable by the Executive's legal representatives.

b) This Agreement shall inure to the benefit of and be binding upon the Company and its successors and assigns.

c) The Company will require any successor (whether direct or indirect, by purchase, merger, consolidation or otherwise) to all or substantially all of the business and/or assets of the Company to assume expressly and agree to perform this Agreement in the same manner and to the same extent that the Company would be required to perform it if no such succession had taken place. The Company shall provide written evidence to the Executive to document compliance with the foregoing sentence within ten (10) business days of the Effective Date. As used in this Agreement, "Company" shall mean the Company as hereinbefore defined and any successor to

its business and/or assets as aforesaid which assumes and agrees to perform this Agreement by operation of law, or otherwise. In addition, the Executive shall be entitled, upon exercise of any outstanding stock options or stock appreciation rights of the Company, to receive in lieu of shares of the Company's stock, shares of such stock or other securities of such successor as the holders of shares of the Company's stock received pursuant to the terms of the merger, consolidation or sale.

12. **Compliance With Section 409A of the Internal Revenue Code**. To the extent applicable, it is intended that this Agreement comply with the provisions of Section 409A of the Code (hereinafter referred to as "Section 409A"). This Agreement shall be administered in a manner consistent with its intent, and any provision that would cause the Agreement to fail to satisfy Section 409A shall have no force and effect until amended to comply with Section 409A. Notwithstanding any provision of this Agreement to the contrary, in the event any payment or benefit hereunder is determined to constitute non-qualified deferred compensation subject to Section 409A, then to the extent necessary to comply with Section 409A, such payment or benefits shall not be made, provided or commenced until six (6) months after the Executive's "separation from service" as such phrase is defined for the purposes of Section 409A.

13. **Release.** The Executive agrees that, with the exception of the Accrued Obligations due to him in accordance with the terms hereunder, that the payment of any severance under this Agreement to the Executive by the Company, is subject to and conditioned on Executive executing a general release of the Company in a form and scope determined by the Company in its sole discretion (the "Release Agreement"), without Executive revoking such Release Agreement within fifty-two (52) days of the Date of Termination (the "Consideration Period") and provided that (a) if the Date of Termination occurs in one calendar year and the Consideration Period (including the payment date) expires during the following calendar year, then notwithstanding anything herein to the contrary, the payments of severance under Section 6(e) will be paid by the Company to the Executive in the second calendar year; (b) the Executive continues to comply with the provisions of the Non-Competition Agreement; and (c) prior to the expiration of the Consideration Period (i) Executive provides satisfactory evidence to the Company that he has returned all Company property, confidential information and documentation to the Company, and (ii) provides the Company with a signed written resignation of Executive's status as an officer of the Company or any of its affiliates, if applicable.

14. **Miscellaneous**.
    a) This Agreement shall be governed by and construed in accordance with the laws of the Commonwealth of Massachusetts, without reference to principles of conflict of laws. The captions of this Agreement are not part of the provisions hereof and shall have no force or effect. This Agreement may not be amended or modified otherwise than by a written agreement executed by the parties hereto or their respective successors and legal representatives.

    b) All notices and other communications hereunder shall be in writing and shall be given by hand delivery to the other party or by registered or certified mail, return

receipt requested, postage prepaid, addressed as follows:

If to the Executive:

505 Natalie Drive
West Chester PA 19382

If to the Company:

Idera Pharmaceuticals, Inc.
505 Eagleview Blvd.
Suite 212
Exton PA 19341
Attention: Chief Executive Officer

or to such other address as either party shall have furnished to the other in writing in accordance herewith. Notices and communications shall be effective when actually received by the addressee.

c) The invalidity or unenforceability of any provision of this Agreement shall not affect the validity or enforceability of any other provision of this Agreement.

d) The Company may withhold from any amounts payable under this Agreement such Federal, state or local taxes as shall be required to be withheld pursuant to any applicable law or regulation.

e) The Executive's or the Company's failure to insist upon strict compliance with any provision hereof shall not be deemed to be a waiver of such provision or any other provision thereof.

f) This Agreement contains the entire understanding of the Company and the Executive with respect to the rights and other benefits that the Executive shall be entitled during the Employment Period, and in connection therewith shall supersede all prior oral and written communications with the Executive with respect thereto; provided, however, that the Invention, Non-Disclosure and Non-Competition Agreement, option or other equity agreements or other employment agreement by and between the Company and Executive shall remain in full force and effect and if the Company's separation policy would provide greater benefits to the Executive than this Agreement, then the Executive may elect to receive benefits under the Company's separation policy in lieu of the benefits provided hereunder. Nothing herein shall affect the application of the Company's separation policy in lieu of the benefits provided hereunder. Nothing herein shall affect the application of the Company's separation policy prior to the Effective Date.

g) The Executive and the Company acknowledge that, except as may otherwise be provided under this Agreement or any other written agreement between the Executive and the Company, prior to the Effective Date, the employment of the Executive by the Company is "at will" and may be terminated by either the Executive or the Company at any time. Notwithstanding anything contained herein, if during or prior to the Employment Period,

the Executive shall terminate employment with the Company other than for Good Reason, then the Executive shall have no liability to the Company.

IN WITNESS WHEREOF, the Executive has hereunto set his hand and, pursuant to the authorization from its Board of Directors, the Company has caused these presents to be executed in its name on its behalf, all as of the day and year first above written.

[Signature page follows]

IDERA PHARMACEUTICALS, INC.

By: /S/ VINCENT J. MILANO
Vincent J. Milano
Chief Executive Officer

EXECUTIVE

/S/ DANIEL SOLAND

Exhibit 23.1

Consent of Independent Registered Public Accounting Firm

We consent to the incorporation by reference in the following Registration Statements:

(1) Registration Statement (Form S-8 No. 333-152669) pertaining to the 2008 Stock Incentive Plan of Idera Pharmaceuticals, Inc.

(2) Registration Statement (Form S-8 No. 333-176067) pertaining to the 2008 Stock Incentive Plan and 1995 Employee Stock Purchase Plan of Idera Pharmaceuticals, Inc.

(3) Registration Statement (Form S-8 No. 333-191076) pertaining to the 2013 Stock Incentive Plan of Idera Pharmaceuticals, Inc.

(4) Registration Statement (Form S-8 No. 333-197062) pertaining to the 2013 Stock Incentive Plan of Idera Pharmaceuticals, Inc.

(5) Registration Statement (Form S-8 No. 333-202691) pertaining to Inducement Stock Option Awards of Idera Pharmaceuticals, Inc.

(6) Registration Statement (Form S-8 No. 333-206129) pertaining to the 2013 Stock Incentive Plan, as amended, of Idera Pharmaceuticals, Inc.

(7) Registration Statement (Form S-8 No. 333-210090) pertaining to an Inducement Stock Option Award of Idera Pharmaceuticals, Inc.

(8) Registration Statement (Form S-1 as amended by Form S-3/A No. 333-136610) of Idera Pharmaceuticals, Inc.

(9) Registration Statement (Form S-1 as amended by Form S-3/A No. 333-187155) of Idera Pharmaceuticals, Inc.

(10) Registration Statement (Form S-2 as amended by Form S-3/A No. 333-109630) of Idera Pharmaceuticals, Inc.

(11) Registration Statement (Form S-3 No. 333-119943) of Idera Pharmaceuticals, Inc.

(12) Registration Statement (Form S-3 No. 333-126634) of Idera Pharmaceuticals, Inc.

(13) Registration Statement (Form S-3 No. 333-131804) of Idera Pharmaceuticals, Inc.

(14) Registration Statement (Form S-3 No. 333-133455) of Idera Pharmaceuticals, Inc.

(15) Registration Statement (Form S-3 No. 333-133456) of Idera Pharmaceuticals, Inc.

(16) Registration Statement (Form S-3 No. 333-139830) of Idera Pharmaceuticals, Inc.

(17) Registration Statement (Form S-3 as amended by Form S-3/A No. 333-185392) of Idera Pharmaceuticals, Inc.

(18) Registration Statement (Form S-3 No. 333-186312) of Idera Pharmaceuticals, Inc.

(19) Registration Statement (Form S-3 No. 333-189700) of Idera Pharmaceuticals, Inc.

(20) Registration Statement (Form S-3 No. 333-191073) of Idera Pharmaceuticals, Inc.

(21) Registration Statement (Form S-3 No. 333-210140) of Idera Pharmaceuticals, Inc.

(22) Registration Statement (Form S-8 No. 333-217665) pertaining to an Inducement Stock Option Award of Idera Pharmaceuticals, Inc.

(23) Registration Statement (Form S-8 No. 333-219740) pertaining to the 2017 Employee Stock Purchase Plan of Idera Pharmaceuticals, Inc.

(24) Registration Statement (Form S-8 No. 333-219741) pertaining to the 2013 Stock Incentive Plan, as amended, of Idera Pharmaceuticals, Inc.

(25) Registration Statement (Form S-8 No. 333-232609) pertaining to the 2017 Employee Stock Purchase Plan of Idera Pharmaceuticals, Inc.

(26) Registration Statement (Form S-8 No. 333-232610) pertaining to the 2013 Stock Incentive Plan, as amended, of Idera Pharmaceuticals, Inc.

(27) Registration Statement (Form S-3 No. 333-238868) of Idera Pharmaceuticals, Inc.

(28) Registration Statement (Form S-3 No. 333-240361) of Idera Pharmaceuticals, Inc.

(29) Registration Statement (Form S-3 No. 333-240366) of Idera Pharmaceuticals, Inc.

(30) Registration Statement (Form S-3 No. 333-248560) of Idera Pharmaceuticals, Inc.

of our report dated March 1, 2021, with respect to the financial statements of Idera Pharmaceuticals, Inc. included in this Annual Report (Form 10-K) of Idera Pharmaceuticals, Inc. for the year ended December 31, 2020.

/s/ ERSNT & YOUNG LLP

Philadelphia, Pennsylvania
March 1, 2021

Exhibit 31.1

Certification of Chief Executive Officer pursuant to Exchange Act Rules 13a-14 and 15d-14, as adopted pursuant to Section 302 of Sarbanes-Oxley Act of 2002

I, Vincent J. Milano, certify that:

1. I have reviewed this Annual Report on Form 10-K of Idera Pharmaceuticals, Inc.;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer 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 annual 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 changes in the registrant's internal control over financial reporting that occurred during the registrant's fourth fiscal quarter 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 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 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 and financial reporting.

/s/ Vincent J. Milano
Vincent J. Milano
Chief Executive Officer

Dated: March 1, 2021

Exhibit 31.2

Certification of Chief Financial Officer pursuant to Exchange Act Rules 13a-14 and 15d-14, as adopted pursuant to Section 302 of Sarbanes-Oxley Act of 2002

I, John J. Kirby, certify that:

1. I have reviewed this Annual Report on Form 10-K of Idera Pharmaceuticals, Inc.;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer 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 annual 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 changes in the registrant's internal control over financial reporting that occurred during the registrant's fourth fiscal quarter 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 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 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 and financial reporting.

/s/ John J. Kirby
John J. Kirby
Chief Financial Officer

Dated: March 1, 2021

Exhibit 32.1

Certification of Chief Executive Officer pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002

In connection with the Annual Report on Form 10-K of Idera Pharmaceuticals, Inc. (the "Company") for the period ended December 31, 2020 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), the undersigned, Vincent J. Milano, Chief Executive Officer of the Company, hereby certifies, pursuant to 18 U.S.C. Section 1350, that to his knowledge:

(1) the Report fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934; and

(2) the information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

A signed original of this written statement has been provided to Idera Pharmaceuticals, Inc. and will be retained by Idera Pharmaceuticals, Inc. and furnished to the Securities and Exchange Commission or its staff upon request.

/s/ Vincent J. Milano
Vincent J. Milano
Chief Executive Officer

Dated: March 1, 2021

Exhibit 32.2

Certification of Chief Financial Officer pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002

In connection with the Annual Report on Form 10-K of Idera Pharmaceuticals, Inc. (the "Company") for the period ended December 31, 2020 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), the undersigned, John J. Kirby, Chief Financial Officer of the Company, hereby certifies, pursuant to 18 U.S.C. Section 1350, that to his knowledge:

(1) the Report fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934; and

(2) the information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

A signed original of this written statement has been provided to Idera Pharmaceuticals, Inc. and will be retained by Idera Pharmaceuticals, Inc. and furnished to the Securities and Exchange Commission or its staff upon request.

/s/ John J. Kirby
John J. Kirby
Chief Financial Officer

Dated: March 1, 2021